NZ TRANSPORT AGENCY
WAKA KOTAHI

TE ARA HAUĀURU
NORTHWEST RAPID TRANSIT

ASSESSMENT OF ECOLOGICAL EFFECTS

IAN BREDIN

15 DECEMBER 2025

New Zealand Government

Qualifications and experience of the author

My full name is Ian Peter Bredin. I am a Principal Ecologist at AECOM. I hold a Master's degree in Veterinarian Science (Zoology) from the University of Pretoria, South Africa (2006). I have 19 years' experience as an ecology consultant. I am a member of the Environment Institute of Australia and New Zealand (EIANZ), and a certified Professional Wetland Scientist (PWS) through the Society of Wetland Scientist's professional certification program.

My relevant experience includes:

- Lead ecologist for the ongoing Te Wai Takamori o Te Awa Kairangi project, which aims to create a safer, more connected, and climate-resilient Lower Hutt.
- Lead ecologist for the ecological assessment to inform the Assessment of Environmental Effects (AEE) for the Te Tupu Ngātahi Supporting Growth Alliance (Te Tupu Ngātahi), Pukekohe Transport Network project.
- Lead ecologist for the ecological assessment to inform the AEE for the Notice of Requirements being sought by KiwiRail and Auckland Transport for the Papakura to Pukekohe – Four-tracking and Active Modes Corridor project.
- Lead verifier for the ecological assessment to inform the AEE sought by KiwiRail to support the resource consent application for resilience improvement upgrades to six sites along the North Island Main Trunk.

Although this matter is not before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses as contained in section 9 of the Environment Court Practice Note 2023. I agree to comply with that Code. My qualifications as an expert are set out above. I am satisfied that the matters which I address in this report are within my area of expertise, except where I state that I am relying on information provided by another person or expert. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

I am the Ecology Lead for the Northwest Rapid Transit Project. I had support from the following people:

- Caitlin Smith (AECOM) - Caitlin supported by drafting the report, and assisting with the stream surveys, marine benthic ecological survey, the vegetation assessments, and lizard survey.
- Ashley Cooper (AECOM) – Ashley assisted with the initial desktop works and site surveys.
- Liz Yu (AECOM) – Liz assisted with vegetation assessment, bat surveys, lizard surveys, stream surveys, report drafting, and Geographic Information System (GIS) tasks.
- Abe Tompkins (AECOM) – Abe assisted with bird surveys, bat surveys, lizard surveys, stream surveys, and report drafting.
- Chris Wedding (Bioresearches) – Chris was the herpetofauna reviewer.
- Emily Jones (SLR Consulting) – Emily was the marine benthic ecology reviewer.

Executive summary

This technical assessment has been prepared to inform a substantive application for the Northwest Rapid Transit Project (the Project) under the Fast-Track Approvals Act 2024 (FTAA). It forms part of a suite of specialist reports that collectively support the applications for statutory approvals.

The report evaluates the actual and potential effects of the Project on terrestrial, freshwater, wetland, and marine ecology and recommends measures to avoid, remedy, or mitigate those effects. Where required, additional management (i.e., offsets) is recommended.

A combination of desktop review and infield assessments within the Project Area and the Zone of Influence (ZOI) covering vegetation, fauna (bats, birds, lizards, invertebrates), freshwater, wetland, and marine habitat informed the assessment.

The Project Area (the Proposed Designation and the extent of the coastal occupation permits sought) and surrounding landscape is a highly modified landscape. The remaining terrestrial and aquatic habitats within the Project Area consist mostly of a mixture of native and exotic planted vegetation within open spaces and along riparian corridors, and two small portions of estuarine habitat dominated by mangroves. In general, the Indicative Design (the indicative design of the Project within the Project Area as shown on the Indicative Design drawings in Part 6) aligns with existing road infrastructure, which limits effects on the above ecological features, but still encroaches into terrestrial Significant Ecological Areas (SEAs), freshwater habitats, and estuarine habitats (marine SEA).

The terrestrial habitat consists of a mixture of open exotic grassland, native planted vegetation, treelands, exotic scrub and regenerating vegetation of **Low** to **Moderate** ecological value.

No bats were recorded during site investigations. However, records from previous ecological assessments in the area confirm the presence of long-tailed bats (**Very High** ecological value) along Tōtara Creek on the edge of the Proposed Designation. Suitable habitat includes portions of mixed native/exotic treeland (TL2) and exotic treeland (TL3) along the creek.

Suitable bird nesting and foraging habitat is present throughout the Project Area. Two regionally critical species (Caspian Tern and Black Shag) and one regionally endangered species (Little Shag) were observed within the Project Area during the field assessments. There were three regionally vulnerable species (Red-billed Gull, White-fronted Tern and Variable Oystercatcher), one regionally increasing species (Wrybill), two regionally naturally uncommon species (Royal Spoonbill and Little Black Shag) and one regionally recovering species (Pied Shag) that were also observed. Ecological value of Threatened and At Risk bird species noted within the Project area ranges between **Moderate** – **Very High**.

Copper skinks (At Risk – Declining) were confirmed within the Project Area. Suitable lizard habitat within the Project Area includes planted native vegetation (PL. 1-3), treelands (TL. 2-3), exotic scrub (ES), regenerative native vegetation (VS5), and unmanaged rank/exotic grassland (EG). The ecological value of lizards is **High**.

The Project traverses across sections of Tōtara Creek, Mānutewhau Stream, Tihema Stream, Rarawaru Stream, a tributary of Mānutewhau Stream, one unnamed stream, and Meola Creek. Seven stream reaches are expected to be impacted by culvert extensions or new bridges. Fish records indicate the presence of several TAR fish species within the stream systems. The ecological value of streams within the Project Area ranged from **Low** to **Moderate**. Two exotic induced wetlands (of **Low** to **Moderate** ecological value) within the Project Area will not be impacted by the Indicative Design.

The Project will cross two marine SEAs at Henderson Creek (with one bridge pile within the sub-tidal zone of Henderson Creek) and Huruhuru Creek (no bridge piles within Huruhuru Creek). The ecological value of the mangrove habitat and sub-tidal estuarine habitat at these estuaries is considered to be **Low**.

Without mitigation, we consider that the construction related effects for the Indicative Design will range from **Very Low** to **Moderate.** Operational effects without mitigation range from **Negligible /Very Low** to **Low.** In addition, without mitigation, we consider that the construction related cumulative effects will be at least **Moderate**. This would largely be due to the loss of portions of SEAs and freshwater habitat.

Project effects can be minimised by implementing best practice construction methods and embedded controls. Mitigation is required to address key ecological effects, including vegetation removal within

terrestrial SEAs, potential harm to bats and loss of roosts, disturbance or injury to birds and nests, impacts on lizards such as copper skinks, permanent modification of stream habitats, and potential injury to native fish or loss of spawning habitat during instream works.

In accordance with the EIANZ Guidelines and informed by professional judgement, we have recommended mitigation where the level of effect was assessed as **Moderate** (or higher). Recommended mitigation was identified for construction effects (no mitigation was deemed necessary for operational effects), and included:

- Restoration planting and pest plant management, to mitigate vegetation loss within the terrestrial SEAs.
- Kauri dieback management.
- Bat management measures including avoidance of suitable bat habitat (where practicable) and the implementation of Bat Roost Protocols (BRPs).
- Bird management during construction including the consideration of vegetation removal timing to avoid the key nesting season and pre-clearance nest checks prior to vegetation removal during the nesting season in the relevant vegetation types throughout the Project Area.
- Lizard management for future WAA applications including the avoidance of suitable lizard habitat (where practicable), timing of vegetation clearance, and a LMP to guide lizard salvage, relocation, and management.
- Riparian restoration along portions of impacted streams.
- The implementation of Fish Salvage and Relocation Protocols (FSRP) during construction stages and consideration of native fish migration and the potential inanga spawning season.

The Indicative Design limits impacts to terrestrial SEAs, through aligning with existing road infrastructure and bridging SEA_T_4938 and a portion of SEA_T_5124. The recommended restoration planting and pest management will enhance the remaining portions of the SEAs within the Project Area, particularly within the SEA at Triangle Road (SEA_T_5124).

Sensitivity testing identified that some Indicative Design changes could result in residual effects that may prove challenging to mitigate or offset/compensate. As such, we recommend the avoidance of further encroachment into the terrestrial SEAs and Tōtara Creek.

We assessed ecological effects after mitigation, and offsets as Low - Very Low. This was based on:

- The implementation of embedded controls, and best practice construction management measures.
- The implementation of the recommended mitigation measures outlined in this assessment.
- The avoidance of increased encroachment into the terrestrial SEAs and Tōtara Creek.

In conclusion, with mitigation and offsetting of residual effects, we have assessed the Indicative Design for the Project as having a Low-Very Low effect on ecological features throughout and directly adjacent to the Project Area.

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Acronyms, definitions and abbreviations

Term	Definition
ABM	Automatic Bat Monitor
ACO	Artificial Cover Object
AEE	Assessment of Environmental Effects
AUP	Auckland Unitary Plan (Operative in Part)
BCM	Biodiversity Conservation Model
CMA	Coastal Marine Area
DOC	Department of Conservation
ECR	Environmental Compensation Ratio
EcIA	Ecological Impact Assessment
EIANZ	Environment Institute of Australia and New Zealand
EIANZ Guidelines	Ecological Impact Assessment (EcIA) Guidelines (Roper-Lindsay et al., 2018), referred to as the EIANZ Guidelines
FTAA	Fast-track Approvals Act 2024
GIS	Geographic Information System
HNZPTA	Heritage New Zealand Pouhere Taonga Act 2014
Indicative Design	The indicative design of the Project within the Project Area as shown on the Indicative Design drawings in Part 6
MCI	Macroinvertebrate Community Index
MCI-sb	Macroinvertebrate Community Index – Soft Bottom
MfE	Ministry for the Environment
MPI	Ministry for Primary Industries
Moata	The Project GIS system
NoR	Notice of Requirement
NPS-FM	National Policy Statement for Freshwater Management (as amended October 2024)
NZTA	New Zealand Transport Agency Waka Kotahi
Project	Te Ara Hauāuru Northwest Rapid Transit
Project Area	The Proposed Designation and the extent of the coastal occupation permits sought
Proposed Designation	The area defined by the Proposed Designation boundary as shown on the Proposed Designation Plans in Part 6
QMCI	Quantitative Macroinvertebrate Community Index
RMA	Resource Management Act 1991
SEA	Significant Ecological Area
SEV	Stream Ecological Valuation
SH16	State Highway 16
TAR	Threatened and At Risk
WAA	Wildlife Act Authority
ZOI	Zone of Influence
5MBC	5 Minute Bird Count

1. Introduction

This technical assessment has been prepared to inform a substantive application for the Northwest Rapid Transit Project (the Project) under the Fast-Track Approvals Act 2024 (FTAA). It forms part of a suite of specialist reports that collectively support the applications for statutory approvals.

1.1 Purpose and scope of this report

The purpose of this report is to evaluate the actual and potential effects of the Project on the environment in relation to ecology. This report addresses the following matters:

- An overview of the methodology undertaken to inform the assessment.
- The findings of ecological desktop and site investigations.
- Actual and potential effects on terrestrial, freshwater, wetland, and marine ecology.

The assessment considers both the construction and operational phases of the Project, identifying any adverse effects and assessing their significance. Where necessary, measures to avoid, remedy, or mitigate effects have been identified.

This report should be read alongside the Substantive Application including the AEE, which contains further details on the context of the Project. The Substantive Application also contains a description of works to be authorised and the typical construction methodologies that will be used to implement this work. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

The AEE also contains a description of works to be authorised and the typical construction methodologies that will be used to implement this work. Indicative construction methodologies have been considered as part of the assessment of effects. As such, they are not repeated here. Where a description of an activity is necessary to understand the potential effects, it has been included in this report for clarity.

2. Assessment methodology

2.1 Ecological impact assessment methodology

This assessment of ecological effects was informed by professional judgement and guided by the following guidelines:

- The Ecological Impact Assessment (EcIA) Guidelines (Roper-Lindsay et al., 2018) (hereinafter referred to as the Environment Institute of Australia and New Zealand (EIANZ) Guidelines).
- EcIA: Module 1 - Assigning Ecological Value to Marine Benthic Habitats (EIANZ EcIA Module 1, 2024).

In addition, the following NZTA standard, policy, and guidelines were also taken into consideration:

- NZTA Z/19 Taumata Taiao – Environmental and Sustainability Standard (NZTA, 2022b), and the NZTA Environment and Social Responsibility Policy (NZTA, 2022a)[1].
- The NZTA Ecological Impact Assessment Guidelines (NZTA, 2023)[2].

The consideration of the EIANZ documents and NZTA guidelines allowed for a structured and robust approach to assessing the actual and potential effects arising from the Indicative Design (the indicative design of the Project within the Project Area as shown on the Indicative Design drawings in Part 6), as well as potential amendments to the Indicative Design within the Project Area (the Proposed Designation and the extent of the coastal occupation permits sought).

[1] This Policy shaped the principles applied during the assessment.

[2] These guidelines are intended for ecologists undertaking EcIAs.

The assessment identifies species protected under the Wildlife Act 1953[3], which are likely to be present within the Project Area, and identifies if there is a risk of killing, or disturbance to, the species.

A combination of desktop review and site investigations within the Project Area and the Zone of Influence (ZOI) of the Project informed the assessment.

2.1.1 Ecological values assessment

The initial step for this EcIA was to assess the value of ecological features (i.e., terrestrial, aquatic (freshwater and marine), wetland habitats, and their fauna) within the Project Area and where relevant directly adjacent to the Project Area. The ecological value of each feature was assessed using a spreadsheet template by assigning a score of *0 (Negligible), 1 (Low), 2 (Moderate), 3 (High), or 4 (Very High)* based on professional judgement (with justification) to attributes associated with each of the four ecological matters recommended within the EIANZ Guidelines: *1) Representativeness; 2) Rarity/distinctiveness; 3) Diversity and pattern; and 4) Ecological context.*

The score for each matter was constrained to the highest score for each aspect (e.g., a High score allocated to a wetland for flood attenuation will result in a High score for the Ecological context matter). The combined ecological value score (ranging from Very High to Negligible) was determined in accordance with the EIANZ Guidelines.

For fauna, an ecological value was given to individual species based on their conservation significance (Table 2-1).

Table 2-1: Table 5 of EIANZ Guidelines: factors to consider in assigning value to individual species

Determining factors	Value
Nationally Threatened species, found in the ZOI either permanently or seasonally	Very High
Species listed as At Risk – Declining, found in the ZOI, either permanently or seasonally	High
Species listed as any other category of At Risk, found in the ZOI either permanently or seasonally	Moderate
Locally (Ecological District (ED)) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pest, and/or species having recreational value	Negligible

2.1.2 Magnitude of ecological effects

The next step for this EcIA was a systematic assessment of the magnitude of ecological effects related to specific Project features and activities. The magnitude of effects assessment was based on (as per the EIANZ Guidelines): *1) Type; 2) Extent; 3) Duration; 4) Frequency; 5) Probability; and 6) Reversibility.*

The magnitude of effect was then combined with the outcome of the value assessment to determine an inherent level of effect prior to impact management (after due consideration to any embedded controls and existing avoidance measures, but prior to consideration of mitigation).

2.1.3 Identifying reasonable and practical mitigation

The final step involved identifying reasonable and practical mitigation consistent with the mitigation hierarchy[4]. We identified reasonable and practical measures to avoid, remedy, mitigate, and where required offset the ecological effects based on the Indicative Design. Through sensitivity testing we further identified reasonable and practical measures to mitigate the potential variations to the effects associated with the realignment or increase of the footprint of the Indicative Design. In general, mitigation was identified where the level of effect was determined to be **Moderate** or higher.

[3] The Wildlife Act 1953 includes specific provisions for activities that may disturb, injure, or kill native animals.

[4] As highlighted in the EIANZ Guidelines, the mitigation hierarchy sets an order of priority for ecological effects management, which is: 1. avoid, 2. remedy, 3. mitigate, 4. offset, 5. compensate.

2.2 Project area and zone of influence

The Project Area includes the area for the busway, the stations, and associated works including construction areas within the Proposed Designation (the area defined by the Proposed Designation boundary as shown on the Proposed Designation Plans in Part 6), and the area for the proposed infrastructure over the Coastal Marine Area (CMA) (i.e., busway bridges) and associated construction areas.

The ZOI of the Project relates to an area occupied by habitats and species that are adjacent to and may go beyond the boundary of the Project Area. It is defined in the EIANZ Guidelines as "*the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities*." The distance of the ZOI and the type of effect from the Project can be different for different species and habitat types. For the purposes of this Project, the ZOI is largely the remaining habitat directly adjacent to the Project Area (e.g., within approximately 100m). Where required, a larger ZOI will be defined (e.g., if required for highly mobile species, bats and birds, and/or downstream freshwater and marine ecosystems). ZOI is used throughout this report to describe the impacts of the Project (both construction and operational) on adjacent or connected terrestrial, freshwater, marine, and wetland habitats, and associated native species.

It should be noted that the presence of habitats and/or species within the ZOI of the Project does not necessarily mean those ecological features will be impacted by the Project.

2.3 Desktop review

To gain an understanding of the ecological features of value that could potentially be impacted by the Project, a desktop review of the following terrestrial, freshwater, wetland, and marine ecological records was undertaken:

- Department of Conservation (DOC) Bioweb records.
- Department of Conservation, Threat Classification Series.
- Department of Conservation, A classification of New Zealand's terrestrial ecosystems (Singers and Rogers, 2014).
- Ecological Regions and Districts of New Zealand (McEwen, 1987).
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers et al., 2017).
- New Zealand Freshwater Fish Database (NZFFD).
- Auckland Council Geomaps: modelled inanga spawning site data.
- Ministry for Primary Industries (MPI) NES – PF Erosion Susceptibility Classification and Fish Spawning Indicator Tool Webmap (https://mpi_nes.cloud.eaglegis.co.nz/NESPF/)
- Trait-based climate change vulnerability assessments of terrestrial taxa in Aotearoa New Zealand (Brumby et al., 2025).
- Ecological assessment reports from the following projects: Spedding Road Plan Change Area, NZTA SH16, Unitec, and the Western Ring Route-Waterview Connection.
- NZTA road edge-effects on ecosystems research report (Simcock, et al., 2022).
- eBird Atlas 10 km^2 grids, for additional sightings in the Project Area.
- Satellite and aerial imagery from Auckland Council Geomaps, Google Earth©, Retrolens, and Google Street View.

2.4 Site investigations

Site investigations were undertaken between February and July 2025 to characterise and assess the terrestrial, freshwater, wetland, and marine ecosystems within the Project Area and the ZOI.

2.4.1 Terrestrial habitats / vegetation communities

Visual inspections of terrestrial habitat present within and adjacent to the Project Area were undertaken during the site investigation. Habitats were classified into the ecosystem types described in Singers et al.

(2017) and assessed in relation to their potential to support indigenous fauna, including birds, bats, lizards, and invertebrates.

The vegetation assessment included recording the dominant or characteristic species present, threatened species present, and the general habitat quality, including structure, maturity, presence of weeds and evidence of disturbance.

2.4.2 Terrestrial fauna

2.4.2.1 Bats

A baseline bat survey was undertaken using passive acoustic monitoring (i.e., Automatic Bat Monitors (ABMs)), following best-practice guidelines adapted from *DOC Inventory and Monitoring Toolbox: Bats* (2012), and relevant New Zealand bat survey protocols.

Monitoring locations were strategically selected to provide representative coverage of habitat features across the Project Area, including treeland edges, open clearings, riparian zones, and along potential flight corridors. Fourteen ABMs were deployed for a minimum of 21 consecutive nights, from 25 March to 6 May 2025. All recordings were processed using Kaleidoscope Pro Analysis software (Wildlife Acoustics Inc.). Following automated processing, all potential bat passes were manually reviewed and verified by a suitably qualified ecologist.

2.4.2.2 Birds

The following baseline bird surveys were undertaken across the Project Area, and where required within suitable habitat directly adjacent to the Project Area (i.e., ZOI):

- 5-minute bird count (5MBC) surveys throughout representative habitats across the Project Area (Hartley & Greene, 2012),
- Targeted one-hour surveys at freshwater and estuarine waterbodies, both within and directly adjacent to the Project Area, and
- Incidental (non-targeted) observations throughout the fieldwork period (between February and July 2025).

2.4.2.3 Herpetofauna

Baseline lizard surveys were undertaken following DOC best practice guidelines (*Lizard Technical Guide* 2016; *DOC Inventory and Monitoring Toolbox: Herpetofauna* 2012), using a combination of active and passive detection methods to detect both diurnal skink and nocturnal gecko species.

Artificial Cover Objects (ACOs) were installed across representative habitats within the Project Area, to target ground-dwelling skinks and arboreal geckos. Two hundred and twenty ground ACOs and 16 tree ACOs were deployed. The ACOs were checked twice after an initial three-week bedding-in' period. The inspections were conducted between 1 May and 12 May 2025, during warm, dry, and calm conditions.

Targeted nocturnal spotlighting surveys were conducted in April 2025. Surveys were undertaken during optimal conditions, between dusk and midnight, to coincide with peak gecko activity. Transects were walked through suitable habitat, focusing on shrublands, and canopy structures. Observers used high-powered LED headlamps and hand-held spotlights to systematically scan foliage, trunks, branches, and rock faces.

Incidental manual searches were undertaken opportunistically throughout the fieldwork period. These involved careful examination of natural cover objects such as logs, rocks, and vegetation where suitable lizard habitat features were present. Observations made outside of formal survey sessions were recorded as incidental records.

2.4.2.4 Invertebrates

Invertebrates were recorded as part of the incidental manual searches for lizards, as well as during the ACO inspections.

2.4.3 Freshwater ecology

Stream surveys were undertaken to describe the existing ecological value of all permanent and intermittent tributaries within, or directly adjacent to (i.e., approximately 100m), the Project Area. The Stream Ecological Valuation (SEV) method (Storey et al., 2011) was applied.

The following stream surveys were undertaken:

- Measurements of physical stream attributes including stream width, depth, velocity, in-stream habitat, and riparian characteristics. The data was used to inform the hydrological function, biogeochemical function and habitat provisions of the stream.
- Macroinvertebrate surveys. Instream macroinvertebrate communities were sampled at SEV locations following protocols developed for the sampling of macroinvertebrates in wadeable, soft-bottomed streams in New Zealand (Stark et al., 2001). Standard community-based invertebrate indices were used to interpret invertebrate data, including the percentage of Ephemeroptera, Plecoptera, and Trichoptera (%EPT), Quantitative Macroinvertebrate Community Index (QMCI) (Stark, 1985), and Macroinvertebrate Community Index (MCI) (Stark, 1985).
- Environmental DNA (eDNA) sampling, augmented with available data from the Freshwater Fish Database (Stoffels, 2022) was used to characterise the fish presence. Filtered water samples were taken using Wilderlab eDNA sample kits and sent to a laboratory (Wilderlab) for analysis. Laboratory analysis included eDNA sequence counts using multi-species DNA metabarcoding targeting fish, macroinvertebrates, mammals, and birds.

We used the SEV method to inform ecological conditions by assigning a SEV score based on 14 key ecological functions. The ecological functions are represented by four broad stream function categories (hydraulic, biochemical, habitat provision, and biodiversity provisions). Inputs from each function were used to calculate (using averages and algorithms) an overall SEV score between 0 (Poor) and 1 (Excellent) (Table 2-2).

Table 2-2: Interpretation of SEV scores (Storey et al. 2011)

SEV Score	Ecological Condition
0 – 0.4	Poor
0.41 – 0.60	Moderate
0.61 – 0.80	Good
0.81 +	Excellent

2.4.4 Wetland ecology

Wetland surveys were undertaken to ground truth desktop delineated wetlands, using the wetland delineation protocols (Ministry for the Environment (MfE), 2022). Wetlands were assessed against the Resource Management Act 1991 (RMA) definition, and National Policy Statement for Freshwater Management (NPS-FM) definition (as amended in 2023) to determine the presence of any wetlands and/or natural inland wetlands. A desktop wetland delineation was undertaken for wetlands within 100m of the Project Area.

2.4.5 Marine ecology – Benthic survey

A benthic survey was undertaken at the two estuary locations, Huruhuru Creek and Henderson Creek, where the Project intersects with the marine environment of the upper Waitematā Harbour. The survey also included a control site on the Whau River, for comparison of results with those in the Project Area (in the event post-construction monitoring is required). The survey followed best practice methods for marine benthic sampling in New Zealand and samples were taken at the three locations in triplicate for taxonomic identification. Sediment samples were analysed for sediment contaminants (e.g., copper, lead, zinc, polycyclic aromatic hydrocarbons (PAH), total organic carbon, and grain size). Taxonomic enumeration and identification of benthic fauna species was to the lowest practicable taxonomic level.

2.5 Limitations and assumptions

- Timing of the project – This assessment has been undertaken on the assumption that the Project is anticipated to be delivered over an approximately 20-year period, and construction will be staged.
- Characterising the Project Area – site investigations required obtaining permission from NZTA, Auckland Council, or private landowners, as the respective property owners. Delays in obtaining permission delayed the start of the faunal surveys, particularly the bat survey. As a result of this time limitation, we were only able to undertake a single bat survey late in the season instead of the preferred two surveys (early season and late season). This was a limitation for the infield assessment component of this study.
- Inputs into to the development of the Indicative Design, including updates to the proposed designation and realignment or redesign, was an iterative process. The approach enabled adjustments based on ecological findings as well as other specialist assessments. However, the potential for ongoing changes to the Indicative Design[5] makes it challenging to determine accurate quantities of appropriate mitigation.
- Mana Whenua values associated with ecological features have not been directly considered in this assessment.
- Bridge construction over Henderson Creek and Huruhuru Creek will require temporary staging from both ends. As per the indicative construction methodology in the AEE (refer to Part 4 of the Substative Application), a 20m-wide access way on one side of each bridge has been assumed. In addition, it is assumed that the bridge over Henderson Creek will have one bridge pile within the sub-tidal zone of Henderson Creek.
- Ten stream reaches (Section 3.4) were surveyed based on the project information available at the time of the assessment. These streams were chosen based on proposed bridge crossings, culvert extensions, or proximity to proposed earthworks. Stream reaches that were assessed were based on the Indicative Design (i.e., the stream reaches within the Proposed Designation, but on the opposite side of the of SH16 to the Indicative Design, were not assessed infield). The assessment was undertaken on the understanding that Tōtara Creek (Stream 1 and 3), Rarawaru Stream (Stream 7), and Meola Creek (Stream 8) will be bridged, with no piers proposed within the instream habitat, and Streams 4[6],6, and 9 will likely require culvert extensions (which will involve temporary diversions, detention and/or over-pumping to enable construction). Details of culvert design and dimensions are based on limited available information in the Indicative Design and indicative construction methodology. Based on the Indicative Design no impacts were assessed for Streams 2, 5, and 10.
- Based on the Indicative Design it was determined that it was unlikely a Complex Freshwater Fisheries permit for Complex Freshwater Activities (Schedule 9 of the FTAA) would be required. However, this will need to be determined at the detailed design phase, when final construction methodology of instream structures is known. If required, a Complex Freshwater Fisheries permit must be obtained.
- The limited wetlands identified within the Project Area were assessed to be induced exotic wetlands. While these are still considered to be inland natural wetlands (as per the NPS-FM), limited infield assessments were undertaken, as the wetlands are avoided by the Indicative Design.

3. Receiving environment

3.1 Ecological context within the existing landscape

The landscape within the Project Area would have historically (i.e., pre-human era) been covered in extensive forest with the dominant terrestrial ecosystem types including kauri, podocarp, broadleaved forest (WF11), puriri forest (WF7.1), puriri, taraire forest (WF7.2), mangrove forest and scrub (SA1), and oioi restiad rushland/reedland (WL10) (McEwen, 1987). The area would have supported a diverse range of invertebrates, amphibians, reptiles, birds and bats (Singers et al.,2017). Like most of the Tāmaki ecological district, the landscape within, and adjacent to, the Project Area has been heavily transformed and is largely urbanised and industrialised. Remaining terrestrial and aquatic habitats within the Project Area consist largely of a mixture of native and exotic planted vegetation within open spaces and along riparian corridors. The Project Area also includes small portions of estuarine habitat dominated by mangroves.

[5] The indicative alignment for the Project within the Proposed Designation will only be confirmed during detailed design.

[6] We have assumed a culvert extension at Stream 4, although it is understood this might change.

3.2 Terrestrial vegetation

3.2.1 Desktop survey

As most of the Project Area is highly developed there is little vegetation. The remaining vegetation largely consists of open exotic grassland (EG), planted vegetation (PL), treelands (TL), exotic scrub (ES), and regenerating vegetation (VS). Apart from a few patches mapped on Auckland Councils Geomaps, limited mapping of the vegetation was available. As such, all vegetation within the Project Area, and directly adjacent to the Project Area (where required), was mapped[7]. Table 3-1 provides a breakdown of the different habitat types identified within the Project Area and the extent of the vegetation relative to the Project Area (including west and east of the causeway between Te Atatū and Waterview interchanges). Refer to Appendix A for the detailed terrestrial vegetation mapping throughout the Project Area, and to Section 3.2.2 for a description of the terrestrial vegetation types.

Table 3-1: Extent of remaining vegetation within the Project Area

Habitat Code	Habitat Description	West of Causeway (ha)	East of Causeway (ha)	Total	% of Project Area
DG	Dwellings and associated Gardens	15.10	2.35	17.46	9.2
BF	Brown Field	0.20	0	0.20	0.0
EG	Exotic Grassland	35.21	1.96	37.17	19.5
ES	Exotic Dominated Scrub	0.38	0	0.38	4.4
PL.1	Planted Native Vegetation <20yrs	24.329	1.21	24.539	19.5
PL.2	Planted Native Vegetation >20yrs	0.01	1.39	1.4	0.73
PL.3	Native Amenity Planting	11.1	9.26	20.36	10.68
VS5	Broadleaved Scrub/Forest	0.70	1.07	1.77	0.93
TL.2	Mixed Native and Exotic Treeland	2.77	1.00	3.77	1.97
TL.3	Exotic Dominated Treeland	5.77	1.73	7.5	3.93
OW	Open Water	0.96	0.03	0.99	0.52
EW	Exotic Wetland	1.59	0.08	1.67	0.87
WL10	Oioi, Restiad Rushland/Reedland	0.55	0.10	0.65	0.34
WL18	Flaxland	0.13	0.07	0.2	0.1
Total (ha)		**88.44**	**23.81**	**112.2**	**58.8**
Proposed Designation (ha)				**190.60**	

The AUP mapping of Significant Ecological Areas (SEAs) together with SEA rules, provide a framework for protecting indigenous biodiversity. In total fifteen SEAs[8] are located within the ZOI (Figure 3-1). Of these, four are within the Project Area (SEA_T_2040; SEA_T_5124; SEA_T_3262; SEA_T_4938). These SEAs are described further in Table 3-2.

[7] At least one notable tree was identified along the Project Area boundary, in the vicinity of Keppell Street. Notable trees have not been included in this assessment and will be considered as part of the Project's Arboricultural Management of Pohutukawa and Notable Trees report.

[8] Other SEAs within the ZOI are: SEA_T_2034, SEA_T_4866, SEA_T_4654, SEA_T_4932, SEA_T_4917, SEA_T_6191, SEA_T_6190, SEA_T_3161, SEA_T_3240, SEA_T_6244a, SEA_T_5288.

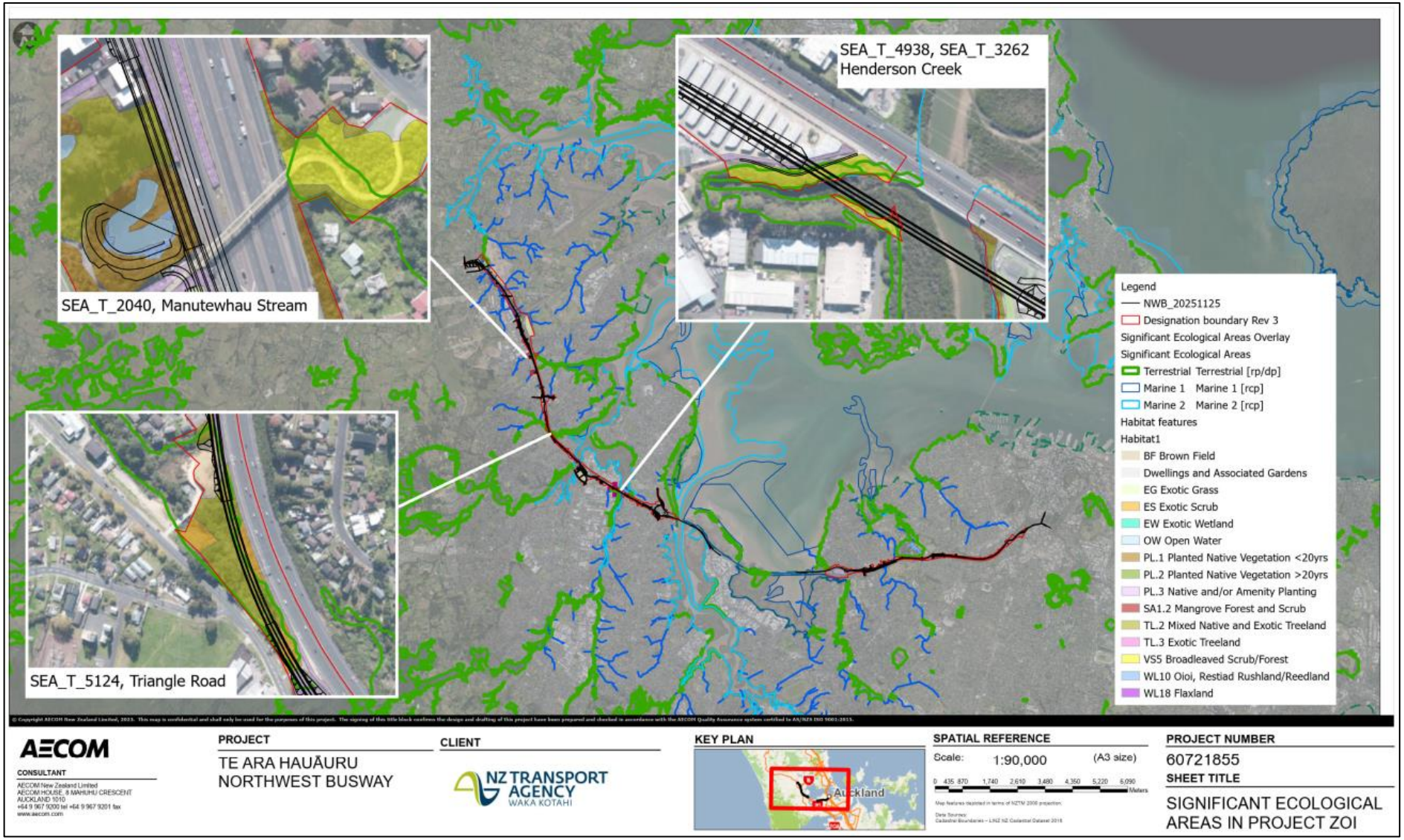


Figure 3-1: SEAs within the Project Area and the broader landscape

3.2.2 Site investigations

Site investigations were undertaken to ground-truth the desktop-mapped vegetation types. The following terrestrial vegetation types were identified:

- Exotic grass (EG): Rank/exotic grassland dominated by exotic species. This vegetation type is present throughout the Project Area, and includes mown lawns within reserves, grass berms, unmanaged grass surrounding planted native vegetation (PL.1) and within private properties. Dominant species include kikuyu grass (*Pennisetum cladestinum*) and paspalum grass (*Paspalum sp.*).
- Exotic scrub (ES): Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species. This vegetation type commonly occurs around riparian areas and within the Triangle Road SEA (SEA_T_5124). Species noted on site include gorse *(Ulex europaeus*), woolly nightshade (*Solanum mauritianum*), pampas (*Cortaderia selloana*), tree privet (*Ligustrum lucidum*) and Chinese privet (*Ligustrum sinense).*
- Planted native vegetation (PL.1): Planted native scrub or forest <20 years old. Present throughout the Project Area, and particularly along the SH16 corridor. Includes restoration planting within riparian areas (especially Tōtara Creek), reserves/parks, around stormwater ponds, and berms/roadside. Species include: kānuka (*Kunzea robusta*), manuka (*Leptospermum scoparium*), cabbage tree (*Cordyline australis*), karamu (*Coprosma* spp.), kahikatea (*Dacrycarpus dacrydioides*), mahoe/whitewood (*Melicytus ramiflorus*), red mapou (*Myrsine australis*), harakeke/flax (*Phormium tenax*), and houpara (*Pseudopanax lessonii*).
- Planted native vegetation (PL.3): Native and/or amenity plantings. PL.3 is mainly present along the roadside and within parks. Species include: akiraho (*Olearia paniculata*), karamu (*Coprosma* spp.), NZ broadleaf/kāpuka (*Griselinia littoralis),* kānuka (*Kunzea robusta*), manuka (*Leptospermum scoparium*), cabbage tree (*Cordyline australis*), Kawakawa *(Piper excelsum subsp. excelsum*), harakeke/flax (*Phormium tenax),* kahikatea (*Dacrycarpus dacrydioides*), mahoe/whitewood (*Melicytus ramiflorus*), and Pōhutukawa (*Metrosideros excelsa*).
- Mixed native and exotic treeland (TL.2): Mixed native/exotic with 25-75% native tree cover. TL.2 is present within riparian areas (Tōtara Creek), next to stormwater ponds, within the SEA at Triangle Road (SEA_T_5124) and adjacent to Huruhuru and Henderson Creek. It is characterised by stands of mixed native vegetation where canopy trees include species such as: Karaka (*Corynocarpus laevigatus*), Tōtara (*Podocarpus totara*), and exotic species such as black wattle (*Acacia mearnsii*), Eucalyptus spp. and pine species. Understorey vegetation includes mahoe (*Melicytus ramiflorus*), karamu (*Coprosma robusta*), red mapou (*Myrsine australis*), karo (*Pittosporum crassifolium*) and exotic weeds such as Chinese privet (*Ligustrum sinense*), Tree privet (*Ligustrum lucidum*), Woolly nightshade (*Solanum mauritianum*), and Climbing asparagus (*Asparagus scandens*).
- Exotic treeland (TL.3): Exotic dominated <25% native, with exotic tree cover dominant. TL.3 is present within riparian margins (such as at Tōtara Creek, Pikau Stream) within parks, on private properties, and on the roadside. Species include pinus spp., eucalyptus spp., willow (*Salix sp*.), beefwood (*Casuarina cunninghamiana*) and undergrowth includes young karamu (*Coprosma* spp.), pampas grass (*Cortaderia selloana*), wild ginger (*Hedychium gardnerianum*), and young kanuka (*Kunzea robusta*).
- Broadleaved scrub/forest (VS5): present within SEAs (SEA_T_2040, SEA_T_4938 and SEA_T_3262) and within Archhill Scenic Reserve. Regenerating vegetation including species such as: long-leaved lacebark (*Hoheria sexstylosa*), kānuka (*Kunzea ericoides*), mahoe (*Melicytus ramiflorus*), red mapou (*Myrsine australis*), karamu (*Coprosma robusta*), tī kōuka (*Cordyline australis*), hangehange (*Geniostoma ligustrifolium*), tarata (*Pittosporum eugenioides*), maidenhair vine (*Muehlenbeckia complexa*), karaka (*Corynocarpus laevigatus*), kawakawa *(Piper excelsum*), manuka (*Leptospermum scoparium*), and silver fern (*Alsophila dealbata).* Weed species noted on site include woolly nightshade, blackberry (*Rubus sp.),* privets, arum lily (*Zantedeschia aethiopica*), wild ginger (*Hedychium gardnerianum*), and pampas grass (*Cortaderia selloana).*

Threatened and At Risk (TAR) plant species (DOC, 2017) occurring within the Project Area include: kānuka (*Kunzea robusta*) (Nationally vulnerable), mānuka (*Leptospermum scoparium var. scoparium)* (At-risk declining), pōhutukawa (*Metrosideros excelsa*) (Nationally vulnerable), and kauri (*Agathis australis*) (Nationally vulnerable).

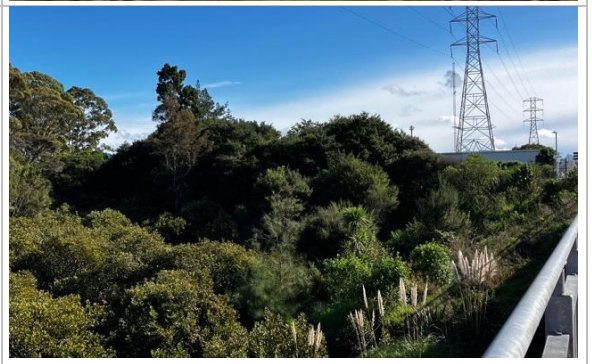
The threat classifications of kānuka, mānuka, and pōhutukawa were raised in response to the arrival of myrtle rust (*Austropuccinia psidii*) to New Zealand. This was a precautionary measure, as myrtle rust has caused severe declines in Myrtaceae species overseas. However, the trees within the Project Area are likely planted and not naturally occurring. As a result, the elevated threat statuses of these species have not been considered as part of assigning ecological value to the respective habitat types.

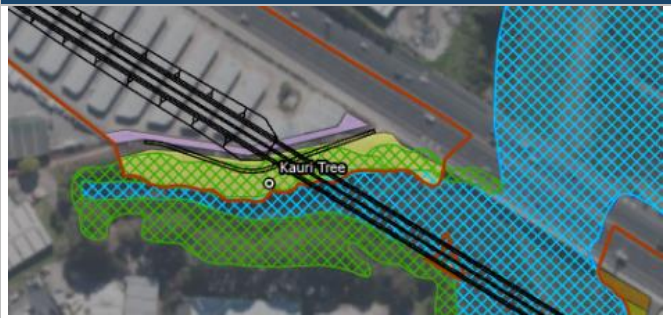
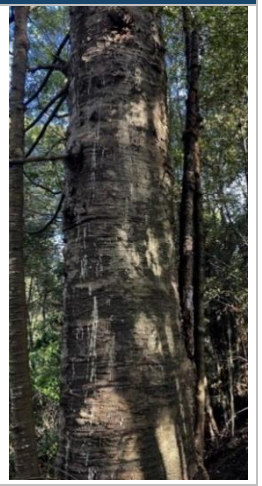
A single kauri tree was observed within the Henderson Creek (SEA_T_4938) (Table 3-2). The tree is located within a kauri management area (Auckland Council's Geomaps) and displayed a potential symptom of Kauri dieback[9], notably bleeding lesions on the lower trunk.

[9] Kauri dieback is a disease caused by a microscopic soil-borne pathogen called *Phytophthora agathidicida*. It infects the tree's roots and starves it of nutrients and water, ultimately killing it.

Table 3-2: Description of Significant Ecological Areas within the Project Area

SEA ID	Desktop vegetation description	Ecological significance criteria met	Site observation	Site photos
SEA_T_2040 **(Across from the Westgate Drive stormwater ponds along Mānutewhau Stream)**	VS3 - Mānuka, kānuka scrub (Regional IUCN threat status: Least concern) Broadleaved shrub and tree species hangehange and māhoe, species of *Coprosma*, *Pittosporum* and *Pseudopanax*, kawakawa, māpou and rewarewa. Tree ferns (e.g. mamaku and ponga)	4c Migration pathway	Vegetation within this SEA was classified as regenerating **VS5 – Broadleaved species scrub/forest** (Regional IUCN threat status: Least Concern) with **TL.2 Mixed Native and Exotic Treeland** around the edges of the SEA Species noted on site include a mix of mostly natives and some exotics: long-leaved lacebark (*Hoheria sexstylosa*), kānuka (*Kunzea robusta*), mahoe (*Melicytus ramiflorus*), red mapou (*Myrsine australis*), karamu (*Coprosma robusta*), tī kōuka (*Cordyline australis*), hangehange (*Geniostoma ligustrifolium*), tarata (*Pittosporum eugenioides*), maidenhair vine (*Muehlenbeckia complexa*), karaka (*Corynocarpus laevigatus*), houpara (*Pseudopanax lessonii*). Weeds occur along stream banks, e.g. arum lily (*Zantedeschia aethiopica*), and SEA edges, e.g. blackberry (*Rubus sp.).* See Figure 3-1 for SEA location.	
SEA_T_5124 **(Triangle Road, Rarawaru Stream)**	Bioresearches (March 2010) described the vegetation within this SEA as a mixture of exotic species (black wattle, gorse, pampas grass) at the bush edge near the motorway, and closer to the stream native species such as hangehange, mahoe and silver tree fern, under a tall wattle canopy.	2b Threatened fish species (*Galaxias maculatus*) 4c Migration pathway	Vegetation types within this SEA include: **TL.2 Mixed Native and Exotic Treeland**, BF Brown Field (bare ground), ES Exotic Scrub, and PL.3 Native and/or Amenity Planting. The southern end of the SEA is mainly exotic scrub. Some large stands of black wattle (*Acacia mearnsii*) form the canopy, the mid layer is comprised of gorse (*Ulex sp*.), tree privet (*Ligustrum lucidum*), Chinese privet (*Ligustrum sinense*) woolly nightshade (*Solanum mauritianum*), pampas grass (*Cortaderia selloana)*. Closer to the stream giant reeds (*Arundo donax*) dominate. The area adjacent to the SH16 bridge is characterised by open exotic grass patches, with black wattle forming the canopy. The understorey is made up of karamu (*Coprosma robusta*), tree ferns and kānuka (*Kunzea ericoides*), harakeke (*Phormium tenax*) and is dominated by exotics including woolly nightshade, blackberry (*Rubus sp*.), and privet. There is one large stand of kānuka close to the motorway. Construction works for a residential development are currently being undertaken within the western portion of this	

SEA ID	Desktop vegetation description	Ecological significance criteria met	Site observation	Site photos
			SEA (within the Proposed Designation). Vegetation has been removed, and a portion of the area is now bare ground. See Figure 3-1 for location of SEA.	
SEA_T_4938 and SEA_T_3262 (Henderson Creek)	Bioresearches (June 2010) noted recent restoration planting around the SEA edge (near the cycleway) and small kanuka, manuka and flax bush. Close to the cycleway two young (15m tall) kauri trees were noted.	3a Habitat diversity (Unclassified (UC), SA1) (SEA_T_4938) and SEA_T_3262) 3b Expected ecosystem diversity (SEA_T_3262) 3c Habitat type supports typical species richness (SEA_T_3262) 4c Migration pathway (SEA_T_3262)	Vegetation within this SEA is classified as regenerating **VS5 – Broadleaved species scrub/forest** (Regional IUCN threat status: Least Concern) Buffers marine SEA (SEA_M2_55a) Recently planted natives are present along the edges of the SEA, adjacent to the cycleway Vegetation consists of rimu (*Dacrydium cupressinum*), kānuka (*Kunzea robusta*), manuka (*Leptospermum scoparium*), silver fern (*Alsophila dealbata*), mapou (*Myrsine australis*), houpara (*Pseudopanax lessonii*), mahoe (*Melicytus ramifloru*), and exotic beefwood (*Casuarina cunninghamiana*), kawakawa (*Piper excelsum*) A large kauri (*Agathis australis*) tree is present about 13m down from the cycleway (as shown on the map below). Symptoms of Kauri dieback.	

SEA ID	Desktop vegetation description	Ecological significance criteria met	Site observation	Site photos
				 

3.2.3 Ecological value of terrestrial vegetation

The terrestrial vegetation types within the Project Area are considered to be of **Low** to **Moderate** ecological value. The Moderate value vegetation types include the broadleaved scrub/forest (VS5) and the mixed native and exotic treelands (TL.2). While the TL.2 vegetation includes some exotic species (as described in Section 3.2.2) the Moderate value stems from the dominance of the native tree cover and/or extent of native species within the understorey. For both vegetation types the Moderate value was due to habitat diversity, species diversity, ecological networks (important breeding and feeding links), and alignment with SEAs and / or reserves or stream corridors creating connectivity in the landscape. All other vegetation types were assessed to have a Low value. This included the exotic grass (EG) and exotic scrub (ES), which has the potential to provide habitat for TAR species.

3.3 Terrestrial fauna

3.3.1 Bats

Desktop investigations

Department of Conservation (DOC Bioweb bat records, and relevant previous ecological assessments were assessed for evidence of bats within the vicinity of the Project Area (Figure 3-2). Long-tailed bats (*Chalinolobus tuberculatus*) were recorded along the western most portion of the Project Area boundary in 2020, along Tōtara Creek east of SH16 (Tonkin & Taylor, 2020). In addition, there are further bat records in the vicinity of Brigham Creek Road, which is less than one kilometre from the Project Area (Figure 3-2, DOC Bioweb records).

There are no bat records within, or directly adjacent to, the rest of the Project Area.

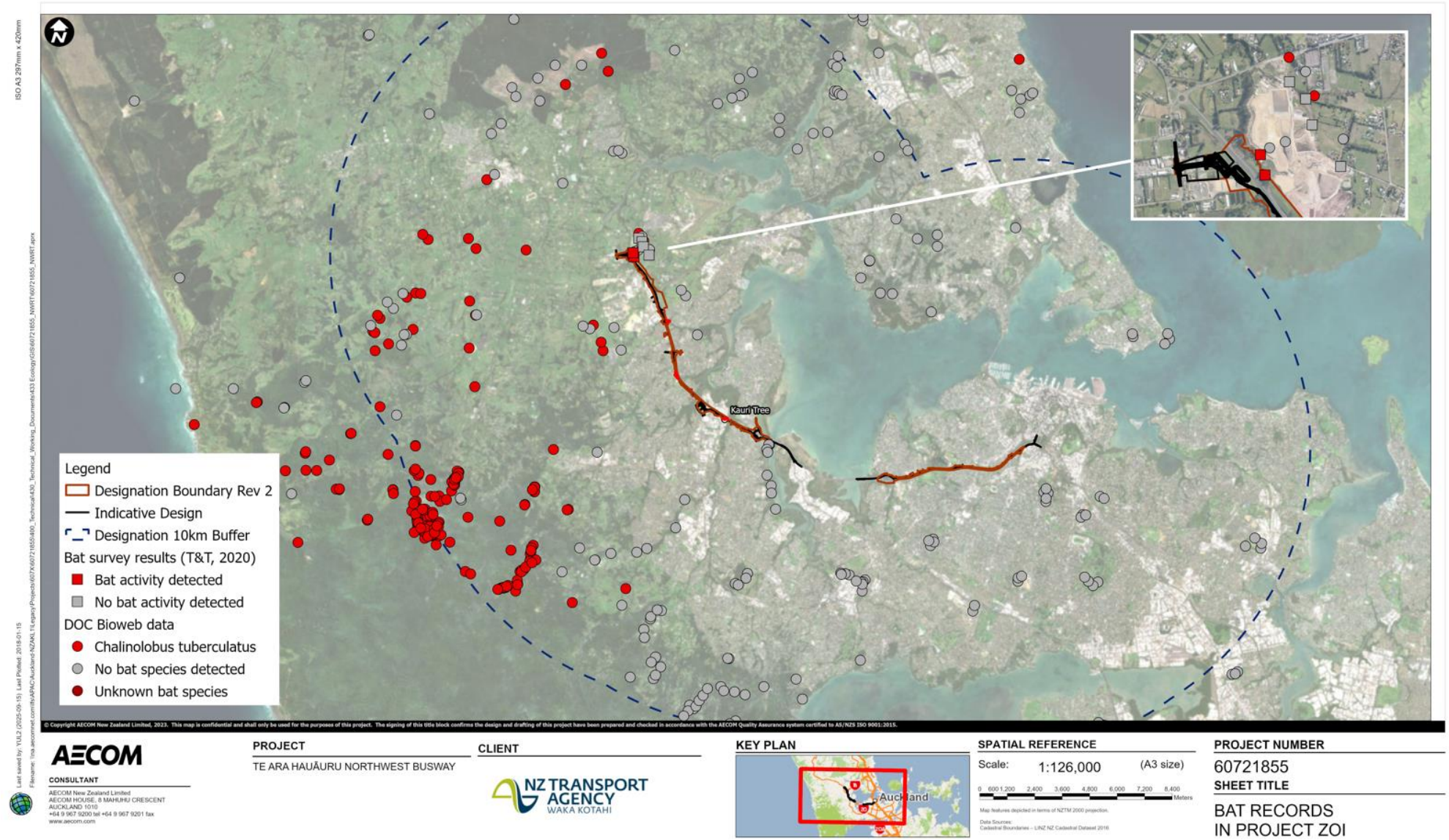


Figure 3-2: Bat records in the within 10km of the Project Area (desktop records)

Site investigations

No bat calls were detected at any of the ABMs within, or adjacent to, the Project Area. Locations of ABMs for the survey are detailed in Appendix B.

While no bats were recorded during the site investigations, existing records (Tonkin & Taylor, 2020) confirmed the presence of long-tailed bats along Tōtara Creek at that time. Site investigations confirmed that there is suitable habitat for long-tailed bats along the riparian margins of Tōtara Creek. This habitat includes portions of mixed native/exotic treelands (TL2) and exotic treeland (TL3) along the creek (Figure 3-3). Trees with cavities, flaky bark and split branches, which have the potential to provide bat roost habitat, are present within these portions of treelands (TL 2-3). Within the footprint of the Indicative Design (Figure 3-3) there is a stand of mature pines that have the potential to provide bat roost habitat.

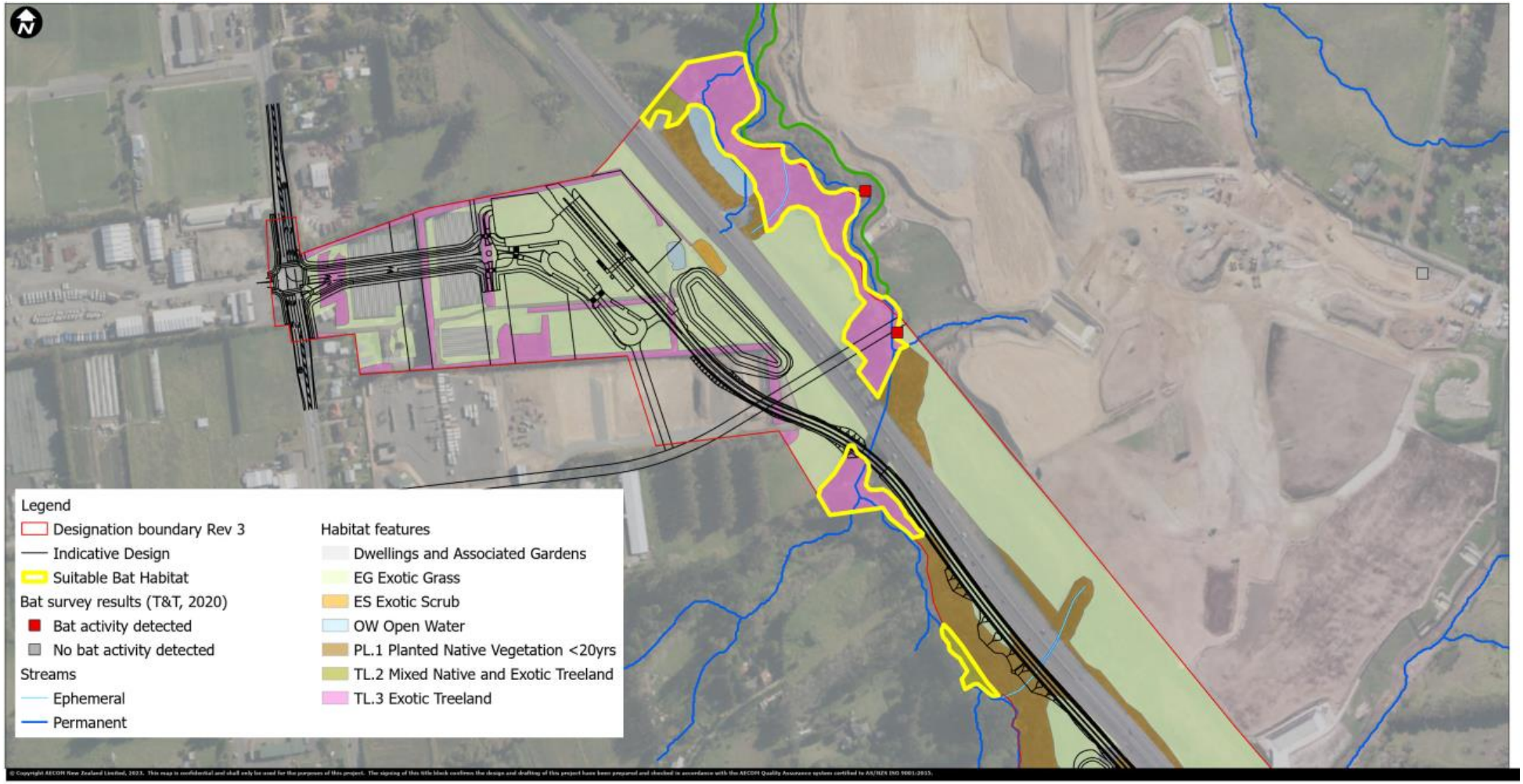


Figure 3-3: Suitable habitat for long-tailed bats along the riparian margins of Tōtara Creek (yellow outline)

3.3.2 Avifauna

Desktop investigations

A review of eBird and iNaturalist databases, and prior ecological assessment findings, confirmed records of 67 bird species within approximately 5km of the Project Area. These species included 45 native/migrant species, of which 24 are TAR species, and 22 non-native / introduced and naturalised species.

Bird species were broadly classified into terrestrial, coastal, and marsh species:

- 32 terrestrial species – These birds inhabit forests, shrublands, grasslands, urban areas, and farmland. They rely on vegetation, seeds, fruits, insects, and small invertebrates for food.
- 23 coastal species – These birds are generally found along beaches, rocky shores, estuaries, and harbours (e.g., Waitematā Harbour, Henderson Creek, Huruhuru Creek). Many are waders, shellfish feeders, or seabirds.
- 12 marsh species – These birds inhabit swamps, wetlands, rivers, and lakes. They depend on aquatic plants, invertebrates, and fish for food, and are often secretive.

Refer to Appendix C for the complete species list from desktop investigations, including conservation status, likelihood of presence within the Project Area, and habitat preferences.

Site investigations

Threatened and At-Risk (TAR) bird species observed within the Project Area are listed in Table 3-3. In addition to the TAR species observed, a further 16 native species were observed during the site investigations. For a complete list of bird species observed, refer to Appendix C. Locations of avifaunal survey sites are detailed in Appendix D.

Table 3-3: Threatened/At-Risk (TAR) bird species observed within the Project Area

Common name/ Māori	Scientific name	Conservation status (Robertson et al., 2021)	Regional conservation status (Woolly et al., 2024)
Caspian Tern/ Taranui	*Hydroprogne caspia*	Threatened – Nationally Vulnerable	Regionally Critical
Wrybill	*Anarhynchus frontalis*	Threatened- Nationally Increasing	Regionally Increasing
Red-billed gull	*Chroicocephalus novaehollandiae scopulinus*	At Risk - Declining	Regionally Vulnerable
White-fronted tern	*Sterna striata*	At Risk- Declining	Regionally Vulnerable
Variable oystercatcher/ Tōrea pango	*Haematopus unicolor*	At Risk- Recovering	Regionally Vulnerable
Black shag	*Phalacrocorax carbo*	At Risk- Relict	Regionally Critical
Little shag	*Phalacrocorax melanoleucos brevirostris*	At Risk - Relict	Regionally Endangered
Royal spoonbill/ Kōtuku ngutupapa	*Platalea regia*	At Risk- Naturally Uncommon	Regionally Naturally Uncommon
Little black shag/ Kawau Tūī	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	Regionally Naturally Uncommon
Pied shag	*Phalacrocorax varius*	At Risk - recovering	Regionally Recovering

There were two regionally critical species (Caspian Tern and Black Shag) and one regionally endangered species (Little Shag) observed within the Project Area during the field assessments. Additionally, there were three regionally vulnerable species (Red-billed Gull, White-fronted Tern and Variable Oystercatcher), one regionally increasing species (Wrybill), two regionally naturally uncommon species (Royal Spoonbill and Little Black Shag) and one regionally recovering species (Pied Shag) also observed. All of these species are

coastal species and move based on the tidal conditions, which means they are regularly on the move when foraging and their daily schedules are highly varied.

3.3.3 Herpetofauna

Desktop investigations

Native lizard species identified within 5km of the Project Area during desktop investigations are presented in Table 3-4. These records were sourced from DOC Bioweb, iNaturalist, and prior ecological assessment findings within or adjacent to the Project Area (e.g., Bioresearches, 2010). While 5km is a broader search radius than the Project Area, it provides context on species likely to occur in the wider landscape. The records highlight the persistence of native lizards despite urbanisation and associated pressures. This information supports an understanding of potential habitat value and connectivity within the urban matrix, even though actual presence within the Project Area would require targeted surveys.

Table 3-4: Native herpetofauna records within 5km of the Project Area

Common name	Scientific name	National conservation status (Hitchmough et al., 2021)	Regional conservation status (Melzer et al., 2022)
Elegant gecko	*Naultinus elegans*	At Risk - Declining	Regionally Declining
Copper skink	*Oligosoma aeneum*	At Risk – Declining	Regionally Declining
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining	Regionally Declining
Ornate skink	*Oligosoma ornatum*	At Risk – Declining	Regionally Declining
Pacific gecko	*Dactylocnemis pacificus*	Not Threatened	Regionally Declining

While these five species have been recorded in the broader landscape, the only species recorded within, or directly adjacent to, the Project Area was copper skink (Figure 3-4).

Site investigations

Two copper skinks were observed during the baseline lizard surveys. One in the planted vegetation along the tributary of the Mānutewhau Stream near the Royal Road/Moire Road intersection, and another within the planted vegetation on the southern side of SH16 near Taitapu Park (Figure 3-4). A high abundance of plague skinks was observed throughout the various vegetation types within the Proposed Designation. No other species of skinks or geckos were observed.

Desktop records of copper skinks within and directly adjacent to the Project Area, the observation of copper skinks during the baseline survey, and the species' ability to persist in heavily modified and degraded environments[10] all provides sufficient evidence to indicate the likely presence of copper skinks within suitable habitat in the Project Area.

Suitable lizard habitat in the Project Area comprises largely of planted native vegetation (PL.1-3), treelands (TL.2-3), exotic scrub (ES), regenerative native vegetation (VS5), and unmaintained exotic/rank grassland (EG) on habitat edges including along stream corridors (Appendix A). These vegetation types have sufficient ground cover such as unmanaged grass, leaf litter and woody debris to support native skinks, but marginal habitat for arboreal gecko species. Maintained grasslands and 'islands' of planted native vegetation isolated by road infrastructure (e.g., strips of planted vegetation along SH16, which have roads all around them) are considered unsuitable habitat and unlikely to support native skinks.

While the potential existence of ornate skink and the gecko species in the Project Area cannot be dismissed, the likelihood of their presence is low. This low likelihood is due to the re-planting history, the relatively young age of the planted and regenerative vegetation, and the existing modified/urbanised broader landscape.

[10] Where there is typically a prevalence of predator species such as rats, cats, both domestic and feral, and hedgehogs.

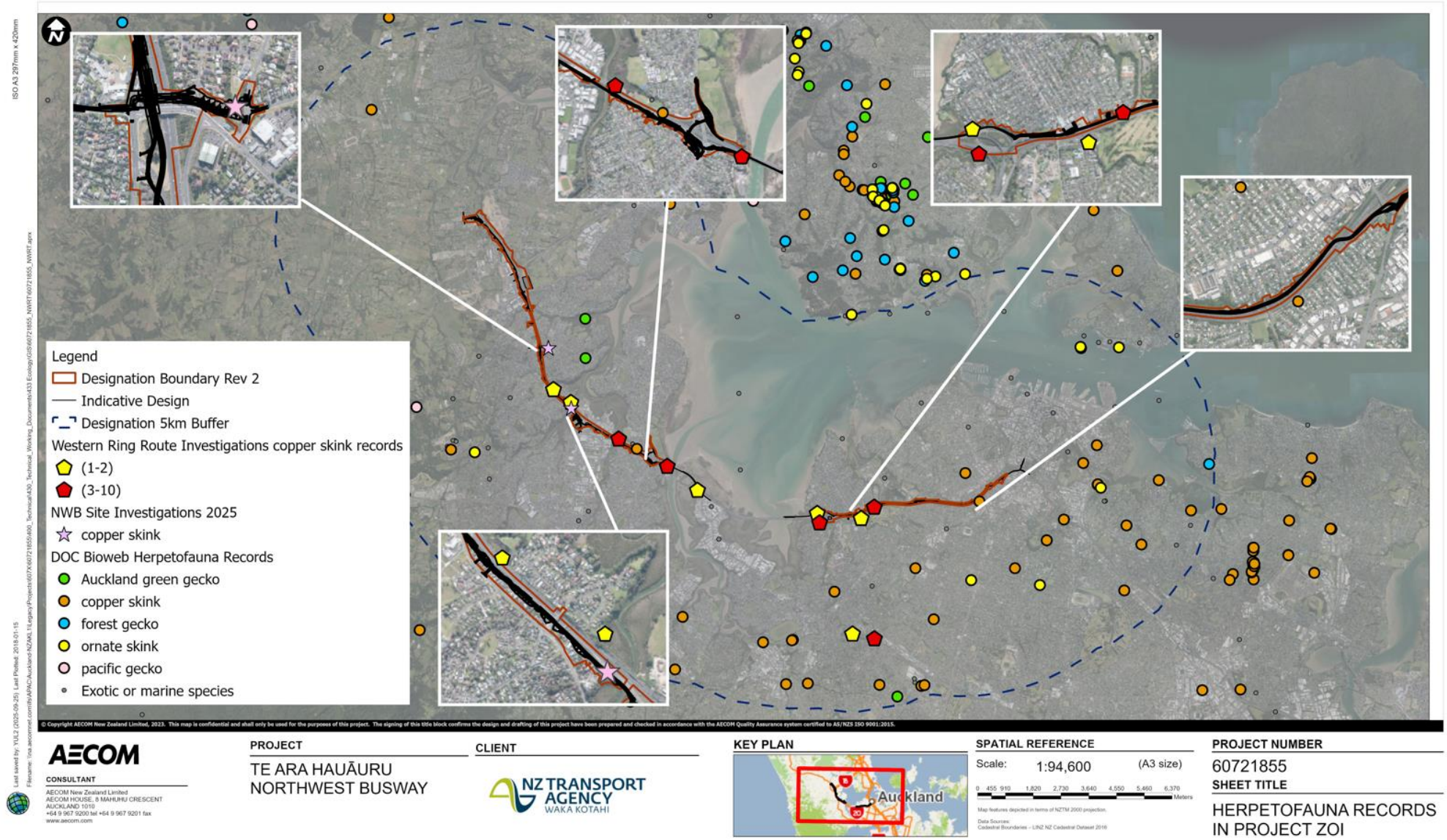


Figure 3-4: Herpetofauna records in Project Area and the broader landscape (5 km)

3.3.4 Invertebrates

Desktop investigations

According to iNaturalist records, common native invertebrates likely to be abundant within the Project Area include the Auckland tree wētā (*Hemideina thoracica*), tunnelweb spiders (*Hexathele sp*.), and the New Zealand nursery web spider (*Dolomedes minor*). These common invertebrate species are not legally protected under the Wildlife Act (1953) as per Schedule 7 of the Act. No TAR invertebrates are anticipated to be present in the Project Area.

Site investigations

Incidental invertebrate sightings during site walkovers and lizard surveys were native bush cockroaches (*Celatoblatta sp.),* Auckland tree wētā, tunnelweb spiders, and the non-native leopard slug (*Limax maximus).*

3.3.5 Ecological value

Table 3-5 presents the ecological values for the terrestrial fauna species with Moderate or higher values. The values presented are based on species identified through desktop and site investigations, which could potentially occur (e.g., Long-tailed bats, Long-tailed Cuckoo, Fernbird, and kākā) or are likely to occur (e.g., all other bird species listed below, and Copper Skinks) within the Project Area and is consistent with the EIANZ Guidelines (2018).

Table 3-5: Ecological values of fauna species within the Project Area (Moderate or higher)

Species	Assessment of ecological value attributes	Ecological value
Bats		
Long-tailed bat	Threatened – Nationally Critical both nationally and regionally within Auckland. Previously recorded bats along the Proposed Designation boundary along Tōtara Creek (north side of SH16), in the Brigham Creek area. Suitable habitat within the Proposed Designation: Mix native/exotic (TL2) and exotic (TL3) dominated treelands along Tōtara creek (Figure 3-3).	Very High
Birds		
Coastal Species: Caspian Tern*; Wrybill*; Red-billed gull*; White-fronted tern*; Variable oystercatcher*; Black shag*; Little shag*; Banded dotterel; Black-billed gull; Banded rail; Dabchick	Regionally Critical / Increasing / Endangered / Vulnerable. Likely to forage at all estuaries and/or large creek locations (Waitemata Harbour, Henderson Creek, Huruhuru Creek). Some species are known to forage in open grasslands, particularly in saturated conditions, and on ponds/streams.	Very High
Marsh Species: Fernbird, Spotless crake	Regionally Vulnerable. Potential to forage and/or breed within dense vegetation at stormwater ponds/wetlands.	Very High
Terrestrial Species: Long-tailed Cuckoo	Regionally Endangered. Potential to forage in mature forested areas.	Very High
Coastal species: South Island Pied Oystercatcher; Red knot	Regionally Declining. Potential to forage at all estuary locations, with the Oystercatcher also foraging on open grasslands, particularly in saturated conditions.	High
Coastal Species: Little black shag*; Pied shag*; New Zealand Dotterel	Regionally Increasing / Naturally Uncommon / Recovering. Potential to forage at all estuary locations. New Zealand Dotterel is known to nest within large construction sites within the region.	Moderate
Marsh Species: Royal spoonbill*; Australian Coot	Regionally Naturally Uncommon. Potential to forage and/or breed at estuary and large creek locations.	Moderate
Terrestrial Species: North Island kākā;	Regionally Recovering. Potential to forage in mature forested areas.	Moderate
Lizards		
Copper skink*	At Risk - Declining nationally, and Regionally Declining. Two observed during site investigations. Suitable habitat within the Proposed Designation: planted native vegetation (PL.1-3), treelands (TL.2-3), exotic scrub (ES), regenerative native vegetation (VS5), and unmanaged rank/exotic grassland (EG) on habitat edges including along stream corridors.	High

*Note * = Species observed.*

3.4 Freshwater ecology

3.4.1 Desktop survey

A desktop assessment was initially undertaken to identify the potential stream habitat within, and adjacent to, the Project Area. The desktop assessment considered all streams within the Project Area and determined if they were permanent, intermittent, ephemeral, and artificial watercourses (Appendix A). The affected streams were classified in the field using AUP definitions[11]. The effects assessment focused on permanent and intermittent streams.

The Project traverses across three sections of Tōtara Creek, Mānutewhau Stream, Tihema Stream, Rarawaru Stream, a tributary of Mānutewhau Stream, one unnamed stream, and Meola Creek (Figure 3-5). These streams fall within the Whenuapai, Massey, and Meola catchments in the Waitemata harbour watershed.

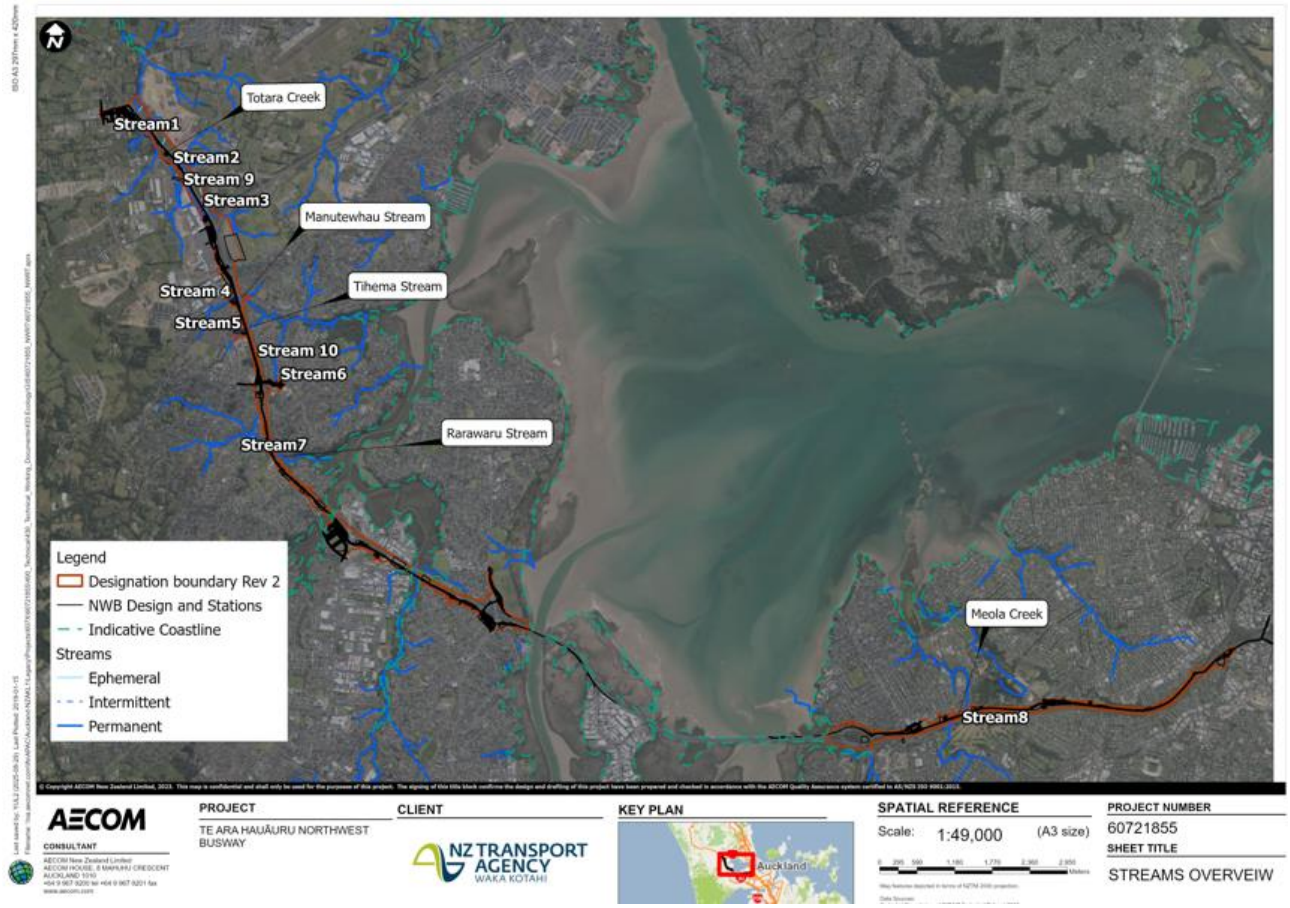


Figure 3-5: Streams within and adjacent to the Project Area

Table 3-6 below provides a summary of available desktop information on the streams traversed by the Project.

Table 3-6: Desktop description of streams

Stream	Desktop description
Tōtara Creek (Stream 1,2,3, and 9) *Whenuapai Catchment*	Tōtara Creek discharges to the Tōtara inlet and Brigham Creek, which is a marine SEA. The riparian margin of the lower downstream portion of Tōtara Creek is a Terrestrial SEA. Previously reported Macroinvertebrate Community Index (MCI) – soft bottom stream (sb) scores for Tōtara Creek were 'poor' and QMCI-sb were 'fair' (Tonkin & Taylor, 2020) indicating poor water quality.

[11] Auckland Unitary Plan. Practice and Guidance note. River/Stream Classification. July 2021. RC 3.3.17 (V2).

Stream	Desktop description
Mānutewhau Stream (Stream 4) *Massey Catchment*	Mānutewhau Stream flows adjacent to the stormwater ponds at 26 Westgate Drive, into a Terrestrial SEA, and ultimately into the Waitemata Harbour.
Tihema Stream (Stream 5) *Massey Catchment*	Tihema Stream flows adjacent to the stormwater ponds at 48 Westgate Drive into Mānutewhau Stream and a Terrestrial SEA. A previous ecological assessment (Bioresearches, 2016) indicates the Tihema Stream had a moderate ecological value.
Unnamed Stream at Westgate Drive Park (Stream 10) *Massey Catchment*	This intermittent stream flows from a culvert from the upstream stormwater ponds at Westgate Drive Park and exits into another culvert adjacent to SH16.
Tributary of Mānutewhau Stream (Stream 6) *Massey Catchment*	This is an intermittent stream (tributary of Mānutewhau Stream). This stream flows from a culvert for about 30-40 m before being piped and re-emerging at the surface downstream in Holmes Reserve and ultimately into Mānutewhau Stream.
Rarawaru Stream (Stream 7) *Massey Catchment*	Rarawaru Stream is located within a terrestrial SEA at Triangle Road, it discharges into a downstream Terrestrial SEA within Lowtherhurst Reserve, and ultimately into a Marine SEA. A previous ecological assessment (Bioresearches, 2016) indicates the Rarawaru Stream had a moderate to high ecological value due to the high level of shading, lack of fine sediment, and high level of hydrologic heterogeneity.
Meola Creek (Stream 8) *Meola Catchment*	Meola Creek is a large watercourse which flows from Mt Albert through to Point Chevalier. Available Land Air Water Aotearoa (LAWA)[12] water quality data for Meola Creek indicates MCI scores for the stream within D band[13] (below the National Bottom Line). The water quality of Meola Creek is impacted by significant stormwater inflows and raw sewage inflows[14]. Various restoration and stream enhancement projects have been planned and undertaken at Meola Creek. A downstream portion of Meola Creek is a Terrestrial SEA. Discharges from Meola Creek ultimately enter Waitemata Harbour.

The watercourses in Table 3-6 are classed as 'permanent' streams under the AUP and RMA definitions except for a tributary of Mānutewhau Stream (Stream 6) and an unnamed stream at Westgate Drive Park (Stream 10), which are 'intermittent' streams.

Fish records from the New Zealand Freshwater Fish Database (NZFFD) indicate the presence of several TAR fish species within the respective stream systems. These are detailed in Table 3-7 below.

3.4.2 Site investigations

3.4.2.1 SEV scores

Stream Ecological Valuation (SEV) scores are measured from a potential maximum of 1.0 and ecological condition is assessed as Poor (0-0.40), Moderate (0.41-0.60), Good (0.61-0.80), and Excellent (>0.8). Stream ecological valuation scores for the 10 stream reaches are provided in Appendix E. Stream locations where SEVs were undertaken are also provided in Appendix E. All the streams have an ecological condition of **Moderate** (SEV score range between 0.41 – 0.60) except for Tihema Stream (Stream 5) which is classed as '**Good**' with a score of 0.645.

3.4.2.2 Fish species

Fish species records from the NZFFD and eDNA data collected during surveys (May – July 2025) at the relevant stream reaches, confirm the presence of several native TAR and 'Not Threatened' fish species (Table 3-7) in streams within the Project Area. TAR species based on desktop and eDNA records are: Longfin eel (*Anguilla*

[12] Land Air Water Aotearoa. https://www.lawa.org.nz/explore-data/auckland-region

[13] Macroinvertebrate community indicative of severe organic pollution or nutrient enrichment

[14] https://www.meolacreek.org.nz/wp-content/uploads/2019/11/Meola-Aquifer-and-Creek-Description-v3.pdff

dieffenbachia), Torrentfish (*Cheimarrichthys fosteri*), Inanga (*Galaxias maculatus*), Giant bully (*Gobiomorphus gobioides*), Giant Kokopu (*Galaxias argenteus*), and Common smelt (*Retropinna retropinna*).

Table 3-7: Freshwater fish species recorded in the stream reaches traversed by the Project

Common name/ Māori name	Scientific name	National Conservation status (Dunn et al., 2017)	Regional Conservation Status (Bloxham et al., 2023)	Desktop record/ eDNA/ site observation	Streams / Species confirmed (eDNA)
Longfin eel/ tuna/ kūwharuwharu	*Anguilla dieffenbachii*	At Risk- Declining	At Risk - Regionally Declining	Desktop eDNA	1, 2, 4, 7, 8
Torrentfish / panoko	*Cheimarrichthys fosteri*	At Risk- Declining	Threatened - Regionally Vulnerable	Desktop eDNA	1, 2,
Koaro	*Galaxias brevipinnis**	At Risk- Declining		Desktop eDNA	3,4,5,6,7
Inanga#	*Galaxias maculatus*	Threatened – Nationally Vulnerable	At Risk - Regionally Declining	Desktop eDNA	8
Giant kokopu	*Galaxias argenteus*	At Risk – Declining	Threatened – Regionally Critical	eDNA	4
Giant bully	*Gobiomorphus gobioides**	At Risk- Naturally Uncommon		Desktop eDNA	1,2,
Cran's bully	*Gobiomorphus basalis**	Not Threatened		Desktop eDNA	
Common bully/ toitoi	*Gobiomorphus cotidianus**	Not Threatened		Desktop eDNA	
Redfin bully	*Gobiomorphus huttoni**	Not Threatened		Desktop eDNA	
Shortfin eel/ tuna/ hao	*Anguilla australis*	Not Threatened	Regionally Not Threatened	Desktop eDNA Site observation	1,2,3, 4, 5, 6, 7, 8
Banded kōkopu	*Galaxias fasciatus*	Not Threatened	Regionally Not Threatened	Desktop eDNA	1,2,3,4,5,6,7^
Common smelt/ ngaore	*Retropinna retropinna*	Not Threatened	Threatened – Regionally Vulnerable	Desktop eDNA	8
Grey mullet; kanae	*Mugil cephalus*	Not Threatened		eDNA	5,7,8

**Desktop NZFFD records (unconfirmed by eDNA) covered the whole catchment, and these species may not be within the affected streams.* eDNA identified bully species but could not differentiate between the different species.
#Inanga also found within Tōtara Creek (stream 1-3) by Tonkin & Taylor, 2020
^ Also noted within the Rarawaru Stream (Stream 7) tributary.

Several pest species were also identified to occur within numerous streams (primarily streams 1,2,8). The pest species were: rudd, gambusia, brown bullhead catfish, goldfish, and koi carp.

In addition, to the fish species, eDNA data confirmed the presence of '**At Risk- Declining**' Freshwater mussels (*Echyridella menziesi*) in Streams 1, 2, 6. Freshwater shrimp were also confirmed in Streams 1, 2, 6, and 8. Desktop data indicated the potential for Kōura to occur, albeit unlikely.

3.4.2.3 Macroinvertebrate community assemblage

The Macroinvertebrate Community Index (MCI) and Quantitative Macroinvertebrate Community Index (QMCI) values for all ten streams are shown in Table 3-8 below. The MCI scores indicate '**poor**' and '**fair**' (only stream 10) stream health and QMCI scores indicate '**poor**' stream health for all streams except stream 3 (Tōtara Creek – '**fair**'). Most of the streams lack Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa (which are indicators of good water quality) but Tihema Stream (Stream 5) had slightly higher EPT taxa than the others.

Table 3-8: Summary results for macroinvertebrates

Stream No./Name	Number of taxa	EPT value	Number of individuals	%EPT taxa	MCI value	MCI class	QMCI value	QMCI class	Dominant taxa
Stream 1 Tōtara Creek	10	1	262	10	53.78	**Poor**	1.93	**Poor**	Mollusc *Potamopyrgus*
Stream 2 Tōtara Creek	9	0	27	0	35.25	**Poor**	0.98	**Poor**	Mollusc *Physella*
Stream 3 Tōtara Creek	13	0	128	0	66.17	**Poor**	4.07	**Fair**	Crustacea *Paracalliope*
Stream 4 Mānutewhau Stream	7	0	26	0	56.86	**Poor**	2.80	**Poor**	Oligochaetes
Stream 5 Tihema Stream	6	2	231	33.33	62.67	**Poor**	2.25	**Poor**	Mollusc *Potamopyrgus*
Stream 6 (unnamed)	4	0	22	0	36	**Poor**	1.68	**Poor**	Mollusc *Potamopyrgus*
Stream 7 Rarawaru Stream	8	0	75	0	39.25	**Poor**	1.95	**Poor**	Mollusc *Potamopyrgus*
Stream 8 Meola Creek	10	0	406	0	42.89	**Poor**	3.61	**Poor**	Oligochaetes
Stream 9 (Tributary of Tōtara Creek)	9	0	27	0	35.25	**Poor**	0.98	**Poor**	Mollusc *Physella*
Stream 10 unnamed	8	1	16	12.5	85.5	**Fair**	3.51	**Poor**	Mollusc *Potamopyrgus*

3.4.3 Stream value

Table 3-9 details the ecological value for the stream sites. The SEV scores, macroinvertebrate, and fish data were used to determine the ecological value of impacted streams using the EcIA criteria (such as representativeness, rarity/distinctness, diversity and pattern, and ecological context outlined in Section 2.1.1). All streams were classified as having Moderate ecological value except for Stream 10 (Low ecological value).

Table 3-9: Stream ecological values (based on EcIA criteria, EIANZ Guidelines)

Stream No./Name	Representativeness (SEV score, invertebrate assemblage, fish assemblage etc.)	Rarity / distinctiveness (species of con. concern, endemic species etc.)	Diversity and pattern (level of natural diversity, species diversity etc.)	Ecological context (stream order, hydroperiod, connectivity, etc.)	Combined value
Stream 1 Tōtara Creek	Moderate	High	Low	High	Moderate
Stream 2 Tōtara Creek	Moderate	High	Moderate	High	Moderate
Stream 3 Tōtara Creek	Moderate	Moderate	High	High	Moderate
Stream 4 Mānutewhau Stream	Moderate	High	Moderate	High	Moderate
Stream 5 Tihema Stream	High	Moderate	Low	High	Moderate
Stream 6 (unnamed)	Moderate	Moderate	Moderate	Moderate	Moderate
Stream 7 Rarawaru Stream	Moderate	Moderate	Low	High	Moderate
Stream 8 Meola Creek	Moderate	High	Moderate	High	Moderate

Stream No./Name	Representativeness (SEV score, invertebrate assemblage, fish assemblage etc.)	Rarity / distinctiveness (species of con. concern, endemic species etc.)	Diversity and pattern (level of natural diversity, species diversity etc.)	Ecological context (stream order, hydroperiod, connectivity, etc.)	Combined value
Stream 9 (Tributary of Tōtara Creek)	Moderate	High	Moderate	High	Moderate
Stream 10 unnamed	Moderate	Moderate	Low	Moderate	Low

3.5 Wetland ecology

3.5.1 Desktop and site survey

The desktop information and site observations identified two wetlands within the Project Area. These wetlands are described in Table 3-10. Several wetlands were also identified within 100m of the Project Area. Theses wetlands are illustrated in Appendix A.

Table 3-10: Wetlands in the Project Area

Wetland	Description
Wetland 1 at 74 Trig Road	Exotic induced wetland dominated by *Carex sp*., kikuyu, flax, bramble. Meets both the RMA and NPS-FM definition of a wetland / natural inland wetland.
Wetland 2 at Eric Armishaw Boardwalk	Exotic induced wetland dominated by slender knotweed (*Persicaria decipiens*), kikuyu grass, pampas grass. Likely to have formed from the adjacent culvert. Meets both the RMA and NPS-FM definition of a wetland / natural inland wetland.

While both exotic induced wetlands are within the Project Area, neither will be directly impacted by the Indicative Design and the Project is not seeking approvals for works in proximity of these.

Wetlands adjacent to the Project Area, include Wetland 2 (i.e., it extends beyond the Project Area), and a large wetland in the vicinity of 4-6 Hobsonville Road. This wetland is associated with Tōtara Creek and is dominated by *Carex sp.* with planted native and exotic vegetation along riparian margins. Historical imagery indicates this wetland has been significantly modified and the stream has been realigned.

Numerous constructed wetland habitats are associated with stormwater ponds located along the SH16 corridor. The Singers et al. 2017 wetland vegetation types were used to describe the dominant vegetation at these artificial/constructed wetland habitats These included:

- WL10 (Oioi restiad rushland/reedland) – dominated by rushes such as *Juncus kraussi, Apodasmia similis* (Jointed rush) and Raupo (*Typha orientalis*); and
- WL18 (Flaxland) – dominated by *carex sp*., harakeke / flax (*Phormium tenax*).

The vegetation at these sites has been classified in this manner due to the dominant species present. These stormwater ponds have the potential to provide habitat for TAR bird species (such as dabchick, black shag, etc.) (refer to Appendix C).

3.5.2 Ecological value

The identified wetlands (Wetland 1 and 2) are considered to have **Low** to **Moderate** ecological value.

3.6 Marine ecology

3.6.1 Desktop survey

The Project will cross Henderson Creek and Huruhuru Creek, which are located within a marine SEA (SEA-M2-55a)[15] (as described in Table 3-11). A terrestrial SEA (SEA_T_4938) also surrounds the western edge of Henderson Creek as discussed in Section 3.2.2 above.

Table 3-11: Marine Significant Ecological Area description

SEA ID	Broad description of SEA
SEA-M2-55-a (Henderson Creek and Te Atatū)	An area of saltmarsh, mangroves, shellbanks and estuarine intertidal banks forming a habitat for a variety of animal and plant communities. The broader SEA area is noted to be a major bird feeding ground. Gulls, terns, pied stilt, white-faced heron and kingfisher can be seen in the area.

Henderson Creek estuary is impacted by significant quantities of sediment, historical inputs of pesticides, urbanisation, and landfilling alongside the estuary as well as historical chemical spills (ARC, 2009).

A previous ecological assessment (Bioresearches, June 2010) undertaken at the Henderson and Huruhuru Creek SH16 bridge crossings identified:

- Variable concentrations of contaminants in the sediments, but none exceeded the relevant ANZECC/ANZG[16] sediment quality guideline values.
- Benthic fauna was dominated by polychaete worm species and the estuarine snail (*Potomopyrgus aestuarinum).* Small numbers of bivalve shellfish (*Austrovenus stuchburyii*) and the exotic invasive Asian date mussel (*Musculista senhousia*) were found within Henderson Creek.
- The Henderson and Huruhuru creek areas are a transitional zone, receiving freshwater from upstream catchments and marine tidal waters from the upper Waitematā Harbour.

The vegetation composition in the Henderson and Huruhuru Creek estuaries is dominated by mangroves, likely owing to catchment land use changes and increased sedimentation, from Auckland's urbanisation over the last century.

3.6.2 Site investigations

Based on field observations, the habitat at the Henderson Creek and Huruhuru Creek estuaries can be classified as **SA1.2: Mangrove forest scrub** (Regional IUCN threat status: Least Concern). The mangrove and sub-tidal habitats are detailed below.

3.6.2.1 Mangrove habitat (intertidal zone)

The estuaries are dominated by native grey mangrove (*Avicennia marina*) with salt tolerant species, such as rushes (e.g., jointed rush, *Apodasmia similis*) and *Juncus sp*. along the edges. While the broader SEA area is noted to be a major bird feeding ground, the areas around the affected Henderson and Huruhuru Creek bridges are unlikely to be major bird feeding grounds given there is significant bird habitat of higher quality available nearby, in sandflats downstream of the proposed bridges and to the east of the bridge areas (Harbourview Reserve – SEA-M1-55b and SEA-M2-55w2).

Coastal birds which may occur within and adjacent to the Project Area at Henderson and Huruhuru Creek are described in Section 3.3.2 and in Appendix C. All of the TAR species observed during the site investigation (Table 3-3) may utilise these mangrove areas as foraging habitat.

[15] **SEA-M1 areas**: Areas which, due to their physical form, scale or inherent values, are considered to be the most vulnerable to any adverse effects of inappropriate subdivision, use and development. **SEA-M2 areas**: Areas are of regional, national or international significance which do not warrant an SEA-M1 identification as they are generally more robust.

[16] Australia and New Zealand Guidelines for Fresh & Marine Water Quality (2000) - Interim Sediment Quality Guidelines

3.6.2.2 Sub-tidal estuarine habitat

The subtidal zone is the area of the estuary that remains submerged during low tide. In Henderson and Huruhuru Creeks, this zone is influenced by tidal movements and freshwater inflows, resulting in brackish conditions. Sediment sample and benthic invertebrate sample locations are presented in Figure 3-6. Sediment quality and grain size results are described in Section 3.6.2.2.1 below and benthic infaunal invertebrate community results are detailed in Section 3.6.2.2.2.

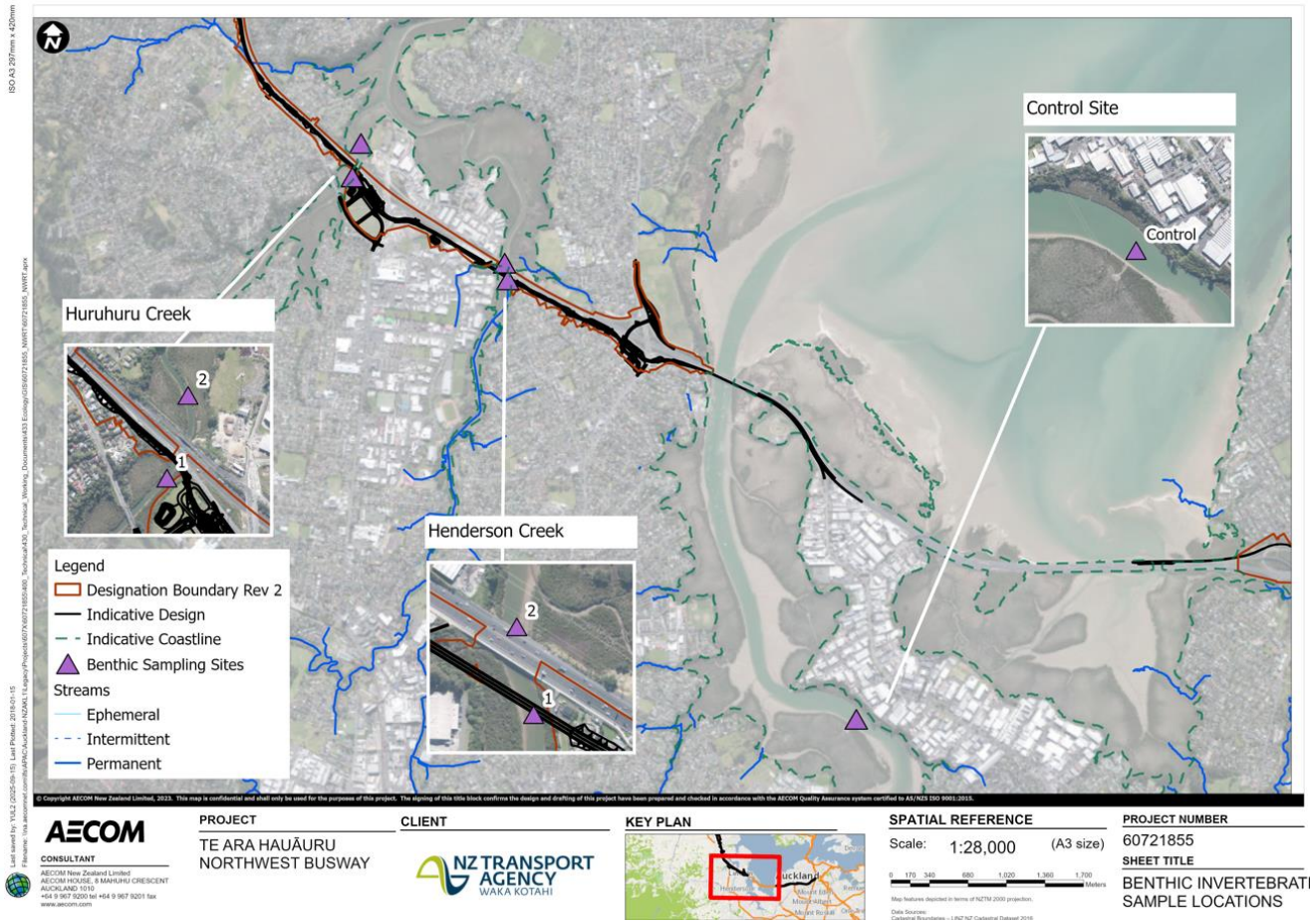


Figure 3-6: Locations of sediment and benthic invertebrate samples taken at Huruhuru Creek, Henderson Creek, and the Control Site

3.6.2.2.1 Sediment quality and grain size

Sediment at Henderson Creek was predominantly silt and clay (over 64%). Sediment particle size at Huruhuru Creek was highly varied and dominated by larger sized sediment particles, primarily fine to coarse sand with some gravel. The control site had a mix of silt and clay with fine and very fine sand (Figure 3-7).

Sediment samples at the Henderson, and Huruhuru Creek bridge sites and the control site were analysed for heavy metals (As, Cd, Cr, Cu, Pb, Ni, Zn) and Polycyclic Aromatic Hydrocarbons (PAHs) (Table 3-12). All contaminant concentrations at Henderson and Huruhuru Creek were *below* the ANZG (2018)[17] sediment quality default guideline values (DGV). The only exceedance of the ANZG DGV's was for zinc at the control site (Table 3-12).

Concentrations of heavy metals in Henderson Creek were consistent with the results reported by Bioresearches (June 2010), with chromium and copper concentrations slightly higher, and zinc slightly lower than 2010 results. Heavy metals concentrations at Huruhuru Creek were all lower than Bioresearches (June 2010) results, except for copper at Huruhuru Site 2 which increased slightly.

[17] Australia and New Zealand Guidelines for Fresh and Marine Water Quality (2018) – Toxicant default guideline values for sediment quality

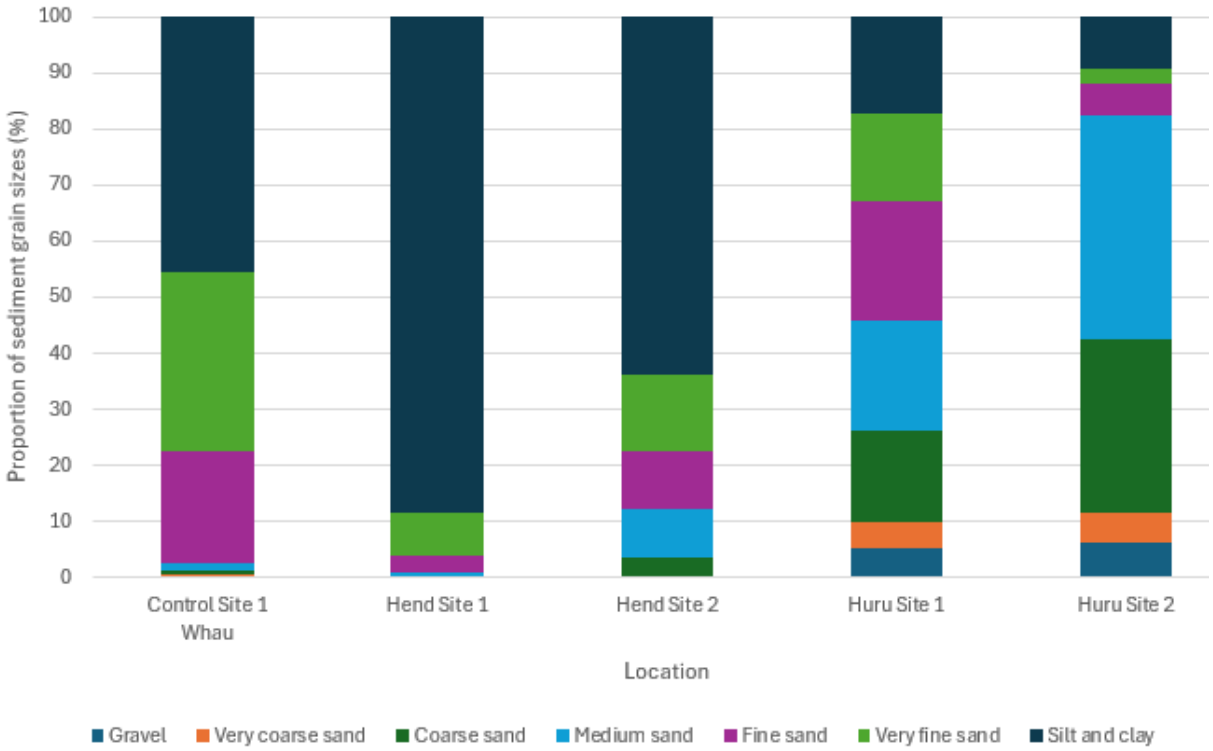


Figure 3-7: Sediment grain size proportions

Table 3-12: Results of sediment quality analysis (heavy metals, mg/kg dry weight)

Analyte	Unit	DGV[1]	Control Site 1 (Whau)	Hend Site 1	Hend Site 2	Huru Site 1	Huru Site 2
Heavy metal							
Heavy metal, trace level As,Cd,Cr,Cu,Ni,Pb,Zn			-				
Total Recoverable Arsenic	mg/kg dry wt	20	10.4	13.5	7.6	6	4.6
Total Recoverable Cadmium	mg/kg dry wt	1.5	0.148	0.09	0.092	0.064	0.048
Total Recoverable Chromium	mg/kg dry wt	80	22	26	21	14.1	10.3
Total Recoverable Copper	mg/kg dry wt	65	31	35	28	14.4	9.9
Total Recoverable Lead	mg/kg dry wt	50	42	28	21	11.3	7
Total Recoverable Nickel	mg/kg dry wt	21	8.4	11	13.1	9.7	14.3
Total Recoverable Zinc	mg/kg dry wt	200	**220**	181	148	91	67

3.6.2.2.2 Benthic infaunal invertebrate community

The benthic invertebrate assemblages found in the Huruhuru and Henderson Creeks were dominated by marine and estuarine species commonly found in New Zealand sub-tidal estuaries and harbours and are generally species known to be disturbance-tolerant or indicative of Low to Moderate water and habitat quality. There were no notable differences between samples collected up or downstream from each road bridge. The difference in species composition between sites is primarily attributable to the differences in sediment characteristics at each sampling area (Figure 3-7).

The benthic invertebrate assemblage at Huruhuru Creek had a relatively low average abundance (≤60 individuals) and species richness (≤9 species), which was similar to the control site, and was dominated by

species more commonly associated with fine sandy sediments and urban estuarine habitats, including oligochaete worms, polychaete worms such as *Capitella capitata, Prionospio* spp. and *Nerididae*, and the gastropod *Potamopyrgus estuarinus* (Figure 3-9*).* The Henderson Creek assemblage had a higher average abundance (up to ~840 individuals) and species richness (up to 13 species), and had species typically found in muddier substrates, including the non-indigenous Asian date mussel (*Arcuatula senhousia*) which is found in dense masses in muddy harbours. Species diversity (using Shannon-Weiner Diversity Index) was between 0.99 (low diversity) and 1.62 (moderate diversity) and there were no clear trends between sites.

The characteristics and difference in benthic invertebrate assemblages at the sample sites is shown in the Multi-Dimensional Scaling (MDS) Plot below (Figure 3-8). The two Henderson Creek sites cluster closely together, indicating a distinct and consistent benthic community composition at this location. In contrast, the Huruhuru Creek sites display greater variability in their species assemblages but show notable similarities to the control site. These patterns align with the sediment characteristics observed at each site (Figure 3-7).

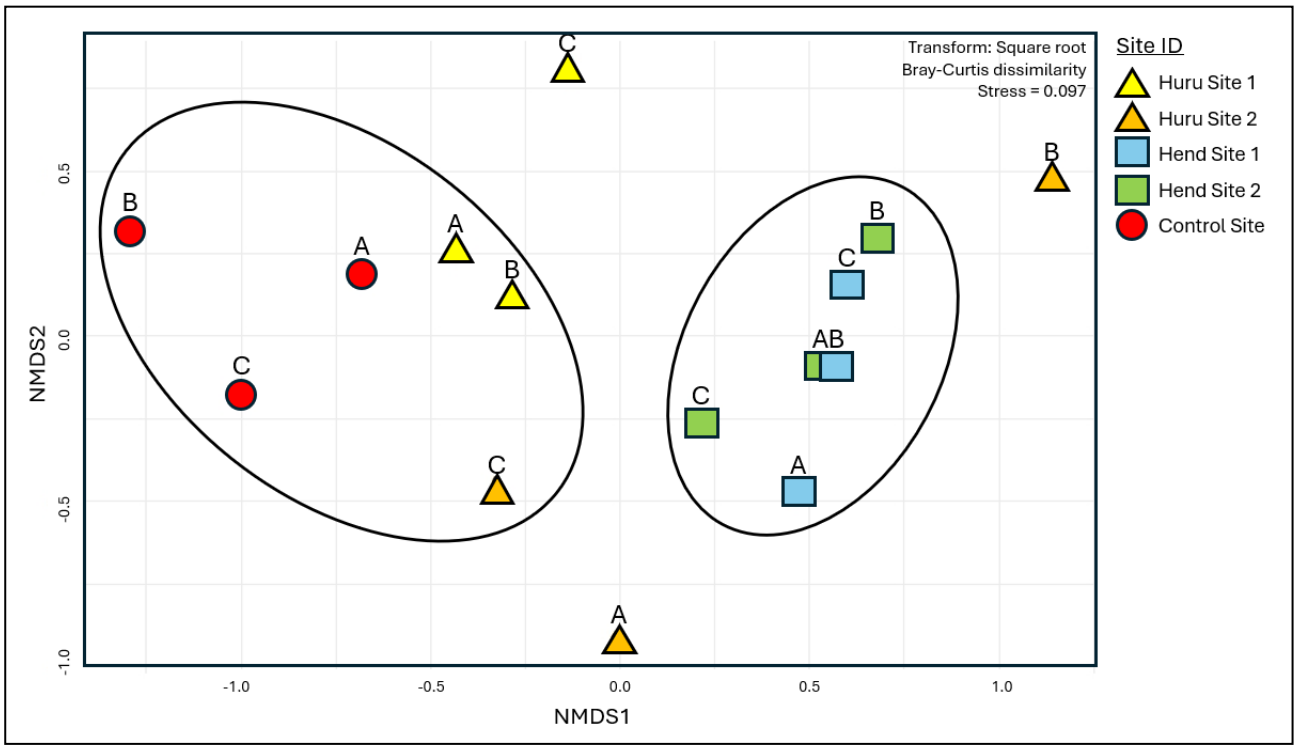


Figure 3-8: MDS plot of benthic communities (*MDS plots provide useful information on the similarities or differences in benthic invertebrates between different sites*)

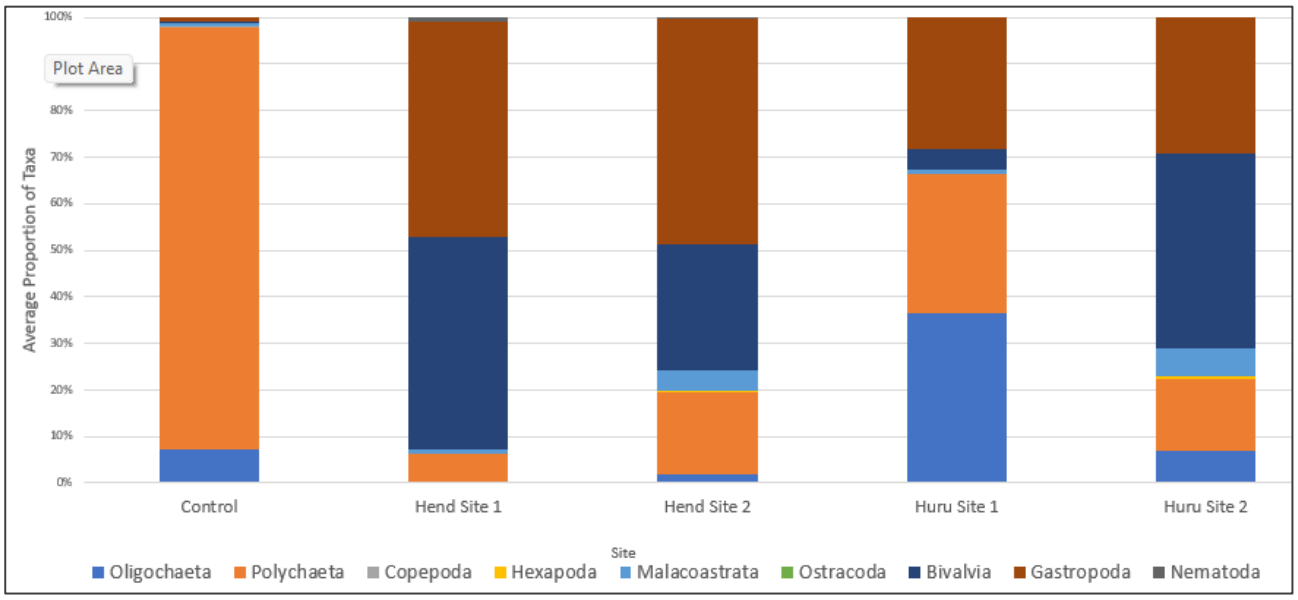


Figure 3-9: Average proportion of Taxa Groups

3.6.3 Ecological value

While the mangrove habitat at the Henderson and Huruhuru Creek bridges is likely to provide some foraging habitat for TAR bird species, it does not provide any notable breeding habitat. These mangrove areas are significantly modified and considered to be of **Low** ecological value.

The sub-tidal areas at the Henderson and Huruhuru Creeks are considered to be of **Low** ecological value. This is due to the presence of common, disturbance-tolerant benthic infauna, low to moderate species richness and diversity, and the presence of non-indigenous species.

4. Assessment of effects

4.1 Embedded controls

The Project has the potential to have both direct and indirect effects on ecological features present within the Project Area, and directly adjacent remaining terrestrial and aquatic habitats. The effects assessment takes into consideration the following embedded controls prior to consideration of mitigation:

- A site-specific Erosion and Sediment Control Plan (ESCP) will be prepared in accordance with Sediment Control Guidelines (GD05) and implemented to manage any effects of erosion and sedimentation in relation to the receiving environment (streams, wetlands, and estuaries).
- Construction within streams is to be undertaken during low-flow conditions (where practicable).
- New culverts and culvert extensions, riprap and aprons will be designed in accordance with New Zealand Fish Passage Guidelines (NIWA, 2024), to maintain existing fish passage.

Table 4-3 and Table 4-4 in the sections below provide the assessment of potential construction and operational effects (direct and indirect) from the Project on ecological features (i.e. terrestrial, freshwater, wetland, and estuarine habitats, and relevant faunal species). Detailed mitigation measures are provided in Section 5.

4.2 Assessment of construction effects

This section assesses the ecological effects of construction activities. We have assessed the effects holistically across the Project Area. Where required, effects only relevant to a particular segment of the Project Area (i.e., particular vegetation types in specific areas of the Project Area) have been assessed separately. The effects assessment has considered the Indicative Design and the indicative construction areas within the Proposed Designation.

For each key ecological effect, the assessment details the ‘Ecological Value’, the ‘Magnitude of Effect’, and subsequent ‘Level of Effect’ as they relate to the ecological features identified (Table 4-3). Impact management is presented generally where the level of effect is assessed to be **Moderate or higher** (in accordance with the EIANZ Guidelines).

The anticipated loss of vegetation within SEAs and stream loss is considered in Sections 4.2.1 and 4.2.2, respectively. Cumulative effects are considered in Section 4.2.3.

4.2.1 Estimated vegetation loss

The Project Area is within a transformed landscape, and remaining habitats consist largely of a mixture of native and exotic planted vegetation. As such, the loss of terrestrial vegetation focused primarily on areas that contribute significantly to the region’s biodiversity (i.e., SEAs). Anticipated vegetation loss, due to both temporary and permanent construction works, within SEAs resulting from the Indicative Design is detailed in Table 4-1 below. Refer to the habitat maps in Appendix A for the distribution of the vegetation types throughout the SEAs.

Table 4-1: Vegetation loss within SEAs

Vegetation Code	Vegetation Description	SEA_T_4938 Henderson Creek	SEA_T_5124 Triangle Road*	Total
PL.3	PL.3 Native and/or Amenity Planting	0.00	0.03	0.03
TL.2	TL.2 Mixed Native and Exotic Treeland	0.00	0.34	0.34
VS5	VS5 Broadleaved Scrub/Forest	0.03	0.00	0.03
Total		**0.03**	**0.37**	**0.40**

** Excludes existing disturbed areas (e.g., brown field and exotic scrub)*

Note: While portions of SEA_T_2040 and SEA_T_3262 are located within the Project Area, the Indicative Design does not result in a direct loss of vegetation within these SEAs.

Terrestrial SEAs are protected areas as they have been identified as areas that contribute to the indigenous vegetation or habitats for indigenous fauna in the Auckland region (Auckland Unitary Plan Operative in part - Updated 12 September 2025). Given the value of these areas, we have assessed the loss of vegetation and the potential reduction of biodiversity separately. The loss of terrestrial vegetation across each of the SEAs is estimated to be:

- Approximately 16% of SEA_T_5124 (Triangle Road); and
- Approximately 2% of SEA_T_4938 (Henderson Creek).

The SEAs are locations identified for their high ecological value, which includes providing habitat for TAR species, native biodiversity, and providing important ecological functions such as migration pathways. The ecological significant criteria for the above SEAs include maintaining migration pathways, and for SEA_T_5124 providing habitat for threatened fish species (*Galaxias maculatus*). The SEAs are narrow strips of remaining vegetation along freshwater and marine ecosystems within a largely urban/transformed landscape, and therefore a loss of even a small part of these areas may trigger ecological consequences that could undermine their value and/or function.

4.2.2 Estimated stream impacts

The loss of stream extent and value were taken into consideration where streams will be directly impacted by the Project. Table 4-2 provides the stream linear impact and area impact resulting in the loss in ecological value across the seven streams anticipated to be impacted by the Indicative Design. The impact is based on the Indicative Design, which allows for culvert extensions, outfalls, bridging, and other stream works. An estimated 78m of stream length across seven streams is anticipated to be impacted based on the Indicative Design. The assessment was undertaken on the basis that streams 2, 5, and 10 will not be directly impacted.

While no bridge piers are proposed within the instream habitat, proposed bridges will still have an impact on stream habitat due to shading and permanent riparian vegetation loss (albeit a smaller impact than new culverts/culvert extensions). This loss in values is accounted for in the SEV/ECR calculations in Section 5.6.

Table 4-2: Potential stream impact length and area

Stream No.*	Stream Name	Stream Catchment	Proposed Infrastructure	Primary Effect[18]	Stream impact length (m)	Stream impact area (m^2)
1	Tōtara Creek	Whenuapai	Bridge	Riparian vegetation loss	10	60
3	Tōtara Creek	Whenuapai	Bridge	Riparian vegetation loss	6	30
4	Mānutewhau stream	Massey	Culvert extension	Impact to stream bed	5	30
6	Mānutewhau stream tributary	Massey	Pipe extension with new outfall	Impact to stream bed	13	39
7	Rarawaru stream	Massey	Bridge	Riparian vegetation loss	20	90
8	Meola creek	Meola	Bridge	Riparian vegetation loss	4	40

[18] There will be other stream effects as a result of proposed infrastructure.

Stream No.*	Stream Name	Stream Catchment	Proposed Infrastructure	Primary Effect[18]	Stream impact length (m)	Stream impact area (m^2)
9	Tōtara creek tributary	Whenuapai	Culvert extension	Impact to stream bed	20	100

** Based on the Indicative Design no impacts were assessed for streams 2, 5, and 10.*

Table 4-3: Construction phase ecological effects

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Recommended Mitigation	Level of Effect after Mitigation, and additional Management (where required)
SEA_T_5124 Vegetation – TL2 (Triangle Road)	Moderate	Temporary loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal	Low	This is a direct, short-term, localised impact, and is highly likely to occur. Reversible as the temporary construction areas can be restored to native vegetation.	Low	Where practicable, reduce/minimise construction areas.	N/A
SEA_T_5124 Vegetation – TL2 (Triangle Road)	Moderate	Permanent loss of habitat/ecosystem, fragmentation, and edge effects due to loss of area within the SEA.	Moderate	This is a direct, localised, permanent impact (affects approximately 20% of habitat), and is highly likely to occur.	Moderate	Where practicable, reduce/minimize the alignment for the detailed design. For the loss of habitat this mitigation will not reduce the level of effect to Low. Additional management is required.	Additional Management: Restoration planting and pest plant control to account for the loss of vegetation within the Indicative Design, in the SEA. Refer to Section 5.1. The additional management will result in an overall Low level of effect.
SEA_T_4938 (Henderson Creek) Vegetation – VS5	Moderate	Temporary loss of habitat/ecosystem, fragmentation, and edge effects due to vegetation removal	Low	This is a direct, short-term, localised impact, and is highly likely to occur. Reversible as the temporary construction areas can be restored to native vegetation.	Low	Where practicable, reduce/ minimise construction areas.	N/A
SEA_T_4938 (Henderson Creek) Vegetation – VS5	Moderate	Permanent loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal.	Moderate	This is a direct, localised impact (affects <10% of habitat) and is likely to occur. Partially reversible as there are areas where native vegetation can be restored.	Moderate	Where practicable, reduce/minimise the alignment for the detailed design. For the loss of habitat this mitigation will not reduce the level of effect to Low. Additional management is required.	Additional Management: Restoration planting and pest plant control to account for the loss of vegetation within the Indicative Design, in the SEA. Refer to Section 5.1. The additional management will result in an overall Low level of effect.

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Recommended Mitigation	Level of Effect after Mitigation, and additional Management (where required)
						Kauri Management - Avoidance of the kauri tree if practicable), directly adjacent to the proposed bridge. An arborist must be consulted prior to any construction activity within SEA_T_4938 to confirm whether the tree is infected (i.e., Kauri dieback), and to identify appropriate management measures (Section 5.2).	
Other vegetation (outside SEAs)	Moderate - Low	Permanent/temporary loss of habitat/ecosystem, fragmentation and edge effects due to vegetation removal.	Low	This is a direct, localised impact (affects approximately 10-20% of habitat) and is likely to occur. Partially reversible in areas where replacement planting can take place.	Low – Very Low	*Mitigation not required.*	N/A
Bats - Long-tailed bats ** Western segment of the project area only – in the vicinity of Tōtara Creek/Brigham Creek Station*	Very High	Kill or injure individual bats, and removal of potential roosts due to vegetation removal	Low	Bats are protected under the Wildlife Act. The killing or injuring of bats or the removal of roosts is unlikely to occur. However, it is still possible without appropriate mitigation. The Indicative Design will result in the loss of a stand of mature Pine trees, which have suitable roost habitat. Localised and permanent.	Moderate	Avoidance - Where practicable, avoid suitable bat habitat, for detailed design. Where practicable, reduce construction areas and the alignment for the detailed design within suitable bat habitat areas (Figure 5-3). Implementation of Bat Roost Protocols (BRPs) (DOC, 2021) for removal of vegetation. Refer to Section 5.3.	Low
	Very High	Loss of foraging habitat due to vegetation removal	Negligible	This is a direct, localised impact, with negligible	Low	Mitigation not required.	N/A

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Recommended Mitigation	Level of Effect after Mitigation, and additional Management (where required)
				loss of foraging habitat. Permanent, partially reversible.		Refer to the sensitivity testing of the Indicative Design (Section 4.4).	
Birds - All native species (Threatened, At-Risk, and non-threatened)	Very High -Low	Kill or injure individuals and/or disturb their nests due to vegetation removal	Negligible	Native birds are protected under the Wildlife Act. The killing or injuring of birds or disturbing their nests is unlikely to occur. Permanent.	Moderate	Where practicable, reduce construction areas and the alignment for the detailed design within suitable bird habitat areas. Timing of vegetation removal – where possible avoid vegetation removal during nesting season (September – February). Pre-clearance nest checks prior to vegetation removal during nesting season (September – February) in the following vegetation types throughout the Project Area: VS5, PL1-3, TL2-3, WL10, WL18, SA1.2., ES, rank grasslands (e.g., unmaintained EG) including the Te Atatū Pony Club paddocks within the Project Area, and trees and shrubs within gardens associated with dwellings along the project route. Refer to Section 5.4.	Very Low

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Recommended Mitigation	Level of Effect after Mitigation, and additional Management (where required)
Birds - Coastal, marsh, and terrestrial TAR species	Very High - Moderate	Loss of foraging habitat due to vegetation removal.	Negligible	This is a localised impact (affects <10% of available bird habitat), largely planted Moderate-Low value habitat, which is partially reversible. Some habitat is artificial (e.g., habitats associated with stormwater ponds).	Low- Very low	Mitigation not required.	N/A
Herpetofauna							
Lizards - Copper skink	High	Kill/injure or disturb due to vegetation removal.	Low	Native lizards are protected under the Wildlife Act. Observed on site, recorded within and adjacent to the Project Area, and likely to occur due to the presence of suitable habitat across the Project Area. Permanent.	Moderate	Where practicable, reduce construction areas and the alignment for the detailed design within suitable lizard habitat areas. Timing of vegetation removal – vegetation removal restricted to October – April (inclusive). Salvage and relocation to be undertaken within suitable habitat during vegetation clearance. Suitable habitat includes: Planted native vegetation (PL.1-3), treelands (TL.2-3), exotic scrub (ES), regenerative native vegetation (VS5), and rank grasslands (e.g., unmaintained EG) on habitat edges including along stream corridors.	Very Low

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Recommended Mitigation	Level of Effect after Mitigation, and additional Management (where required)
						Lizard management as outlined in Section 5.5.	
Lizards - Copper skink	High	Loss of potential lizard habitat due to vegetation removal.	Low	This is a localised impact (affects <10% of available lizard habitat), largely planted Moderate-Low value habitat, which is partially reversible (e.g., Restoration of SEA portions with the Project Area, and potentially portions of planned landscaping).	Low	Mitigation not required.	N/A
Invertebrates							
Invertebrate species of note that may occur in the Project Area	Low	Loss of habitat due to vegetation removal	Negligible	This is a direct, localised impact (affects <10% of suitable vegetation within the Project Area). Loss of vegetation is unlikely to impact on notable invertebrate species. Partially reversible (restoration).	Very Low	Mitigation not required.	N/A

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Recommended Mitigation	Level of Effect after Mitigation, and additional Management (where required)
Freshwater ecology							
Streams 1-9 (excluding Stream 2, 5,10) *Based on the Indicative Design no impacts were assessed for streams 2, 5, and 10.* *Based on the Indicative Design and dimensions of the proposed instream stormwater structures, works within streams 6 and 9 will trigger consent.*	Moderate	Permanent loss/modification of instream habitat and/or riparian vegetation due to culverting/ other structures/ bridge shading	Moderate	Direct impact on estimated 78m length of streams, highly likely to occur, permanent, partially reversible.	Moderate	Where practicable, reduce/minimise construction areas and the alignment for the detailed design within instream and riparian habitat. Undertake riparian restoration planting within **temporary** construction areas (i.e., the rectifying of the direct impacts to riparian areas at the affected sites - construction areas within the riparian areas, outside of the Indicative Design). Refer to Section 5.1. This mitigation will not reduce the level of effect to Low. Additional management is required. Refer to Section 5.6.	Additional management: Riparian restoration along portions of the impacted streams (Upstream or downstream of streams 1, 3, 4, 6, 7, 8,9). This restoration is to address the loss of instream and riparian areas within the footprint of the bridges and culvert extensions. Indicative lengths, areas, and locations for the restoration have been determined based on the Indicative Design. Refer to recommended stream management measures (Section 5.6). The additional management will result in an overall Low level of effect.
Streams 1-10	Moderate - Low	Potential uncontrolled discharge leading to habitat and water quality degradation due to earthworks, machinery use and chemical leaks or spills	Moderate-Low	Indirect impact on streams, short term during construction, infrequent, but likely to occur. Partially preventable through embedded controls.	Low- Very Low	Relevant Embedded Controls reduce the effects (i.e., such as the ESCP, and construction during low-flow conditions).	N/A
Native fish	High - Moderate	Kill/injure fish due to culverting/other structures (e.g., bank armouring, channel diversions, etc.)	Low	Native fish are protected under the Wildlife Act. Direct impact on native fish at a local catchment scale. Effect is	Moderate	Implemented Fish Salvage and Relocation Protocols (FSRP) during each of the construction stages when working in	Very Low

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Recommended Mitigation	Level of Effect after Mitigation, and additional Management (where required)
				permanent, infrequent and likely to occur.		streams 1, 3, 4, 6, 7,8, and 9. Refer to fish salvage and relocation requirements in Section 5.7.	
Wetlands							
Wetlands (exotic / induced / constructed wetlands	Moderate - Low	Uncontrolled discharge leading to habitat and water quality degradation due to earthworks, machinery use and chemical storage	Low	Indirect impact on wetlands, short term during construction, infrequent but likely to occur. Partially preventable through embedded controls.	Very low	Mitigation not required. Refer to embedded controls. Refer to the sensitivity testing of the Indicative Design (Section 4.4).	N/A
Marine (Estuaries)							
Estuaries – Huruhuru Creek and Henderson Creek	Low	Construction of temporary staging for bridges (including temporary piles) resulting in loss of *mangrove habitat*	Low	Temporary occupation of mangrove habitat. Mangrove habitat will recover once the piles are removed.	Very Low	Where practicable, minimise vegetation removal. No specific mitigation required.	N/A
	Low	Temporary shading of *mangrove habitat* and *sub-tidal areas* during construction due to the temporary staging bridge	Low	Shading is temporary - habitat will recover once the temporary staging bridge is removed. Approximate area of shading for Henderson Creek = 2,525m^2, Huruhuru Creek = 645m^2	Very Low	Mitigation not required.	N/A
	Low	Construction of permanent bridge structures and piles resulting in permanent loss of *mangrove habitat* and avifauna foraging habitat	Low	Will result in loss of less than 1% of total surrounding mangrove habitat	Very Low	Where practicable, minimise vegetation removal. No specific mitigation required.	N/A
	Low	Construction of permanent bridge piles within the Henderson Creek channel	Low	Impacted area as a result of bridge piles is less	Very Low	Mitigation not required.	N/A

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Recommended Mitigation	Level of Effect after Mitigation, and additional Management (where required)
		(sub-tidal area) resulting in habitat loss and disturbance		than 1% of total subtidal area			
	Low	Remobilisation of contaminants in sediment (*sub-tidal area*) during earthworks for bridge construction	Negligible	Contaminant levels in sediments that may be resuspended are below ANZG DGV's	Very Low	Mitigation not required.	N/A
	Low	Noise and vibration disturbance to marine fauna (fish, invertebrates, birds) from construction activities (especially vibratory piling for bridge construction)	Low	Construction noise and vibration activities are temporary. Vibration piling activities will take place over a few days and it is considered that during piling fish and birds will avoid the area.	Very Low	Mitigation not required.	N/A

4.2.3 Cumulative construction effects

The Project Area is located within an area that is subject to considerable urban development and pre-existing effects. Cumulative effects from the construction of the Project, without mitigation, will result in at least a Moderate cumulative effect. This would largely be due to the loss of portions of SEAs and freshwater habitat. With the implementation of the recommended mitigation and additional management, the cumulative effects are likely to result in minor shifts away from baseline conditions. There will be removal of native and exotic vegetation that provides habitat for terrestrial avifauna, bats and herpetofauna. There will also be temporary disturbance to terrestrial fauna arising from elevated noise, artificial light, dust and vibration. The Project will be constructed in a staged manner, which minimises temporary cumulative effects from construction of the Project. The terrestrial fauna within the ZOI is generally expected to be well-accustomed to urbanised environments and temporary disturbances. With the implementation of the recommended management measures (Section 5) we have assessed the overall cumulative effects on terrestrial fauna and habitat as low.

Freshwater habitats including wetlands and riparian margins may be impacted by slightly elevated sediment loads during construction and potential accidental contaminant spills. Provided that precautionary best practice construction management is followed (i.e., an ESCP is developed and implemented) we have assessed the cumulative construction effects as low. Multiple stream crossings involving culvert extensions or bridges are proposed within the Project area. Given the urbanised nature of these stream catchments, resulting in a wide range of existing stream impacts (e.g., existing stream crossings), the freshwater habitats have significant existing impacts. Additional structures can have cumulative impacts on the freshwater ecological condition of the relevant streams. However, we consider that with implementation of embedded controls (Section 4.1) and the recommended stream management measures (Section 5.6) this will have a low cumulative effect on the freshwater habitats.

We have assessed the cumulative effect of vegetation loss, disturbance of sediment and noise and vibration effects at the affected estuaries (Huruhuru and Henderson Creek), in the wider catchment, as very low. This is due to the low ecological values of these habitats and the scale of effect from the Project compared to the wider habitat area.

4.3 Assessment of operational effects

Table 4-4: Operational phase ecological effects

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Mitigation	Level of Effect After Mitigation
Bats							
Bats - Long-tailed bats ** Western segment of the Project Area only – in the vicinity of Tōtara Creek/Brigham Creek Station*	Very high	Loss in connectivity due to permanent habitat loss, light and noise effects from the busway and bus stations, leading to fragmentation of habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Negligible	Direct, localised impact, negligible extent of habitat, permanent. Additional light and noise effects of the busway likely to be minor (taking into consideration electric buses and existing SH16 corridor).	Low	Mitigation not required.	N/A
	Very high	Kill or injure individuals due to vehicle movement (infrastructure use), resulting in changes to the population dynamics	Negligible	Direct, localized impact, permanent. However, highly unlikely to occur.	Low	Mitigation not required. Note – Retention of large trees to maintain a hop over along the Tōtara Creek riparian corridor would be beneficial.	Low
Birds							
Birds - Coastal, marsh, and terrestrial TAR species	Very High - Moderate	Loss in connectivity due to permanent habitat loss, light and noise effects from the busway and bus stations, leading to fragmentation of habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Negligible	Direct, localised impact (<10% of available habitat), permanent, unlikely. The Project will only result in minor loss of suitable habitat and is unlikely to result in disturbance (related to noise, traffic flows, light) that deviates much from the existing conditions.	Low - Very low	Mitigation not required.	N/A
Birds - Coastal, marsh, and terrestrial TAR species	Very High - Moderate	Kill or injure individuals due to vehicle movement (infrastructure use), resulting in changes to the population dynamics	Negligible	Direct, localised impact, permanent. However, highly unlikely to occur.	Low - Very low	Mitigation not required.	N/A

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Mitigation	Level of Effect After Mitigation
Herpetofauna							
Lizards - Copper skink	High	Loss in connectivity due to permanent habitat loss, light and noise effects from the busway and bus stations, leading to fragmentation of habitat due to the presence of the infrastructure, resulting in changes to the population dynamics	Negligible	Direct, localised (<10% habitat), permanent. The Project is unlikely to result in disturbance (related to noise, traffic flows, light) that deviates much from the existing conditions.	Very Low	Mitigation not required.	N/A
Lizards - Copper skink	High	Kill or injure individuals due to vehicle movement (infrastructure use), resulting in changes to the population dynamics	Negligible	Direct, localised impact, permanent. However, highly unlikely to occur.	Very low	Mitigation not required.	N/A
Freshwater ecology							
Streams 1-10	Moderate - Low	Stormwater discharging into streams potentially resulting in elevated sediments and contamination (if stormwater is not treated effectively).	Negligible		Negligible	Mitigation not required.	N/A
Native fish	High - Moderate	Loss of connectivity due to culvert or instream structure preventing fish passage up and downstream, resulting in changes to the population dynamics.	Negligible	Direct, localized impact, short-term, unlikely.	Very Low	Mitigation not required. Refer to embedded controls, fish passage requirements.	N/A
Wetland ecology							
Wetlands (exotic / induced / constructed wetlands)	Moderate - Low	Degradation of wetland habitat and water quality due to untreated stormwater runoff/discharge (pollutants) such as heavy metals.	Negligible	Indirect, localised impact, short term, unlikely (given proposed stormwater treatment, electric buses).	Very low	Mitigation not required.	N/A
Marine (estuaries)							
Marine (Henderson and Huruhuru Creek Estuary)	Low	Shading of mangrove habitat as a result of permanent bridge structure (estimated shaded area of 1,443m^2 at Henderson	Low	Will result in loss of less than 1% of total surrounding habitat.	Very low	Mitigation not required.	N/A

Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Mitigation	Level of Effect After Mitigation
		Creek and 100m^2 at Huruhuru Creek)					
	Low	Stormwater discharges– potential increase in runoff and contaminants affecting marine habitat.	Negligible	Stormwater treatment devices, electric buses using the new bridges (lower risk of contaminants).	Very low	Mitigation not required.	N/A

4.3.1 Cumulative operational effects

Operational disturbance to terrestrial fauna (birds, herpetofauna and bats) is related to adverse effects that may arise from elevated noise from increased traffic flows and artificial light from the busway and stations, as well as permanent habitat loss/ loss in connectivity. Considering the extent of habitat loss, restoration planting and pest plant management (as recommended in Section 5.1) and the fact that current faunal assemblages are expected to be well accustomed to high levels of operational disturbances (e.g., due to the existing SH16, associated with roading noise, lighting, etc.), we consider the cumulative operational effects to terrestrial fauna to be Very Low.

The creation of additional impervious surfaces within the Project's catchments may result in elevated runoff, increasing flow velocities within streams, which can result in scouring of riparian margins. An increase in stormwater runoff can also result in further sedimentation and contaminant input into wetlands and streams. These issues are addressed in the Stormwater and Flooding Assessment Report. Based on that report, we consider that the resulting change is expected to cause a very minor shift away from existing baseline conditions and the cumulative level of effects are assessed to be Very Low.

We have assessed the cumulative effect of loss of mangrove habitat due to shading and the effects of increased stormwater discharges at affected estuaries (Huruhuru and Henderson Creek), taking into consideration the existing wider catchment impacts, future development in the catchment and climate change, to be Very Low. This is due to the low ecological values of these habitats and the scale of loss at the Project Area compared to the wider habitat area.

4.4 Sensitivity testing of Indicative Design

The Indicative Design may move within the Proposed Designation depending on the final design. The Proposed Designation allows for limited horizontal and vertical shifts of the Indicative Design. Changes to the Indicative Design within the Proposed Designation could affect sensitive ecological features (e.g., streams, wetland, and suitable habitat for TAR species), potentially resulting in a variation to the effects assessment (i.e., other than the effects outlined in Sections 4.2 and 4.3). Movement of the Indicative Design may require additional mitigation. However, a change to the Indicative Design that results in the same level of effects in a different location will not require additional mitigation.

Particular areas within the Project Area that may be sensitive to a change in Indicative Design have been indicated in the sensitivity maps in Appendix F (Sensitivity Zones). The sensitivity maps assign a 'Medium' (orange) or 'High' (red) sensitivity depending on the ecological feature. Increased loss or disturbance within the Medium sensitive zones is likely to require the same, or more of the same, relevant mitigation outlined in Section 5. Increased loss or disturbance within High sensitive zones (i.e., wetlands, streams, SEAs, suitable bat habitat (TL.2-3), broadleaved forest and scrub (VS5)) is highly likely to require more extensive mitigation (e.g., if more stream length (in addition to the current 78m) is impacted). We recommend that any changes to the Indicative Design should consider avoiding increased disturbance and loss of ecological features within these Sensitivity Zones, primarily the High sensitive zones (Appendix F). Additional mitigation that may be required in the event of increased loss or disturbance within the Sensitivity Zones is outlined below:

- If additional bat habitat (more mature trees within TL.2-3) is impacted then in addition to the management measures outlined in Section 5.3, restoration planting may be required as well as the potential need to install temporary roost sites (i.e., the installation of bat boxes, to mitigate the loss of roost habitat).
- Additional loss within riparian, instream habitat, and wetland habitat may require offsets/compensation.
- Additional vegetation loss within SEAs would likely require additional restoration planting and pest management to offset the loss.

The main areas / ecological features that are sensitive, and that we recommend should be considered in any proposed change in the Indicative Design are summarised below:

- Suitable bat habitat within TL2 and TL3 vegetation along Tōtara Creek (high sensitivity).

  The Indicative Design is anticipated to impact on a stand of mature Pine trees (<10 trees), which are considered to have suitable roost habitat. Therefore, the current impact is limited to individual trees. A

change in the Indicative Design that would increase the impact within the TL.3 vegetation type or within any portions of the TL.2 vegetation type may require additional mitigation. This may increase the loss of foraging habitat due to vegetation removal and would likely require restoration of bat foraging habitat and potentially the installation of temporary roost sites. If required, the additional mitigation would need to be determined by an ecologist at the detailed design phase.

- All PL.1 and TL.3 vegetation along the riparian area of Tōtara Creek, including the tributaries north of SH16, and the instream area (both sides of SH16) (mix of high and medium sensitivity).

  The Indicative Design aligns with SH16 and has limited impact on these vegetation types. A realignment that further encroaches into these vegetation types may increase the loss of potential lizard habitat. It is recommended that the Lizard Management Plan (LMP) (necessary to support the future Wildlife Act Authority (WAA)) should incorporate triggers that would guide the need for additional mitigation (i.e., lizard habitat restoration), where required.

  Further encroachment could also lead to effects on the riparian area and instream habitat of Tōtara Creek, and tributaries. Minor increases to stream length impact could be mitigated through adjustments to the proposed mitigation (i.e., recalculating the required restoration). However, a significant increase in the impact on stream length (e.g., if the Indicative Design was shifted to over Tōtara Creek, or across large portions of the stream), would require stream offsetting that would likely be difficult to achieve. As such, it is recommended that further encroachment into Tōtara Creek is avoided. If unavoidable, further offset/compensation will need to be determined at the detailed design phase.

- TL2 habitat along Mānutewhau Stream and the instream area at the stormwater ponds along Westgate Drive (high sensitivity). The intermittent (stream 6) tributary of Mānutewhau stream and associated PL1 habitat (medium sensitivity). Meola Creek (high sensitivity).

  Further encroachment into these areas could increase the loss of potential lizard habitat and potentially impact on the riparian areas or the instream habitat. We recommend that the LMP for the future WAA application should incorporate triggers that would guide the need for additional mitigation (i.e., lizard habitat restoration), where required. Additional increased impacts on riparian areas and/or instream habitats would require an adjustment of the proposed stream mitigation (i.e., recalculating the required restoration).

- Tihema Stream (Stream 5), and the intermittent unnamed stream (stream 10) adjacent to SH16, which isn't currently impacted (high and medium sensitivity, respectively). A change in the Indicative Design may result in an impact. The SEV scores determined for the streams should be used to determine the appropriate restoration required to mitigate the possible stream length impact.

- Triangle Road SEA (SEA_T_5124) (high sensitivity). Broadleaved forest and scrub (VS5) within the SEA (SEA_T_4938) at Henderson Creek (high sensitivity).

  An increase in the footprint of the Indicative Design within the SEAs would likely require additional restoration planting and pest management to offset the loss, which would not be able to be achieved within the current Project Area. As such, it is recommended that further encroachment into the SEAs, including the removal of the Kauri tree in SEA_T_4938, is avoided. If required, additional offset/compensation will need to be determined at the detailed design phase.

- Exotic wetland at 74 Trig Road (high sensitivity). Exotic wetland, and adjacent areas, at Eric Armishaw Boardwalk (high sensitivity).

  A change in the Indicative Design that impacts on these wetlands would likely require wetland offset/compensation. It is recommended that potential amendments to the Indicative Design continue to avoid the wetlands. If required, wetland offset/compensation will need to be determined at the detailed design phase.

- Broadleaved forest and scrub VS5 habitat at Arch Hill Scenic Reserve (medium sensitivity).

  The Indicative Design has limited impact on the vegetation type. A realignment that further encroaches into the VS5 may increase the loss of potential lizard habitat. It is recommended that the LMP for the future WAA should incorporate triggers that would guide the need for additional mitigation (i.e., lizard habitat restoration), where required.

- SEA_T_2040 along Mānutewhau Stream (high sensitivity). VS-5 Broadleaved species scrub/forest and TL2 Mixed Native Exotic Treeland.

At the time of undertaking this assessment the Indicative Design did not include any infrastructure or construction areas within the SEA. Should the footprint of the Indicative Design and/or construction areas encroach into this SEA, we consider that restoration planting and pest management would be required. The quantity of restoration planting and pest management, potentially including an offset/compensation component, would need to be determined at the detailed design phase. We recommend that further encroachment into the SEA is avoided.

5. Recommended measures to avoid, remedy or mitigate effects

Measures to avoid or minimise potential adverse ecological effects have been developed through the development of the Indicative Design for the Project[19]. In this section we have provided a high-level outline of the effects management measures to avoid, remedy, or mitigate effects where possible, and management measures to address outstanding effects. We recommend that the detailed mitigation, following best-practice techniques where available, to achieve the below measures are specified during the detailed design phase for each stage of the Project.

This section outlines the mitigation requirements for actual and potential effects from the Project outlined in Sections 4.2 and 4.3. Measures to avoid, remedy or mitigate effects, including outstanding effects, are focused on ecological features where the level of effect was assessed to be Moderate or higher (or in compliance with the Wildlife Act (1953)).

We recommend the following management during the staged construction of the Project:

- Restoration planting and pest plant management;
- Management protocols for Kauri dieback spread;
- Bat management;
- Bird management;
- Lizard management;
- Stream management; and
- Fish Salvage and Relocation Protocols (FSRP).

All operational effects were deemed to be less than Moderate. As such, no ecological management is proposed for the operational phase of the Project.

5.1 Restoration Planting and Pest Plant Management

The Indicative Design will likely result in approximately 12ha of vegetation loss across the terrestrial habitats throughout the Project Area (excluding BF, EG, and DG). At least a further approximate 3ha of vegetation will be removed for temporary construction areas. Of the vegetation loss, approximately 0.4ha will likely be lost from within the two terrestrial SEAs (Table 4-1). To mitigate this loss we recommend restoration planting and pest plant management for two SEAs, as detailed in the Sections 5.1.1- 5.1.1 below.

Restoration planting and pest plant management will need to be developed prior to each of the staged construction phases of the Project, by a suitably qualified person (e.g., restoration ecologist), with the objective of achieving a broadleaved scrub/forest (VS5) vegetation type. We recommend that the following criteria be included in the restoration planting and pest plant management:

- Planting design details.
- Plant species and plant mixes.
- Spacing/densities and sizes (at the time of planting).
- Details of the sourcing of native plants including genetic sourcing of native plants from the Ecological District and including the use of TAR species, and species that provide food sources for native fauna.

[19] This included an options assessment process, whereby the Project has aimed to avoid ecological features of value, where possible.

- Planting methods.
- Planting programme.
- Pre-planting pest plant control management.
- Ground preparation (top soiling and decompaction) specifications.
- Plant pest management. Weed control within a 20 m buffer of the works and any new planting should be undertaken for at least 5 years following planting. This should be carried out following recommendations in the Auckland Regional Pest Management Plan 2020 – 2030 (Auckland Council, 2021), or a subsequent equivalent plan.
- Methods to monitor and inspect the performance of any new planting to satisfy the vegetation maintenance requirements and pest control requirements.
- Planting should be undertaken in accordance with Biosecurity New Zealand's guidance on managing native plants susceptible to myrtle rust when undertaking restoration planting (Biosecurity New Zealand, 2018).

5.1.1 Restoration to account for the loss of SEA habitat

Loss of SEA habitat from the construction of the project elements within the Indicative Design cannot be remedied at the affected sites and requires offsetting.

The Biodiversity Compensation Model (BCM) (Baber et al., 2021) was used to outline actions required to address the loss of vegetation resulting from the Indicative Design within SEAs. The BCM was used in the absence of relevant qualitative data to inform the use of the Biodiversity Offset Accounting Model (BOAM) (Maseyk et al., 2015). Based on the Indicative Design, the BCM calculates a 'No-Net-Loss' outcome, whilst accounting for uncertainty of planting success and time lag between 'loss at the impact sites' and the gain being created within the remaining portions of the respective SEAs. In summary, the BCM:

- Accounts for 'like-for-like' biodiversity trades/currencies aimed at demonstrating 'No-Net-Loss'.
- Calculates the present biodiversity value to estimate whether 'No-Net-Loss' can be achieved.
- Incorporates the use of a time discount rate to account for time lag (the recommended discount rate of 3%).
- Makes an allowance for uncertainty of success (i.e., a degree of confidence) in relation to proposed offset actions.

As such the approach provides transparency, and a robust process for determining restoration planting to address the effect of vegetation loss from the construction of the project elements within the Indicative Design, within SEA_T_5124 (Triangle Road) and SEA_T_4938 (Henderson Creek). The quantities of restoration to offset the loss of SEA habitat is detailed below (Sections 5.1.1.1 and 5.1.1.2). We recommend that restoration planting and pest plant control management include the criteria outlined above (Section 5.1).

5.1.1.1 SEA_T_5124 (Triangle Road)

The Indicative Design through SEA_T_5124 is anticipated to result in the loss of mixed native and exotic treeland (TL.2), exotic scrub (ES), native and/or amenity planting (PL.3), and bare ground. While the impact is within an SEA, some of the current habitat is dominated by exotic and weedy species (e.g., ES and disturbed areas dominated by weeds). As such, only the loss of the moderate value TL.2 was taken into consideration (approximately 0.235ha).

Applying a BCM determined that approximately 0.792ha of restoration would likely address the loss of the moderate value habitat within the SEA. The recommended offset site for the restoration is within the adjacent remaining portion of the SEA (Figure 5-1), excluding the riparian area which will be the focus of the stream management (refer to Section 5.6). The extent of restoration to address the loss of the moderate value habitat within the SEA can be adjusted at detailed design phase. If required, the BCM provided in Appendix G should be used as a guide to recalculate the required extent of restoration[20].

[20] A reduced Net Gain target of 5% has been used.

Figure 5-1: SEA_T_5124 - Extent of the recommended restoration

Restoration of indicative construction areas and to account for the loss of SEA habitat will reduce the overall effect to Low. No further impact management is anticipated.

5.1.1.2 SEA_T_4938 (Henderson Creek)

The Indicative Design allows for the bridging of SEA_T_4938, therefore minimising the impact to the SEA. However, construction activities will result in the loss of vegetation, which includes the land required for construction works according to the indicative design. This is anticipated to result in an approximate loss of 0.033ha of broadleaved forest and scrub (VS5).

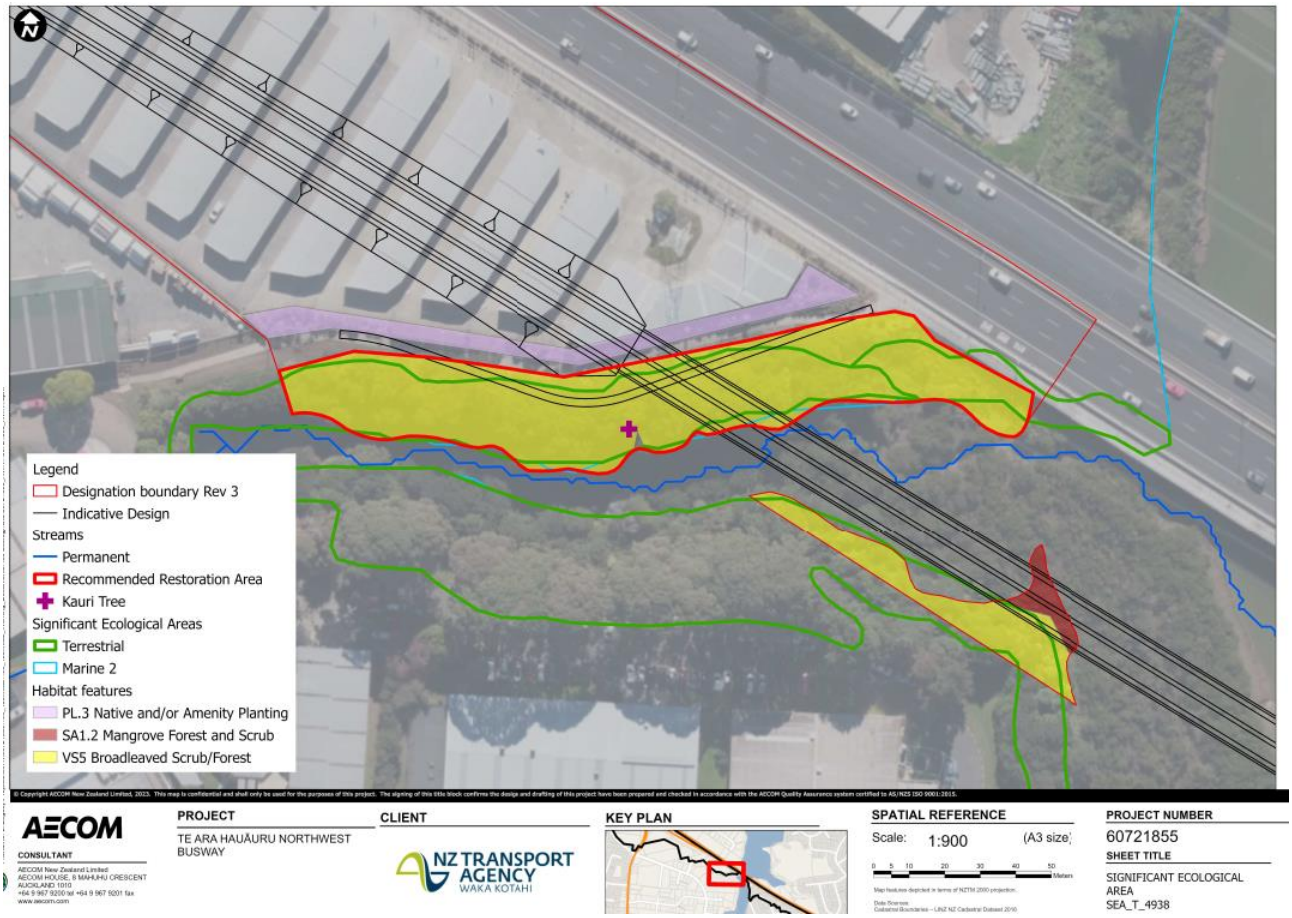


Figure 5-2: SEA_T_4938 - Extent of the recommended restoration

Applying a BCM determined that 0.212ha of restoration would be appropriate to address the loss of habitat within the SEA. We recommend that approximate 0.212ha within the recommended restoration area in Figure 5-2, be restored to VS5. The planting would include restoration planting and pest plant management within the recommended restoration area, but with a particular focus on the edge habitat. It is acknowledged that there will be limited opportunity for restoration under the bridge. However, it is anticipated that low stature vegetation, i.e., selective broadleaved scrub species, could be planted. The extent of restoration to address the loss of the moderate value habitat within the SEA can be adjusted at detailed design phase. If required, the BCM provided in Appendix G should be used as a guide to recalculate the required extent of restoration[21].

Restoration of indicative construction areas and to account for the loss of SEA habitat will reduce the overall effect to Low. No further impact management is anticipated.

5.2 Kauri dieback management

The kauri tree located within SEA_T_4938 at Henderson Creek (Section 3.2.2) is located within a kauri management area and is possibly infected with kauri dieback (A soil-borne disease caused by the pathogen *Phytophthora agathidicida*). We recommend that this tree be assessed by a suitability qualified person (e.g., arborist) prior to construction. If required, Kauri dieback management and an appropriate Tree Protection Zone (and/or hygiene zone) will need to be developed and implemented by a suitably qualified person (e.g., arborist), in accordance with the Biosecurity (National Pest Management Plan for *Phytophthora agathidicida*) Order 2022, the Auckland Regional Pest Management Plan 2020 – 2030 (Auckland Council, 2021), and the Kauri Hygiene Standard Operating Procedures (Auckland Council, 2021).

The impact is assessed as Very Low post mitigation.

[21] A reduced Net Gain target of 5% has been used.

5.3 Bat management

Suitable bat habitat was identified along Tōtara Creek, in the vicinity of the proposed Brigham Creek station and SH16 (Section 3.3.1) which is adjacent to where bats have been previously recorded by Tonkin & Taylor (2020). This vegetation included native and exotic treelands (TL.2-3) (Figure 5-3). Potential construction related effects requiring mitigation include mortality or injury of bats, and the potential removal of roosts. A suitable qualified person will be required to undertake the recommended bat management measures, which are:

- Where practicable avoid encroachment into suitable bat habitat areas (Figure 5-3).
- Implementation of Bat Roost Protocols (BRPs) (DOC, 2021) prior to removal of the stand of Pine trees within the Indicative Design. These are the mature trees with suitable roost habitat in the vicinity of the proposed bridge over Tōtara Creek.

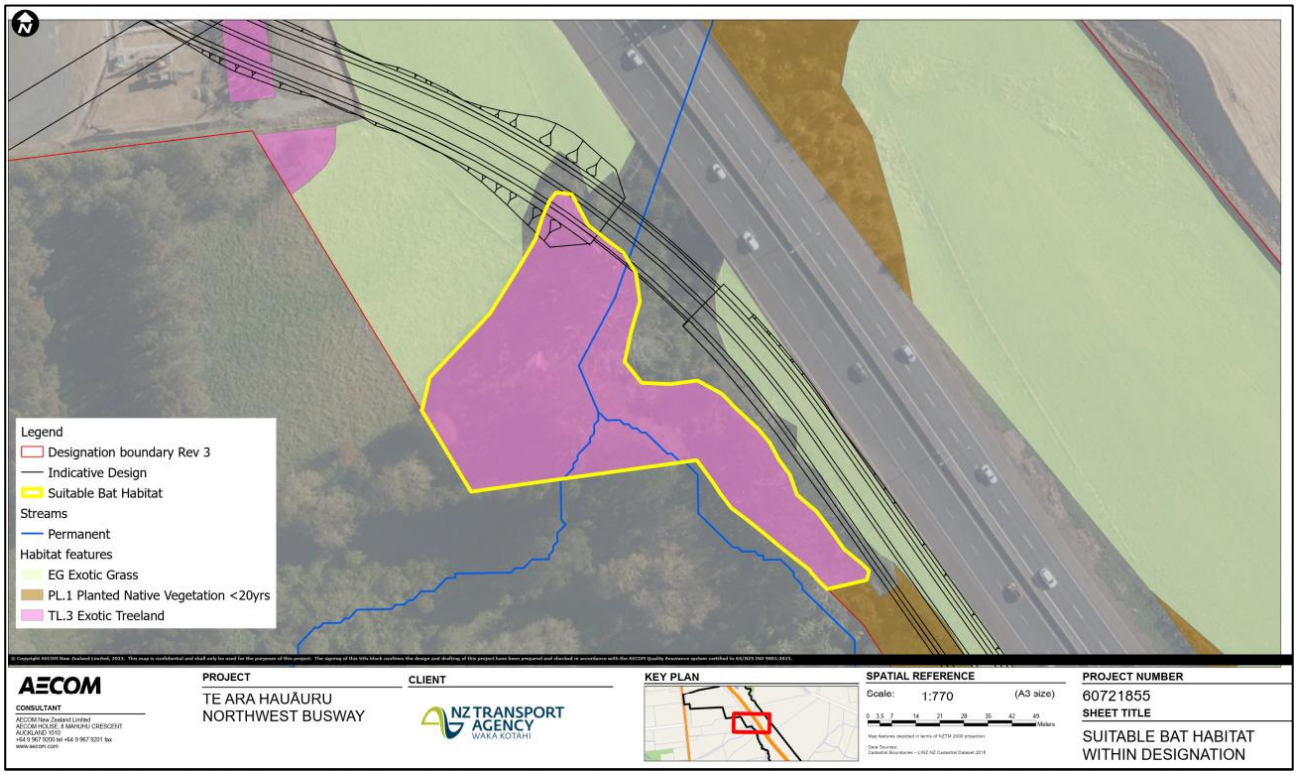


Figure 5-3: Suitable habitat for long-tailed bats along the riparian margins of Tōtara Creek

The impact is assessed as Low post mitigation. No further impact management is anticipated.

5.4 Bird management

Based on the Indicative Design and associated vegetation clearance during construction works, all potential bird species likely to be present across the Project Area are highly mobile and will disperse to the wider area for foraging and/or roosting when disturbed. Habitat of similar value is abundant in the surrounding area and will provide a suitable, alternative location for dispersal during times of construction. Additionally, during breeding season (September – February inclusive), pre-clearance nesting bird checks will greatly minimise and/or eliminate the potential of nest disturbance across all species and habitat types.

Suitable bird nesting and foraging habitat is present throughout the Project Area (Section 3.3.2). Potential construction related effects requiring mitigation include mortality or injury to birds and nest loss. We recommend the following bird management measures during construction:

- Consideration to timing of vegetation removal to avoid the key nesting period (September to February, inclusive). Where this is not practicable, undertake pre-clearance nesting bird surveys throughout the following vegetation types: regenerative broadleaved forest and scrub (VS5), planted vegetation (PL1-3), treelands (TL2-3), planted wetland vegetation (described as WL10 &18), mangroves (SA1.2), exotic scrub (ES), rank grasslands (e.g., unmaintained EG) including the Te Atatū Pony Club paddocks within

the Project Area (this excludes actively maintained/mowed EG areas), and trees and shrubs within gardens associated with dwellings along the project route.

- When active nest sites of native birds are identified these are to be managed with set-back distances (defined by a suitably qualified ecologist) until young birds have fledged, or the nest is naturally abandoned.

The impact is assessed as Very Low post mitigation. No further impact management is anticipated.

5.5 Lizard management

Potential habitat for Copper skinks is present throughout the following vegetation in the Project Area: Planted vegetation (PL1-3) (excluding planted vegetation that is disconnected from the surrounding habitat), treelands (TL.2-3), exotic scrub (ES), regenerative broadleaved forest/scrub (VS5), and rank grasslands (e.g. unmaintained EG) on habitat edges including along stream corridors (this excludes actively maintained/mowed EG areas) (Refer to Appendix A). These vegetation types account for less than 25% of the area to be impacted by the Indicative Design. Noting that permitted vegetation removal, pruning, and/or alterations can take place within road reserves[22], it is likely that this potential habitat will undergo changes over time. Given the value of most of the available habitat and the potential for expansion or contraction of the different vegetation types, no lizard habitat restoration is proposed. However, we recommend that the LMP for future the WAA application incorporates triggers for lizard habitat restoration. In addition, and where practicable, we recommend that lizard habitat features be incorporated into other planting activities, such as landscaping and stormwater infrastructure, which would help to improve long-term habitat stability.

While no upfront lizard habitat restoration is proposed, the potential that vegetation clearance may result in mortality or injury to native lizards (primarily focused on Copper Skink), requires management. We recommend the following lizard management measures during construction:

- A LMP will be required for future Wildlife Act authorisation, and this will need to be developed prior to lizard salvage. The LMP will need to outline salvage and relocation methodology. The LMP will also need to identify a relocation site(s), and if triggered, a pest control regime at the relocation site(s). We note that Wildlife Act authorisations are not being sought as part of the current FTAA approvals.
- For the future Wildlife Act authorisation, we recommend that potential adverse effects on lizards should be managed through the following management actions:
  - Avoidance through construction footprint minimisation (if practicable).
  - Appropriate timing of vegetation clearance, which should be between October-April (inclusive).
  - Construction-assisted salvage and relocation during vegetation clearance (undertaken by a suitably qualified ecologist or herpetologist).
  - Protocols for the accidental discovery of lizards.
  - Protocols for accidental injury and/or death to lizards.
  - Relocation site selection and habitat enhancement.

The impact is assessed as Very Low post mitigation. No further impact management is anticipated.

5.6 Stream management

Bridge crossings, culvert extensions, and other instream works within the Indicative Design will result in impacts to seven stream reaches (permanent and intermittent streams). Given, the recommended stream management takes into consideration the Indicative Design, this management will need to be refined once detailed design is available for the respective structures.

It is anticipated that instream works will follow best practice construction management practices for sediment, dust, and erosion controls (outlined in Section 4.1). The impact to stream extent and value must be considered where streams are being directly impacted by the Project. Given the anticipated impacted stream length (i.e., 78m across seven stream reaches), we recommend that mitigation for stream impacts focuses

[22] The Indicative Alignment is located within large portions of the road reserve for SH16.

on riparian restoration[23]. Riparian restoration planting and pest plant control management should include the criteria outlined in Section 5.1.

Temporary construction areas, within riparian areas, will be required to construct the bridge crossings and culvert extensions (i.e. areas adjacent to the Indicative Design). Once construction is completed, we recommend that the required construction areas within the riparian areas, are restored. This will allow for the rectifying of the direct impacts to riparian areas at the affected sites.

While the loss of riparian areas to temporary construction areas can be remedied at the affected sites, the loss of instream and riparian areas within the footprint of the bridges and culvert extensions, cannot. These areas require offsetting. The SEV and associated environmental compensation ratio (ECR) tool has been used to quantify the amount of instream and riparian area impacted, and the required riparian restoration.

The ECR utilises the SEV score to calculate a ratio for the minimum stream area (stream bank width x stream length) to be restored. The mitigation area calculations are indicative and could change significantly if design changes. These calculations would require re-checking at detailed design.

ECR = [(SEVi-P – SEVi-I) / (SEVm-P – SEVm-C)] × 1.5

Where: SEVi-P is the potential SEV value for the site to be impacted. SEVi-I is the predicted SEV value of the stream to be impacted after impact. SEVm-C is the current SEV value for the site where environmental compensation is applied. SEVm-P is the potential SEV value for the site where environmental compensation is applied.
Restoration length required = (impact area × ECR) / restoration channel width.

The ECR calculation formula requires SEV scores to be calculated for both the impact and proposed mitigation/offset sites (if applicable). This provides a basis from which to quantify the likely loss in values and functions at an impact site with the increase in stream ecological values and functions at a mitigation site. In this case there are limited stream reaches available for restoration within the Project Area. Adjacent reaches on the impacted streams have been considered as the 'offset/restoration sites', as there is considered to be sufficient stream length available for the proposed restoration. For most of the streams, except for stream 6, there is sufficient stream length within the Project Area for the proposed mitigation) (Stream 6 restoration would extend downstream beyond the current Proposed Designation). Ideally an 'offset site' should be like for like, but in the case of stream 6 we propose the use of Tōtara Creek, within the Project Area, as the offset site[24].

The use of adjacent stream reaches as offset sites allows for riparian restoration to be undertaken directly adjacent to the impact sites (within the same reach, either upstream or downstream). However, this approach results in the ECRs being slightly higher as there are less 'gains' in comparison to using offset sites where there is little existing value and/or function (e.g., a cleared stream channel within a paddock).

The ECR calculation takes into account the difference in bridges vs culverts (i.e. the SEVi score for culverts is lower, generally resulting in a higher ECR).

Table 5-1 provides an estimate of the required stream mitigation length and stream mitigation area required for offset riparian restoration planting based on the ECR calculations. The total length of stream reach recommended for offsetting the loss of instream and riparian areas within the footprint of the bridges and culvert extensions is 213m.

[23] The indicative construction methodology in the AEE indicates all proposed culverts are anticipated to be less than 30m in length and thus AUP Rule E3.4.1(A33) is not triggered.

[24] Riparian restoration along the portion of Tōtara Creek, to offset the impacts on stream 6, provides opportunity for gains in stream ecological value and function within a stream in the same watershed.

Table 5-1: Stream mitigation requirements based on ECR calculation

No.	Stream Name	SEV (current)	SEVp	SEVi	Bankfull width (m)	Stream mitigation length (m)	Stream mitigation area (m2)	Mitigation within Project Area (same stream)
1	Tōtara creek *Used existing stream as offset site in ECR*	0.478	0.535	0.449	6	23	136	Yes (upstream of the impacted stream reach)
3	Tōtara creek Used existing stream as offset site in ECR	0.553	0.600	0.538	5	12	59	Yes (downstream of the impacted stream reach)
4	Mānutewhau stream *Used existing stream as offset site in ECR*	0.46	0.485	0.420	6	20	117	Yes (upstream of the impacted stream reach)
6	Mānutewhau stream tributary *Used Tōtara Creek as offset site in ECR*	0.457	0.475	0.432	3	16	48	**No*** Available in downstream reach (outside Proposed Designation, alternatively Tōtara Creek)
7	Rarawaru stream *Used existing stream as offset site in ECR*	0.562	0.590	0.521	4.5	58	261	Yes (upstream of the impacted stream reach)
8	Meola creek *Used existing stream as offset site in ECR*	0.559	0.583	0.541	10	11	105	Yes (downstream of the impacted stream reach)
9	Tōtara creek tributary *Used existing stream (directly downstream of impact site) as offset site in ECR*	0.48	0.550	0.423	5	73	366	Yes (downstream of the impacted stream reach)

Note: Detailed SEV scores provided in Appendix E.

The extent of offset riparian restoration to address the loss of instream and riparian areas within the footprint of the bridges and culvert extensions can be adjusted at detailed design phase. If required, the SEV scores provided in Appendix E should be used as a guide to recalculate the required extent of offset riparian restoration.

Riparian restoration, at construction areas and at offset sites will reduce the overall effect to Low. No further impact management is anticipated.

5.7 Fish Salvage and Relocation Protocols

Instream works such as culvert extension and stream diversion may result in fish injury or death. To prevent this we recommend that Fish Salvage and Relocation Protocols (FSRP) are developed and implemented during each of the construction stages when working in streams 1, 3, 4, 6,7,8, and 9. The FSRP must include (but not be limited to) the following:

- Methodologies for fish salvage and relocation.
- Details of timing of plan implementation, taking into account native fish migration and potential inanga spawning season (November to May).
- Details of suitably qualified ecologist to undertake the capture and relocation and be present on-site during dewatering to rescue and relocate any remaining fish present.
- Details of relocation site(s) and measures to ensure relocated fish remain within the source catchment if possible.
- Euthanasia procedures for exotic species or injured native fish.
- Storage and transport measures.

- Methods to invite Mana Whenua to exercise kaitiakitanga through participation in fish recovery work, where safe and practicable to do so.
- Any necessary permits or authorisations (e.g., Ministry for Primary Industries (MPI), DOC and Fish and Game).

Generic FSRP are provided in Appendix H.

While significant Inanga (*Galaxias maculatus*) spawning habitat was not noted in the affected streams during surveys, the species was detected in eDNA samples and noted by Tonkin & Taylor (2020). Inanga spawning habitat should be confirmed and be taken into consideration in relation to the timing of instream works if present (see Appendix H).

The impact is assessed as Very Low post mitigation.

6. Conclusion

In this assessment we address the potential ecological effects arising from the Indicative Design within the Proposed Designation for the Project, which is anticipated to be delivered over an approximately 20-year period, and construction will be staged.

The EcIA involved both desktop and infield assessments of terrestrial habitats, terrestrial fauna (including bats, birds, herpetofauna and invertebrates (incidental observations), freshwater habitat, wetland habitat, and marine habitat (benthic survey).

The Project Area and surrounding landscape are transformed. The remaining terrestrial and aquatic habitats within the Project Area consist mostly of a mixture of native and exotic planted vegetation within open spaces and along riparian corridors, and two small portions of estuarine habitat dominated by mangroves. In general, the Indicative Design aligns with existing road infrastructure, which limits effects on the identified cological features, but still encroaches into terrestrial Significant Ecological Areas (SEAs), freshwater habitats, and estuarine habitats (marine SEA). We consider that the effects will be minimised by the implementation of best practice construction methods and embedded controls (Section 4.1). However, mitigation will be required. We identified the following key ecological effects trigger the need for mitigation, and where required, additional management / offset:

- Vegetation removal, particularly within terrestrial SEAs (additional management / offsetting required).
- Potential killing or injuring bats, and potential removal of bat roosts due to vegetation removal.
- Potential killing or injuring birds, and the disturbance of nests due to vegetation removal.
- Potential killing or injuring lizards (copper skink).
- Permanent loss or modification of stream habitat (additional management / offsetting required).
- Potential killing or injuring of native fish during instream works.

In accordance with the EIANZ Guidelines, we have recommended mitigation where the level of effect was assessed as Moderate (or higher). Recommended mitigation was identified for construction effects (no mitigation was deemed necessary for operational effects), and included:

- Restoration planting and pest plant management, to mitigate the loss of vegetation within the terrestrial SEAs. The restoration and pest plant management should be implemented within the recommended restoration areas, or similar areas within the Project Area (Section 5.1).
- Kauri dieback management. The kauri tree located within SEA_T_4938 at Henderson Creek will need to be assessed by a suitably qualified person (e.g. arborist) prior to construction. If required, an appropriate Tree Protection Zone (and/or hygiene zone) will need to be developed and implemented by a suitably qualified person.
- Bat management measures including avoidance of suitable bat habitat (where practicable) and the implementation of Bat Roost Protocols (BRPs) for the removal of the stand of Pine trees in the vicinity of the proposed bridge over Tōtara Creek.
- Bird management during construction including the consideration of the timing of vegetation removal to avoid the key nesting season (September – February, inclusive) and pre-clearance nest checks prior to

vegetation removal during the nesting season in the relevant vegetation types (Section 5.4) throughout the Project Area.

- Lizard management for the future WAA application including the avoidance of suitable lizard habitat (where practicable), timing of vegetation clearance (between October-April, inclusive), and a LMP to guide lizard salvage, relocation, and management.
- Riparian restoration along portions of impacted streams (streams 1,3,4, 6-9), which in total is estimated at 213m.
- Fish Salvage and Relocation Protocols (FSRP), as per Section 5.7 and Appendix H, should be developed and implemented during each of the construction stages when working in streams 1,3, 4, 6 -9.

The Indicative Design limits impacts to terrestrial SEAs, through aligning with existing road infrastructure and bridging SEA_T_4938 and a large portion of SEA_T_5124. The recommended restoration planting and pest management will enhance the remaining portions of the SEAs, within the Project Area, particularly within the SEA at Triangle Road (SEA_T_5124). Therefore, post mitigation impacts were assessed as Low.

For lizard management, no upfront lizard habitat restoration has been proposed. From an authorisation perspective (Wildlife Act authorisation), it is acknowledged that alternative pathways could be considered for the salvaging of lizards, but it is our recommendation that a Project Specific Wildlife Act authorisation is obtained. Regardless of the pathway for obtaining WAA, a LMP will be required to be developed prior to lizard salvage. We recommend that the LMP incorporates triggers for lizard habitat restoration. The LMP will guide the need for additional mitigation according to the species and quantity of lizards salvaged, and the location(s) of salvaged lizards. In addition, and where practicable, lizard habitat features should be incorporated into other planting activities, such as landscaping and stormwater infrastructure, which would help to improve long-term habitat stability.

In addition to assessing the effects of the Indicative Design, the sensitivity to changes in the design were also taken into consideration. A shift in the Indicative Design that would result in the same level of effect, but in a different location, was not anticipated to result in a change to the overall effects, and hence the proposed mitigation. However, should the Indicative Design change and move into, or encroach further into, the identified sensitive ecological areas (Section 4.4), this would increase impact and require additional and/or different mitigation. In most cases the additional mitigation would be achieved through adjusting the current extents/quantities proposed. The adjustments to the mitigation would need to be undertaken by an ecologist at the detailed design phase. Importantly, the sensitivity testing identified that some changes to the Indicative Design could result in residual effects that may prove challenging to mitigate or even offset/compensate (outlined in Section 4.4). As such, we recommend the avoidance of further encroachment into the terrestrial SEAs and Tōtara Creek.

We assessed ecological effects after mitigation, and additional management / offsets as Low - Very Low. This was based on:

- The implementation of embedded controls, and best practice construction management measures.
- The implementation of the recommended mitigation measures outlined in this assessment.
- The avoidance of increased encroachment into the terrestrial SEAs and Tōtara Creek.

With the implementation of the recommended management measures and best practice construction management measures, cumulative effects as a result of the construction of the Project are considered to be Low to Very Low.

In conclusion, with mitigation and offsetting, we have assessed the Indicative Design for the Project as having a Low-Very Low effect on ecological features throughout and directly adjacent to the Project Area.

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Appendix A. Habitat maps

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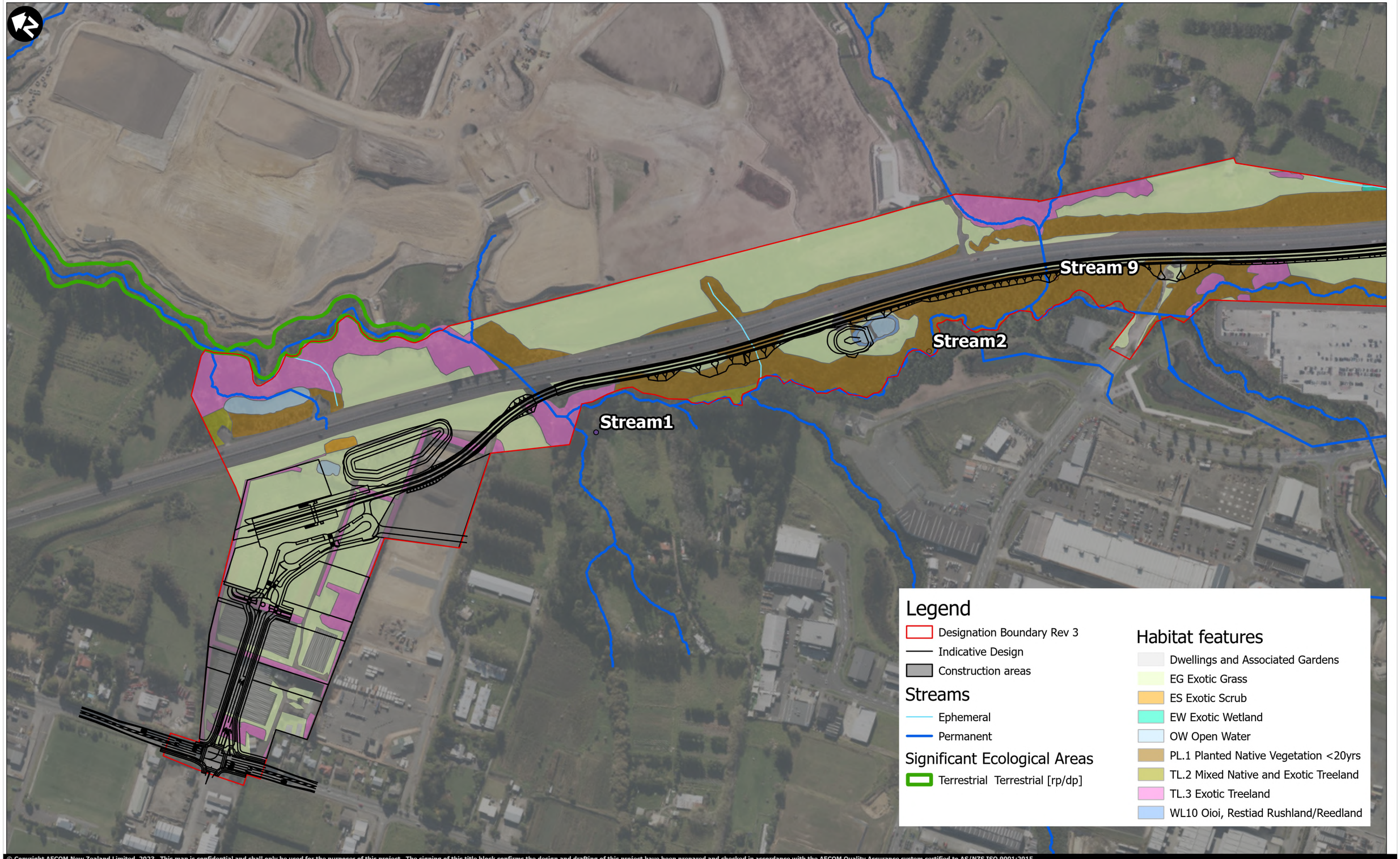

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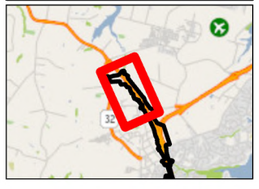
KEY PLAN



SPATIAL REFERENCE

Scale: 1:5,400 (A3 size)

40 20 0 40 80 120 Meters

Map features depicted in terms of NZTM 2000 projection.

Data Sources:
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2016

PROJECT MANAGEMENT

Approved	IB	Date	10.12.25
Checked	IB	Date	10.12.25
Drawn	LY, CS	Date	10.12.25

ISSUE/REVISION

Rev	Date	Description
C	10.12.25	Final with Designation Revision 3
B	25.09.25	Draft with Designation Revision 2
A	28.08.25	Draft with Designation Revision 2

PROJECT NUMBER
60721855

SHEET TITLE
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WEST NOR
TERRESTRIAL HABITATS

MAP NUMBER
Page 1

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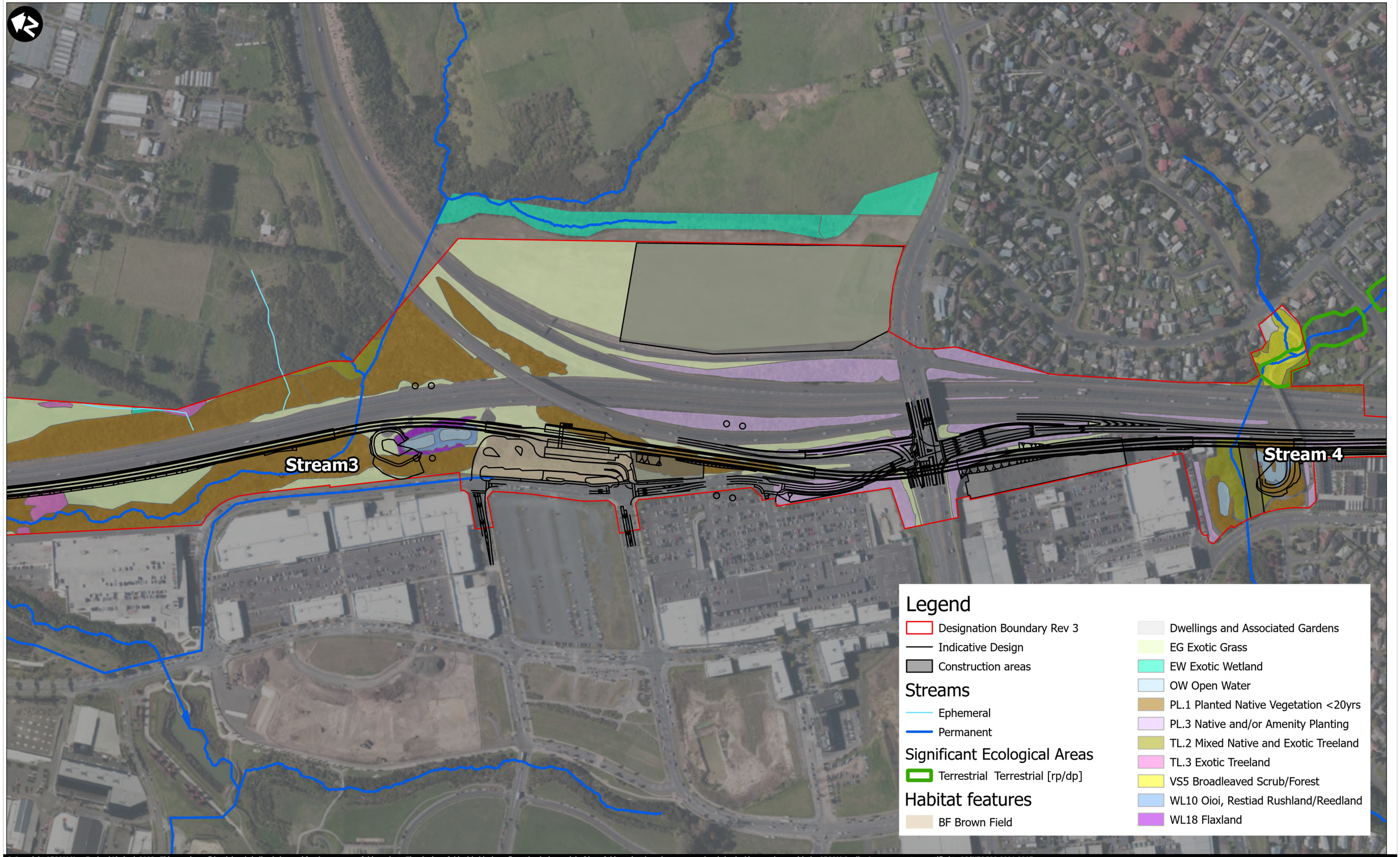

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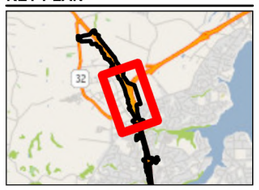
KEY PLAN



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Data Sources:
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SHEET TITLE
NORTHWEST BUSWAY
WEST NOR
TERRESTRIAL HABITATS

MAP NUMBER
Page 2

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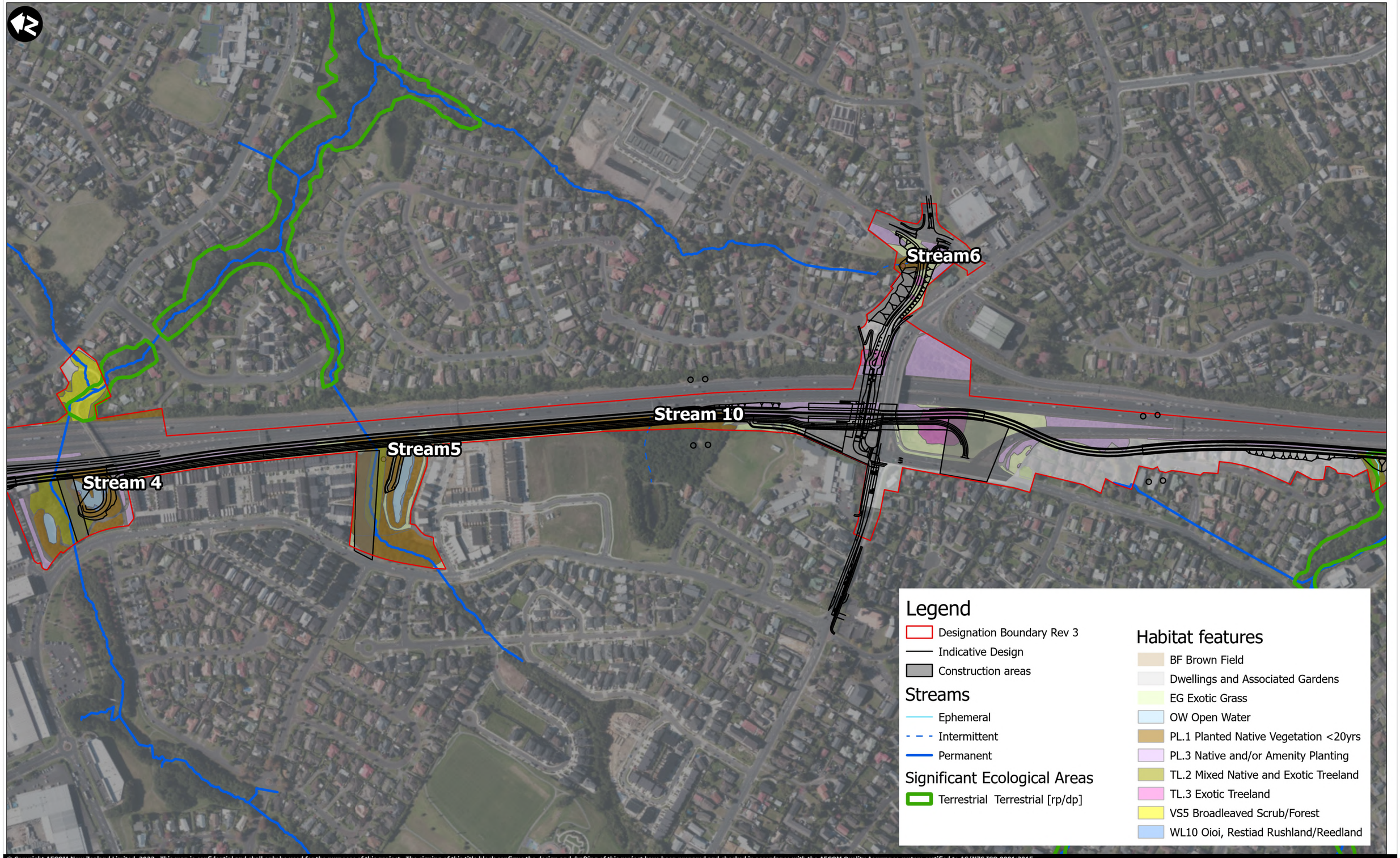

Legend

- Designation Boundary Rev 3
- Indicative Design
- Construction areas

Streams

- Ephemeral
- Intermittent
- Permanent

Significant Ecological Areas

- Terrestrial Terrestrial [rp/dp]

Habitat features

- BF Brown Field
- Dwellings and Associated Gardens
- EG Exotic Grass
- OW Open Water
- PL.1 Planted Native Vegetation <20yrs
- PL.3 Native and/or Amenity Planting
- TL.2 Mixed Native and Exotic Treeland
- TL.3 Exotic Treeland
- VS5 Broadleaved Scrub/Forest
- WL10 Oioi, Restiad Rushland/Reedland

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NORTHWEST BUSWAY

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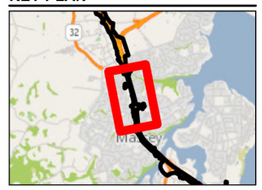
KEY PLAN



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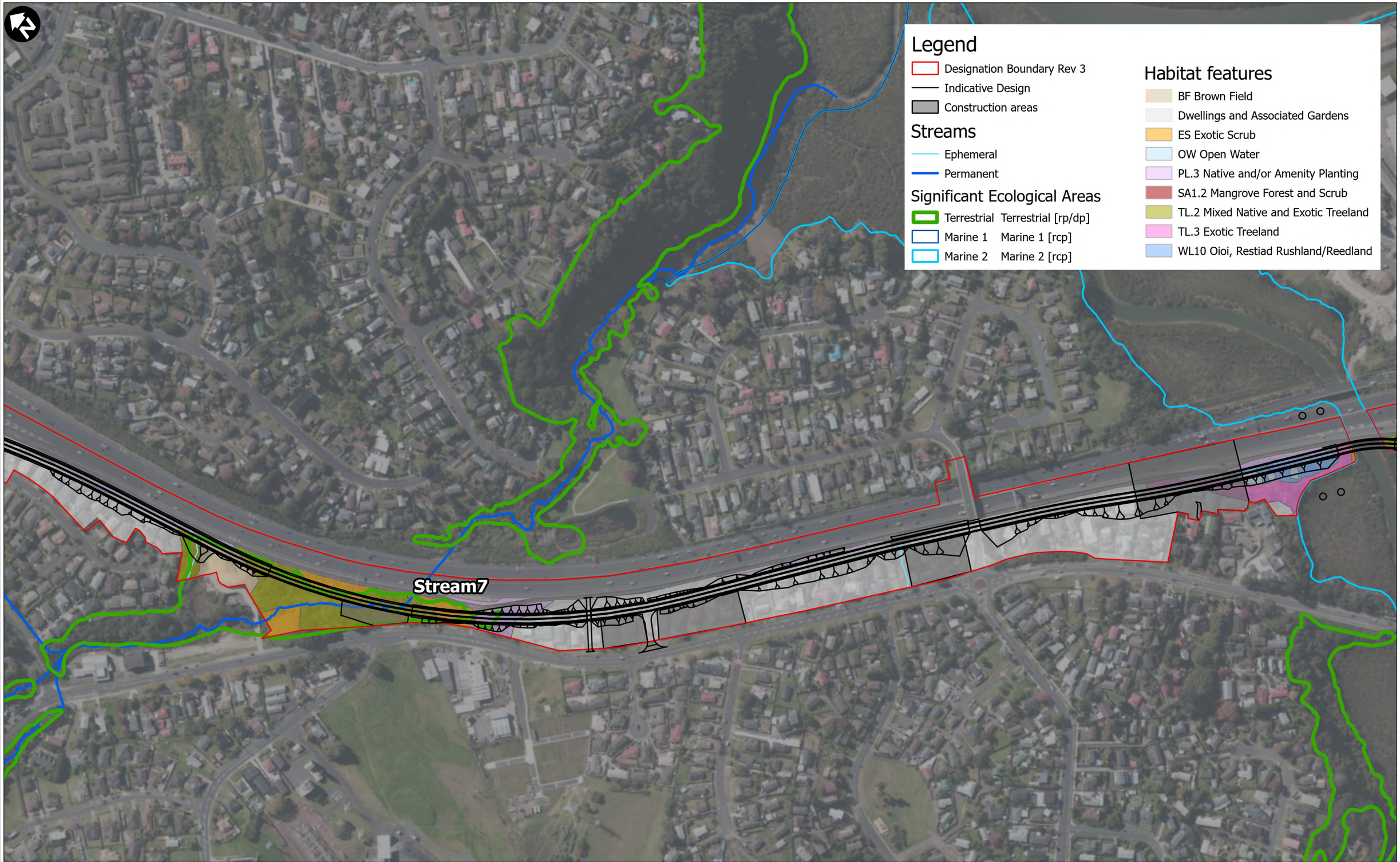

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SPATIAL REFERENCE
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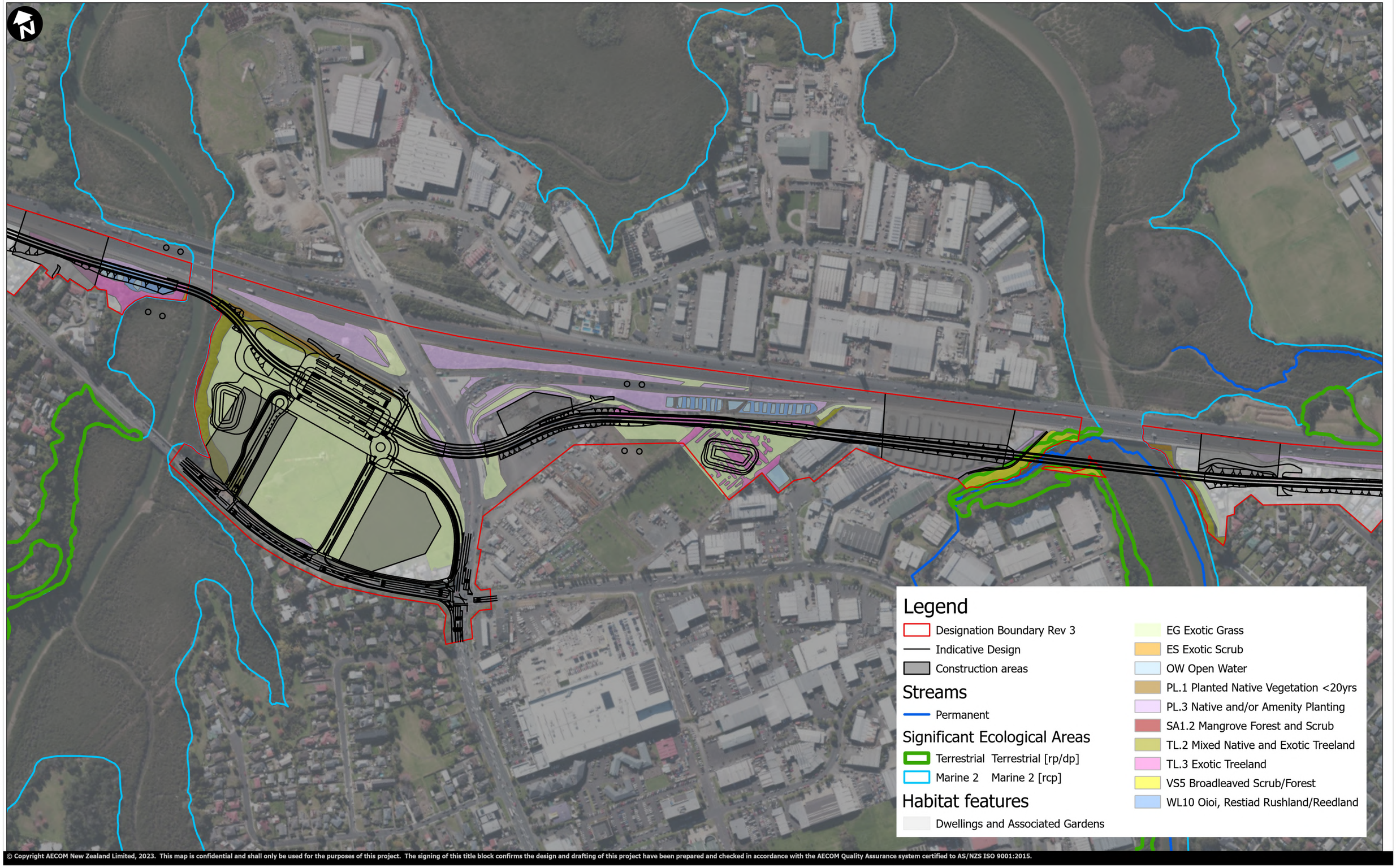

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SPATIAL REFERENCE

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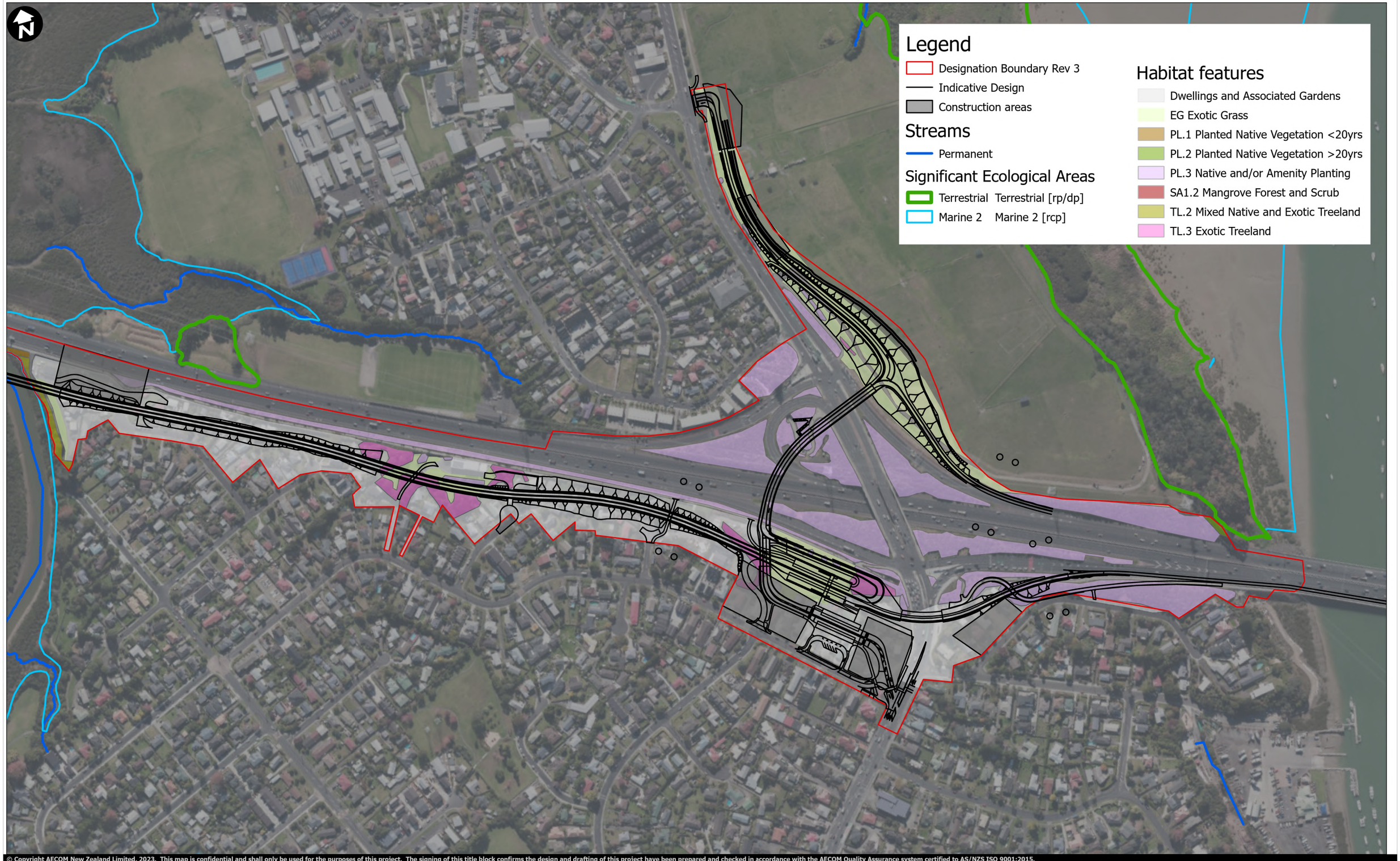

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TERRESTRIAL HABITATS

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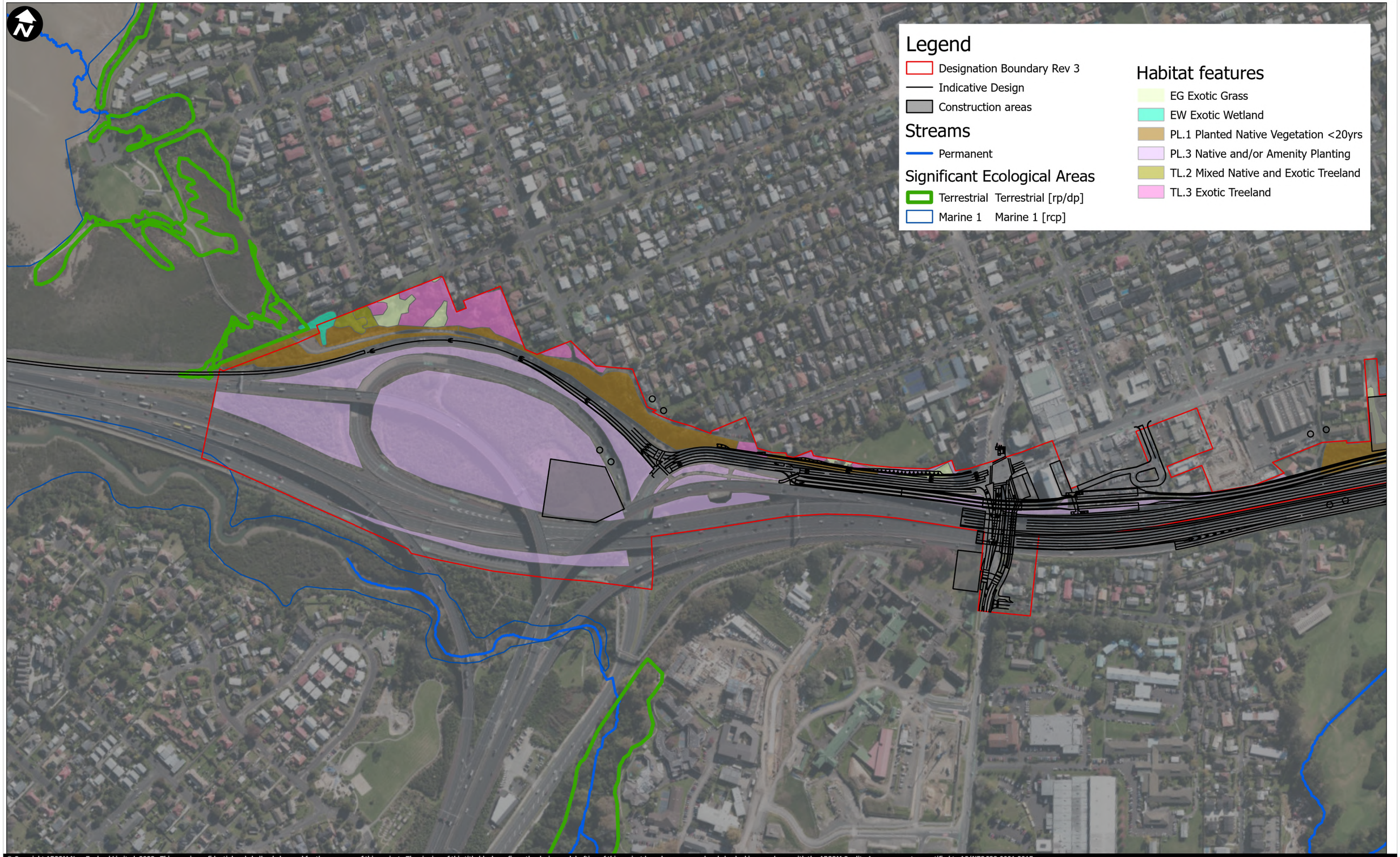

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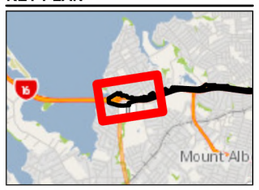

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TERRESTRIAL HABITATS

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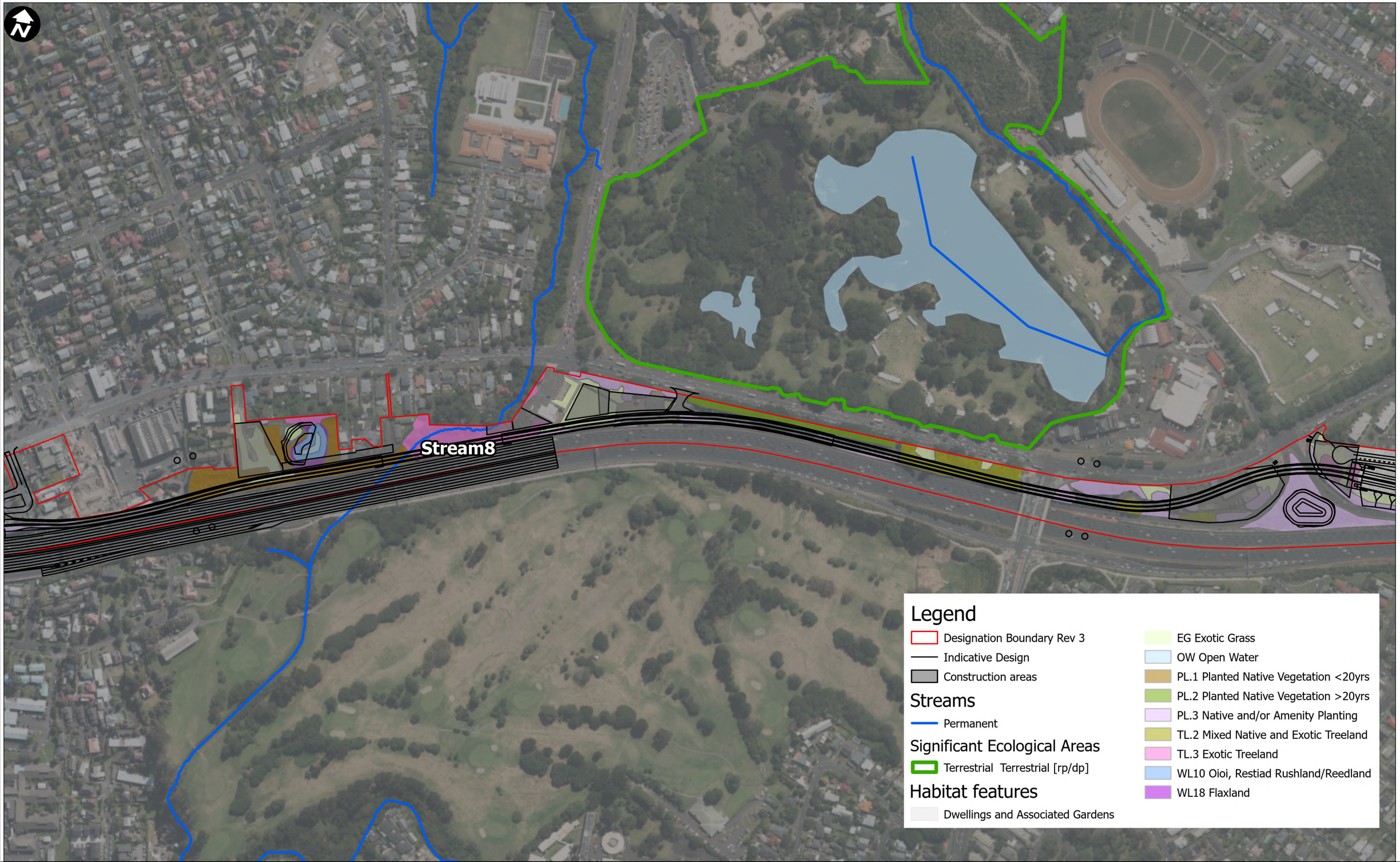

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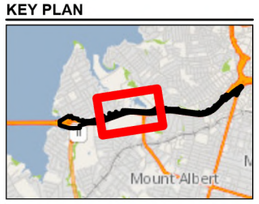

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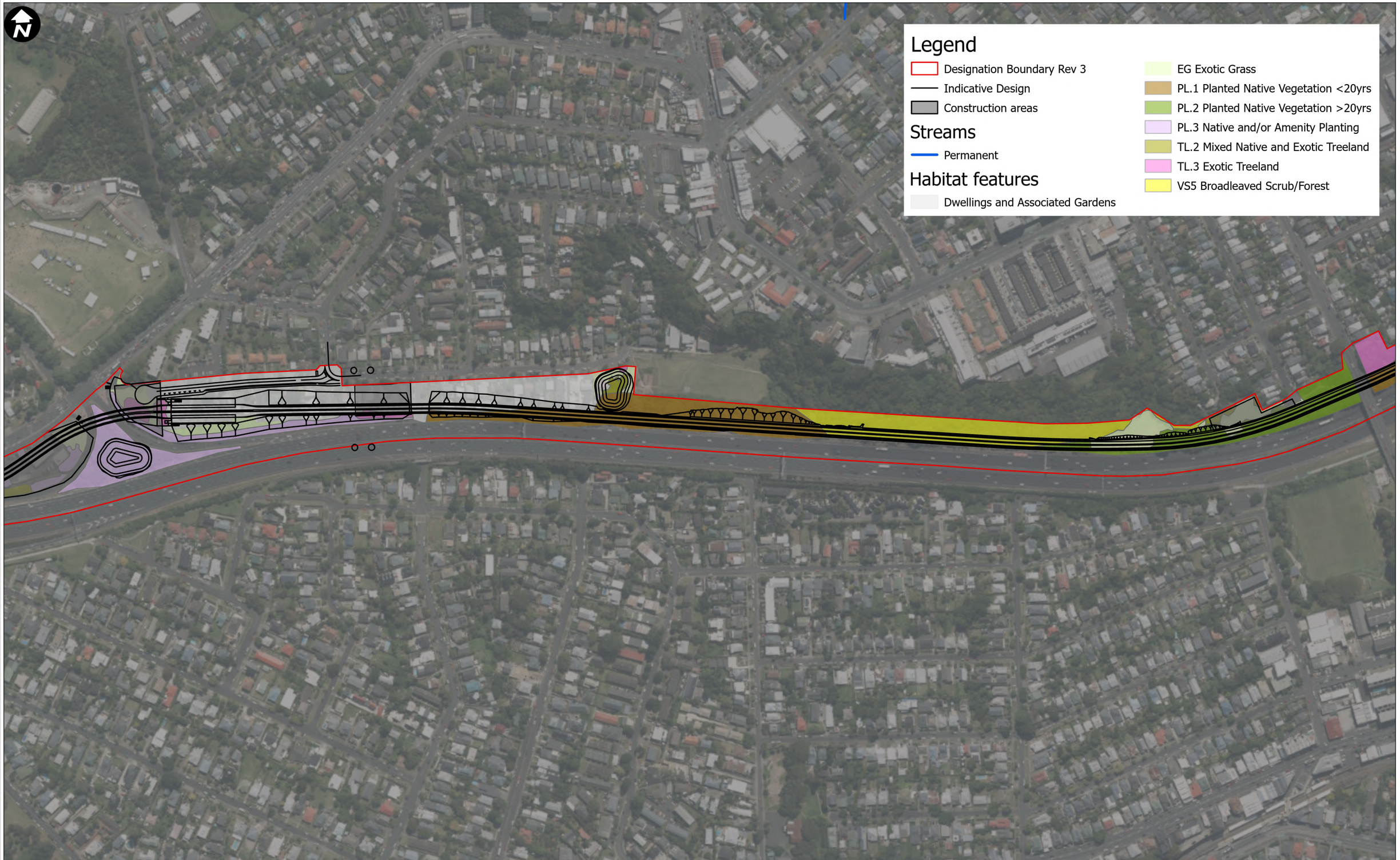

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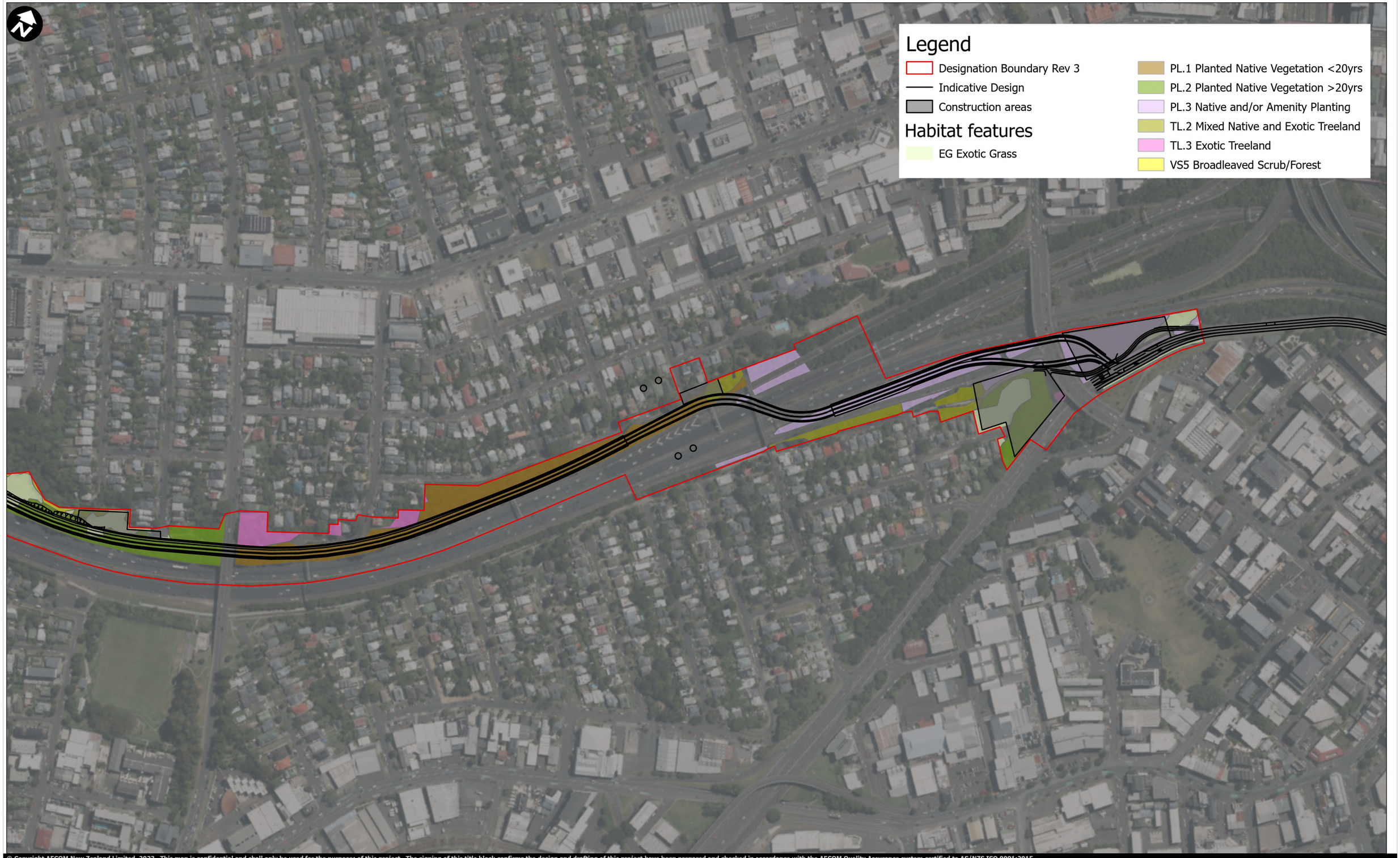

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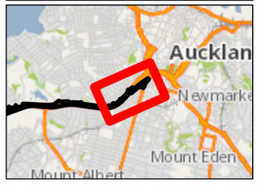

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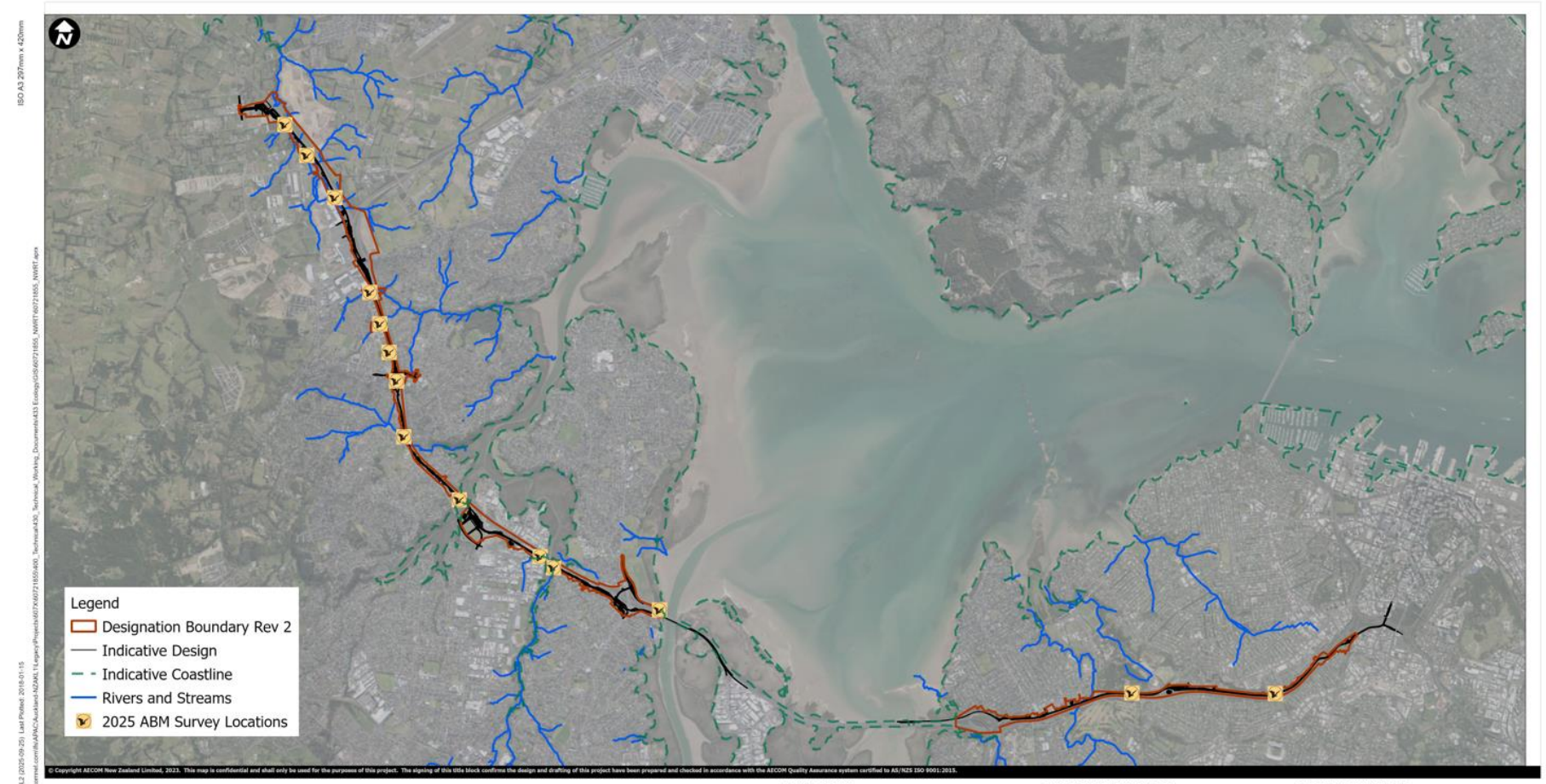
Appendix B. Bat survey locations



Appendix C. Avifauna species list (desktop and site observations)

Common name/ Māori	Scientific name	Conservation status (Robertson et al., 2021)	Regional Threat Status	Source	Likelihood of presence within the proposed designation	Observed on site?	Comments – suitable habitats	Habitat
Caspian Tern/ Taranui	*Hydroprogne caspia*	Threatened – Nationally Vulnerable	Regionally Critical	5MBC	Likely to forage at all estuary and/or large creek locations	Yes	Waitemata Harbour, Henderson Creek, Huruhuru Creek	Coastal
Long-tailed Cuckoo/ Koekoeā	*Urodynamis taitensis*	Threatened – Nationally Vulnerable	Regionally Endangered	eBird	Potential to forage in mature forested areas	No	Mature forests like the 'Enchanted Forest'	Terrestrial
Wrybill	*Anarhynchus frontalis*	Threatened- Nationally Increasing	Regionally Increasing	5MBC	Likely to forage at all estuary locations	Yes	Waitemata Harbour	Coastal
Banded dotterel	*Anarhynchus bicinctus*	At Risk- Declining	Regionally Endangered	eBird	Likely to forage at all estuary locations	No	Waitemata Harbour	Coastal
Red-billed gull	*Chroicocephalus novaehollandiae scopulinus*	At Risk - Declining	Regionally Vulnerable	5MBC	Likely to forage at all estuary and/or large creek locations	Yes	Waitemata Harbour, Henderson, Huruhuru Creek	Coastal
Black-billed gull/ Tarāpuka	*Larus bulleri*	At Risk - Declining	Regionally Endangered	eBird	Potential to forage at all estuary locations	No	Waitemata Harbour	Coastal
Bar-tailed godwit/ Kauka	*Limosa lapponica baeuri*	At Risk - Declining	Regionally Not Threatened	eBird	Potential to forage at all estuary locations	No	Waitemata Harbour	Coastal
White-fronted tern	*Sterna striata*	At Risk- Declining	Regionally Vulnerable	5MBC	Likely to forage at all estuary and/or large creek locations	Yes	Waitemata Harbour, Henderson Creek, Huruhuru Creek	Coastal
Spotless crake	*Zapornia tabuensis*	At Risk- Declining	Regionally Vulnerable	eBird	Potential to forage and/or breed within dense vegetation at stormwater ponds	No	Stormwater ponds	Marsh
Variable oystercatcher/ Tōrea pango	*Haematopus unicolor*	At Risk- Recovering	Regionally Vulnerable	5MBC	Likely to forage on mudflats and open grassy fields	Yes	Waitemata Harbour, Henderson Creek, Huruhuru Creek, plus open grassland particularly in saturated conditions	Coastal
North Island kākā	*Nestor meridionalis septentrionalis*	At Risk - Recovering	Regionally Recovering	eBird	Potential to forage mature forested areas	No	Mature forest like the 'Enchanted Forest'	Terrestrial
Black shag	*Phalacrocorax carbo*	At Risk- Relict	Regionally Critical	5MBC	Potential to forage and/or breed at estuary and large creek locations	Yes	Waitemata Harbour, Henderson Creek, Huruhuru Creek, plus	Coastal

Common name/ Māori	Scientific name	Conservation status (Robertson et al., 2021)	Regional Threat Status	Source	Likelihood of presence within the proposed designation	Observed on site?	Comments – suitable habitats	Habitat
							other pond or stream locations	
Little shag	*Phalacrocorax melanoleucos brevirostris*	At Risk - Relict	Regionally Endangered	5MBC	Potential to forage and/or breed at estuary and large creek locations	Yes	Waitemata Harbour, Henderson Creek, Huruhuru Creek, plus other pond or stream locations	Coastal
Royal spoonbill/ Kōtuku ngutupapa	*Platalea regia*	At Risk- Naturally Uncommon	Regionally Naturally Uncommon	5MBC	Potential to forage and/or breed at estuary and large creek locations	Yes	Waitemata Harbour, Henderson Creek, Huruhuru Creek	Coastal
Little black shag/ Kawau Tūī	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	Regionally Naturally Uncommon	5MBC	Potential to forage and/or breed at estuary and large creek locations	Yes	Waitemata Harbour, Henderson Creek, Huruhuru Creek, plus other pond or stream locations	Coastal
Red-necked stint	*Calidris ruficollis*	Migrant	Regional Migrant	eBird	Potential to forage at all estuary locations	No	Waitemata Harbour	Coastal
Shining cuckoo	*Chrysococcyx lucidus lucidus*	Not Threatened	Regionally Not Threatened	eBird	Potential to forage and/or breed in forested areas (and parasitise Grey Warbler nests)	No	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial
Australasian harrier/ Kāhu	*Circus approximans*	Not Threatened	Regionally Not Threatened	5MBC	Potential to forage in grassy or lightly forested areas	Yes	Open grassland areas like the farthest west portion of the designation, plus areas near the pony club/Enchanted Forest	Terrestrial
Black swan/ Kakīānau	*Cygnus atratus*	Not Threatened	Regionally Not Threatened	eBird	Likely to forage with potential to breed in wetlands/wetland margins	Yes	Waitemata Harbour, plus ponds like Western Springs Lakeside Reserve	Marsh
White-faced heron/ Matuku	*Egretta novaehollandiae Novaehollandiae*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage with potential to breed near estuaries or creeks	Yes	Roadsides and grassland areas	Marsh
Grey Warbler/ Riroriro*	*Gerygone igata*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and nest within scrub or forested areas	Yes	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial

Common name/ Māori	Scientific name	Conservation status (Robertson et al., 2021)	Regional Threat Status	Source	Likelihood of presence within the proposed designation	Observed on site?	Comments – suitable habitats	Habitat
New Zealand wood pigeon/ Kereru*	*Hemiphaga novaeseelandiae*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and breed in native woodland/forest	Yes	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial
Pied stilt	*Himantopus himantopus*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage at all estuary locations	Yes	Waitemata Harbour	Coastal
Welcome swallow/ Warou	*Hirundo neoxena neoxena*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage at all waterbodies and grassy areas; likely to breed utilisiing man-made structures	Yes	Over waterbodies like Waitemata Harbour, plus other open areas like grassland	Terrestrial
Southern black-backed gull	*Larus dominicanus*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage at all estuary locations and open grassy areas	Yes	Waitemata Harbour, Henderson Creek, Huruhuru Creek, plus open grassland	Coastal
Australasian gannet/ Tākapu	*Morus serrator*	Not Threatened	Regionally Not Threatened	eBird	Potential to forage at all estuary locations	No	Waitemata Harbour	Coastal
Morepork/ Ruru	*Ninox novaeseelandiae novaeseelandiae*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and breed within scrub or forested areas	Yes	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial
Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and breed in grassy areas near water	Yes	Roadsides and grassland areas	Marsh
Tui	*Prosthemadera novaeseelandiae*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial
North Island fantail	*Rhipidura fuliginosa placabilis*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial
Paradise shelduck/Pūtangitangi	*Tadorna variegata*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and breed in wet areas generally near a permanent waterbody	Yes	Open grassland	Marsh
New Zealand kingfisher/ Kōtare*	*Todiramphus sanctus vagans*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and breed near all water locations	Yes	Near any waterbodies	Marsh
Spur-winged plover	*Vanellus miles novaehollandiae*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and breed in grassy areas	Yes	Open grassland	Terrestrial

Common name/ Māori	Scientific name	Conservation status (Robertson et al., 2021)	Regional Threat Status	Source	Likelihood of presence within the proposed designation	Observed on site?	Comments – suitable habitats	Habitat
Silvereye/ Tauhou	*Zosterops lateralis lateralis*	Not Threatened	Regionally Not Threatened	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial
Common myna	*Acridotheres tristis*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Widespread, especially around urban development	Terrestrial
Mallard	*Anas platyrhynchos*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in wetland/wetland margins	Yes	Waitemata Harbour and other ponds/wetlands	Marsh
European goldfinch	*Carduelis carduelis*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial
European greenfinch	*Chloris chloris*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Newer regrowth areas, grassland and scrub; Suffolk Reserve, Arch Hill	Terrestrial
Rock pigeon/ Kererū aropari	*Columba livia*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Widespread, especially around urban development	Terrestrial
Yellowhammer/ Hurukōwhai	*Emberiza citrinella*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Scrub and or open grassland	Terrestrial
Chaffinch/ Pahirini	*Fringilla coelebs*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or open grassland areas	Yes	Open grassland	Terrestrial
House sparrow/ Tiu	*Passer domesticus*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Widespread, especially around urban development	Terrestrial
Common pheasant	*Phasianus colchicus*	Introduced and Naturalised	Regionally Introduced and Naturalised	eBird	Likely to forage and breed in dense grassy areas	No	Forested areas with open understorey, plus grassland	Terrestrial
Eastern rosella	*Platycercus eximius*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Forested and/or newer regrowth areas and scrub; Suffolk Reserve, Arch Hill	Terrestrial

Common name/ Māori	Scientific name	Conservation status (Robertson et al., 2021)	Regional Threat Status	Source	Likelihood of presence within the proposed designation	Observed on site?	Comments – suitable habitats	Habitat
Dunnock	*Prunella modularis*	Introduced and Naturalised	Regionally Introduced and Naturalised	eBird	Likely to forage and breed in scrub or forested areas	No	Forested areas, scrub and grassland	Terrestrial
Spotted dove	*Streptopelia chinensis*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Widespread, especially around urban development	Terrestrial
European starling	*Sturnus vulgaris*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Widespread, especially around urban development	Terrestrial
Eurasian blackbird	*Turdus merola*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Widespread, especially around urban development	Terrestrial
Song thrush	*Turdus philomelos*	Introduced and Naturalised	Regionally Introduced and Naturalised	5MBC	Likely to forage and breed in scrub or forested areas	Yes	Widespread, especially around urban development	Terrestrial
Pied shag	*Phalacrocorax varius*	At risk - recovering	Regionally Recovering	5MBC	Likely to forage with potential to breed at all estuary and/or large creek locations	Yes	Waitemata Harbour, Henderson Creek, Huruhuru Creek, plus other pond or stream locations	Coastal
Graylag Goose	*Anser anser*	Introduced and Naturalised	Regionally Introduced and Naturalised	eBird	Likely to forage and potentially breed near ponds	No	Open grassland and/or pastureland	Marsh
Pacific Black Duck (Grey Duck)	*Anas superciliosa*	Threatened - Naturally Vulnerable	Regionally Critical	eBird	Not likely to be found on site. See comment.	No	Records in/near cities in NZ are inaccurately recorded as being the native Grey Duck, known in Australia as the Pacific Black Duck, but these birds will be hybridised with Mallards and not hold the Threatened - Naturally Vulnerable status.	Marsh
New Zealand Scaup	*Aythya novaeseelandiae*	Not threatened	Regionally Not Threatened	eBird	Likely to forage and breed on ponds	No	Waitemata Harbour and other ponds/wetlands	Marsh
California Quail	*Callipepla californica*	Introduced and Naturalised	Regionally Introduced and Naturalised	eBird	Likely to forage and breed in grassland, scrub or well-managed areas	No	Urban development with manicured gardens, plus light scrub	Terrestrial

Common name/ Māori	Scientific name	Conservation status (Robertson et al., 2021)	Regional Threat Status	Source	Likelihood of presence within the proposed designation	Observed on site?	Comments – suitable habitats	Habitat
Indian Peafowl	*Pavo cristatus*	Introduced and Naturalised	Regionally Introduced and Naturalised	eBird	Likely to forage and breed in scrub or forested areas	No	Forested areas with open understorey, plus grassland	Terrestrial
African Collared Dove	*Streptopelia roseogrisea*	Introduced and Naturalised	Regionally Introduced and Naturalised	eBird	Likely to forage and breed in scrub or forested areas	No	Widespread, especially around urban development	Terrestrial
Australian Coot	*Fulica atra australis*	At Risk - Naturally Uncommon	Regionally Naturally Uncommon	eBird	Likely to forage and breed on ponds	No	Waitemata Harbour and other ponds/wetlands	Marsh
South Island Pied Oystercatcher	*Haematopus finschi*	At Risk - Declining	Regionally Declining	eBird	Likely to forage on mudflats and open grassland	No	Waitemata Harbour, Henderson Creek, Huruhuru Creek, plus open grassland particularly in saturated conditions	Coastal
New Zealand Dotterel	*Anarhynchus obscurus*	At Risk - Recovering	Regionally Increasing	eBird	Potential to forage at all estuary locations	No	Waitemata Harbour	Coastal
Red knot	*Calidris canutus*	At Risk - Declining	Regionally Declining	eBird	Potential to forage at all estuary locations	No	Waitemata Harbour	Coastal
Parasitic Jaeger (Arctic Skua)	*Stercorarius parasiticus*	Migrant	Regional Migrant	eBird	Potential to forage in estuary locations	No	Waitemata Harbour	Coastal
New Zealand Grebe (Dabchick)	*Poliocephalus rufopectus*	Threatened - Naturally Increasing	Regionally Critical	eBird	Likely to forage and breed on ponds	No	Waitemata Harbour and other ponds/wetlands	Coastal
Laughing Kookaburra	*Dacelo novaeguineae*	Introduced and Naturalised	Regionally Introduced and Naturalised	eBird	Likely to forage and breed in scrub or forested areas	No	Forested areas and edge habitats, sometimes near ponds and other waterbodies	Terrestrial
Eurasian Skylark	*Alauda arvensis*	Introduced and Naturalised	Regionally Introduced and Naturalised	eBird	Likely to forage and breed in grassland or scrub areas	No	Open grassland	Terrestrial
Banded rail	*Hypotaenidia philippensis*	At Risk–Declining	Regionally Vulnerable	Records from adjacent reserve	Potential to forage and/or breed within dense vegetation at estuary locations	No	Waitemata Harbour, Henderson Creek, Huruhuru Creek	Coastal

Common name/ Māori	Scientific name	Conservation status (Robertson et al., 2021)	Regional Threat Status	Source	Likelihood of presence within the proposed designation	Observed on site?	Comments – suitable habitats	Habitat
North Island fernbird	*Poodytes punctatus vealeae*	At Risk–Declining	Regionally Vulnerable	Records from adjacent reserve	Not likely to be found on site. See comment.	No	Recorded at the Orangihina Park wetland. Suitable habitat absent from the Project Area	Marsh

Appendix D. Avifauna survey locations

Appendix E. SEV coordinates, scores, and conditions

Impact Sites

Stream	Stream name	Coordinates		SEV Score (current)	Ecological Condition	SEV-i (SEV impact score)	SEV-p (SEV potential score)	ECR	Infrastructure impacting stream
1	Tōtara Creek	36.802994	174.603166	0.478	Moderate	0.449	0.535	2.263	Bridge
2	Tōtara Creek	36.806704	174.605924	0.485	Moderate	n/a	n/a	n/a	Not currently impacted
3	Tōtara Creek	36.812757	174.611138	0.553	Moderate	0.538	0.600	1.979	Bridge
4	Mānutewhau Stream	36.822056	174.615279	0.46	Moderate	0.420	0.485	3.9	Culvert extension
5	Tihema Stream	36.825883	174.616851	0.645	Good	0.581	0.652	n/a	Not currently impacted.
6	Unnamed	36.831795	174.621304	0.457	Moderate	0.432	0.480	1.241	New pipe / pipe extension, and outfall
7	Rarawaru Stream	36.839864	174.620838	0.562	Moderate	0.521	0.606	2.898	Bridge
8	Meola Creek – immediately upstream of the existing site	36.869335	174.717265	0.559	Moderate	0.541	0.583	2.625	Bridge
9	Tributary of Tōtara Creek	36.807640	174.607601	0.48	Moderate	0.423	0.550	3.663	Culvert extension
10	Unnamed	36.829058	174.618077	0.518	Moderate	0.429	0.544	n/a	Not currently impacted.

Offset/restoration site

Stream no.	Offset/restoration site	SEVm-C	SEVm-P
1	Tōtara Creek- immediately upstream of existing impact site	0.478	0.535
3	Tōtara Creek – immediately downstream of existing impact site	0.553	0.600
4	Mānutewhau Stream – immediately upstream of existing impact site	0.460	0.485
6	Tōtara Creek as offset site (between Stream site 1 and 3)	0.504	0.562
7	Rarawaru Stream – immediately upstream of existing impact site	0.562	0.606
8	Meola Creek – immediately downstream of impact site	0.559	0.583
9	Tōtara Creek – immediately downstream of impact site	0.483	0.535

Appendix F. Sensitivity Map

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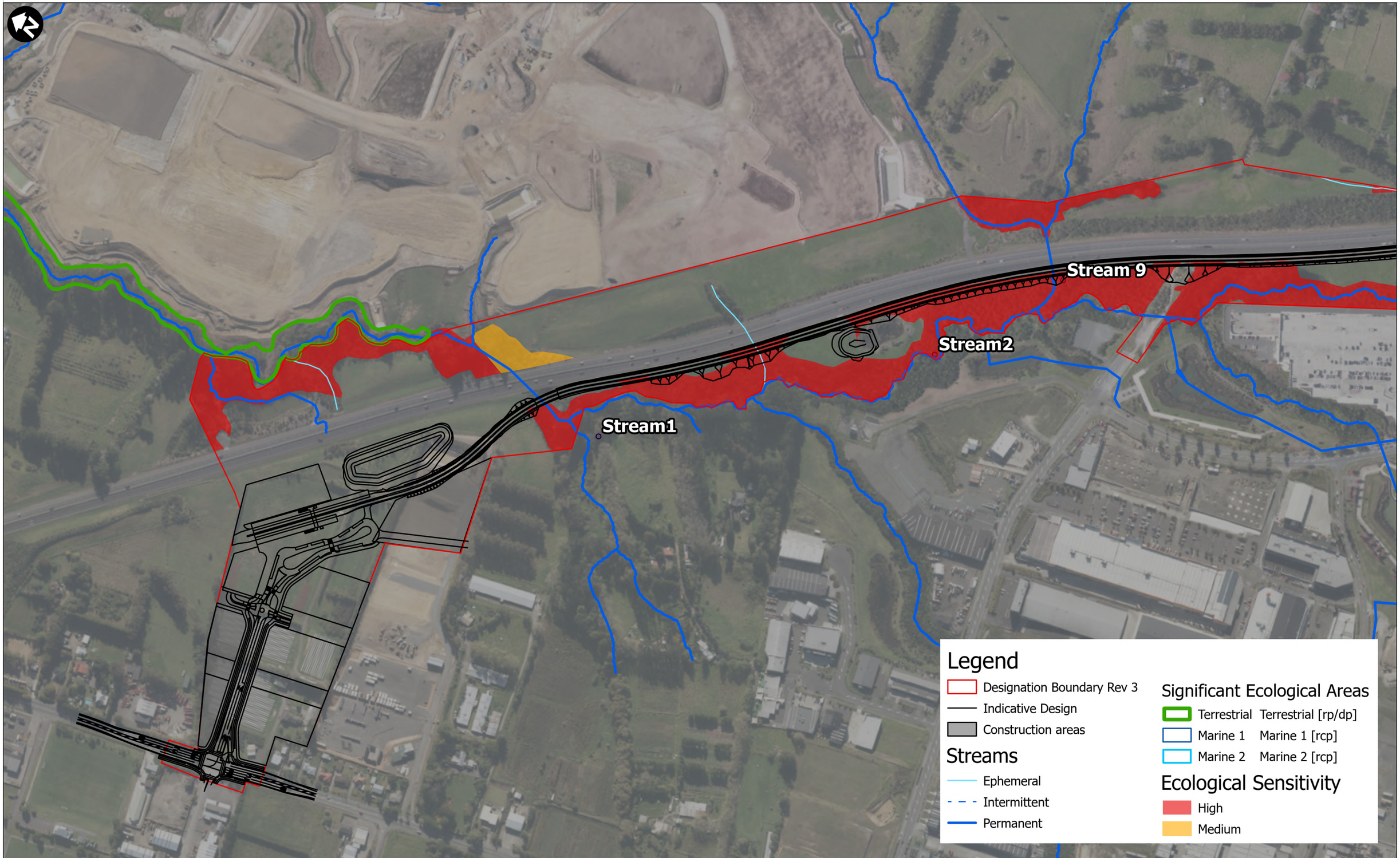

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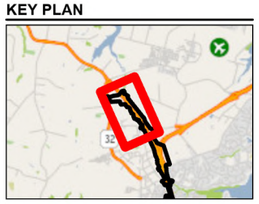

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PROJECT MANAGEMENT

Approved	IB	Date	10.12.25
Checked	IB	Date	10.12.25
Drawn	LY	Date	10.12.25

ISSUE/REVISION

Rev	Date	Description
C	10.12.25	Final with Designation Revision 3
B	25.09.25	Draft with Designation Revision 2
A	29.08.25	Draft with Designation Revision 2

PROJECT NUMBER
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SHEET TITLE
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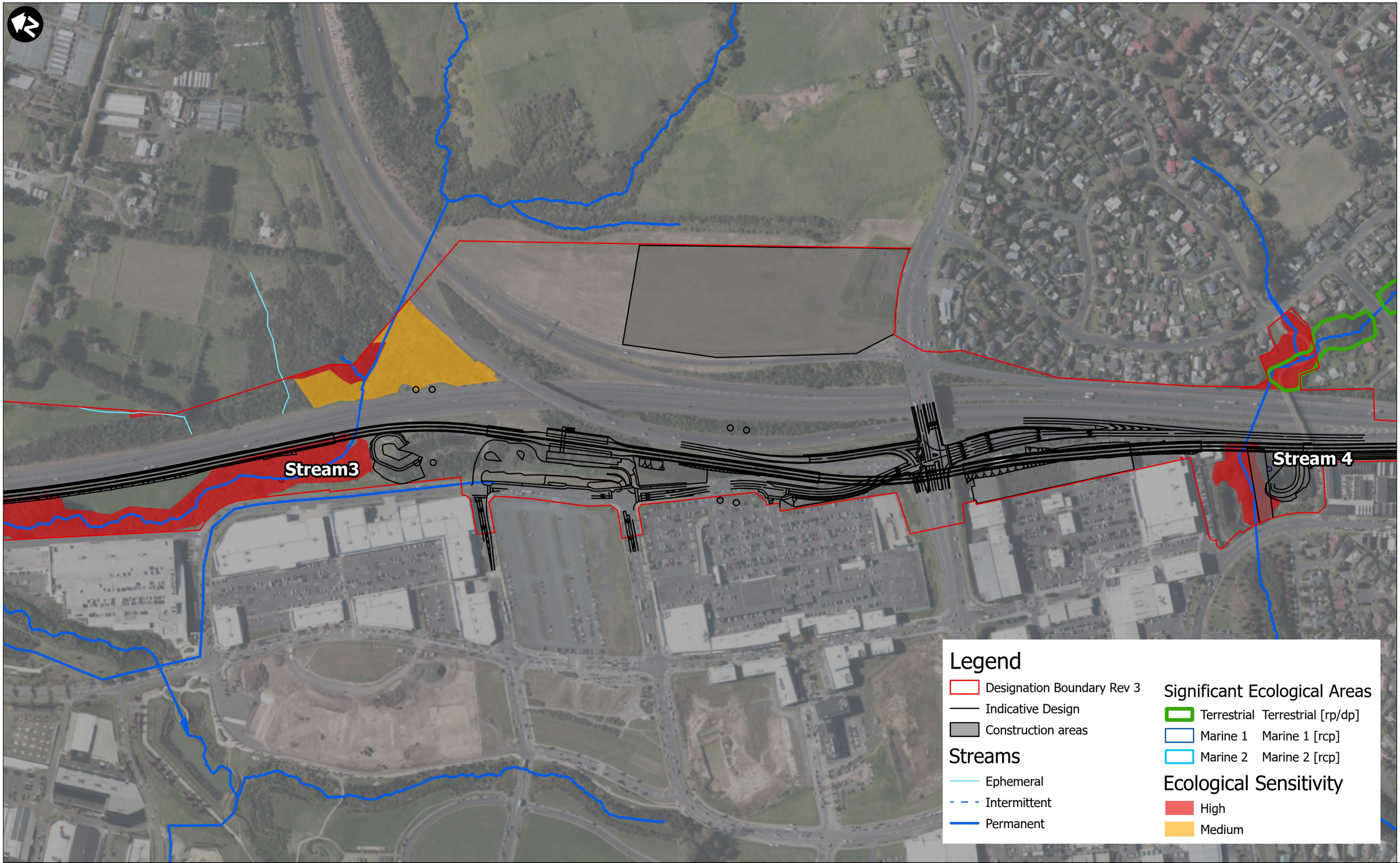

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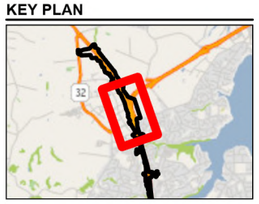

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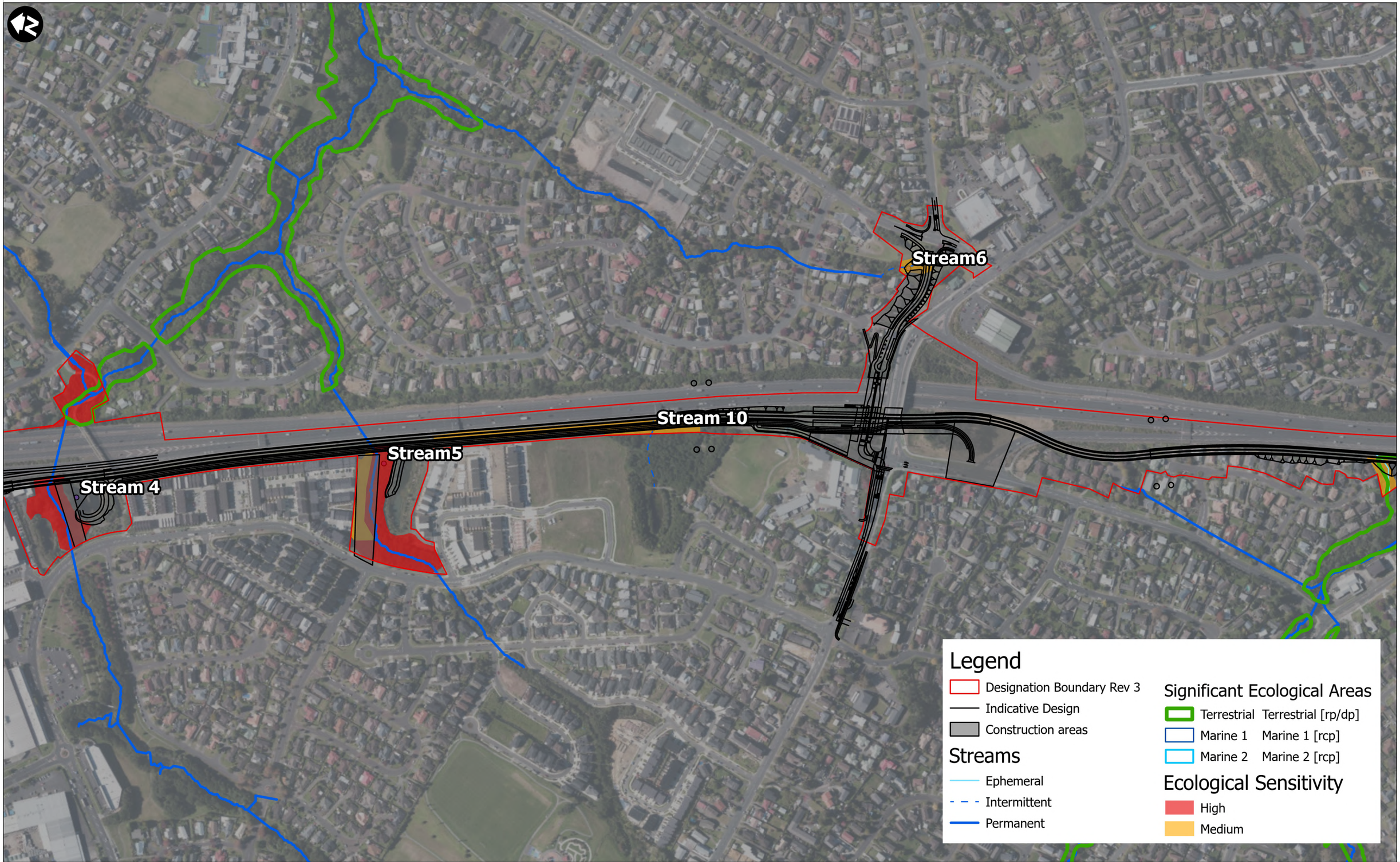

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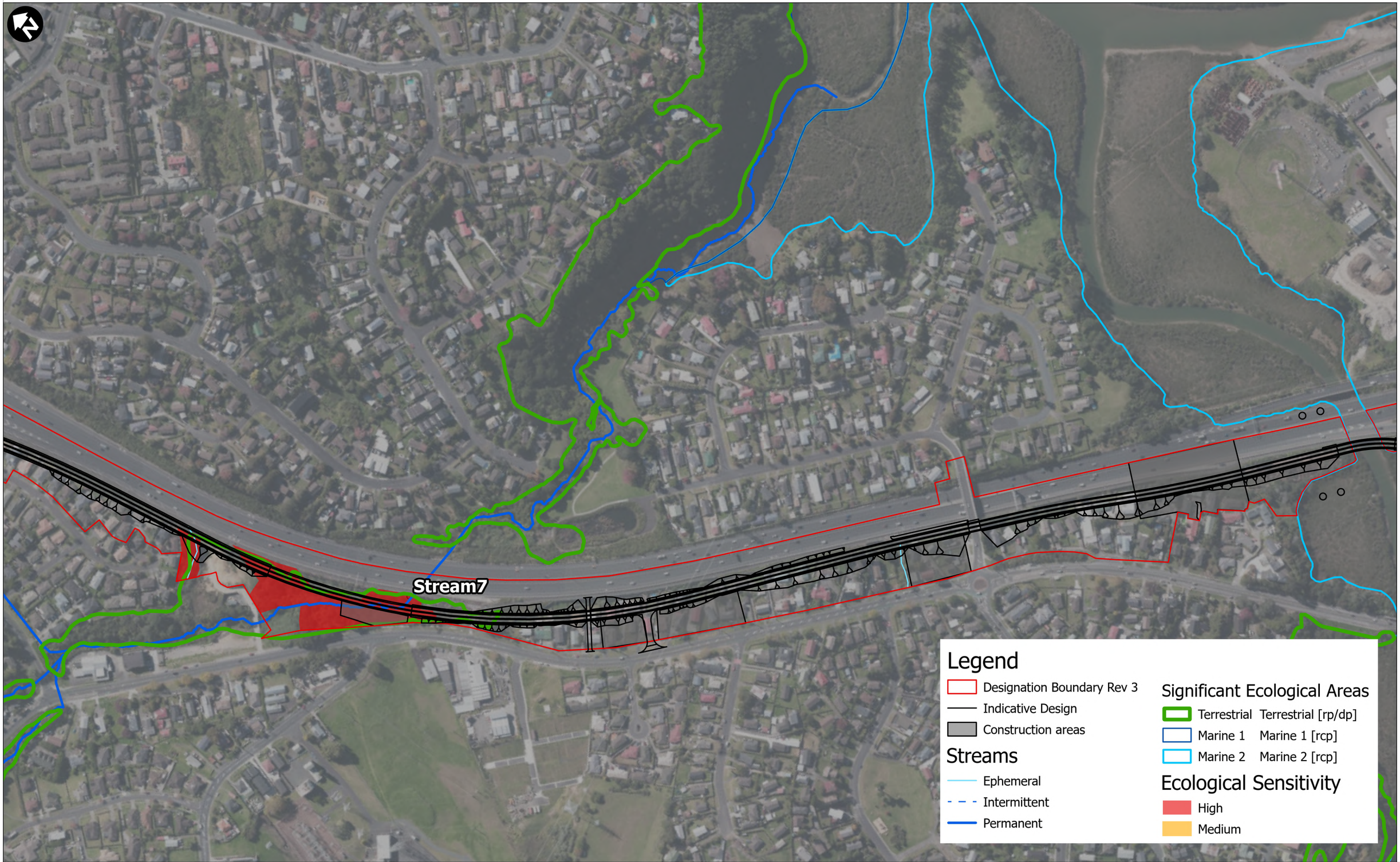

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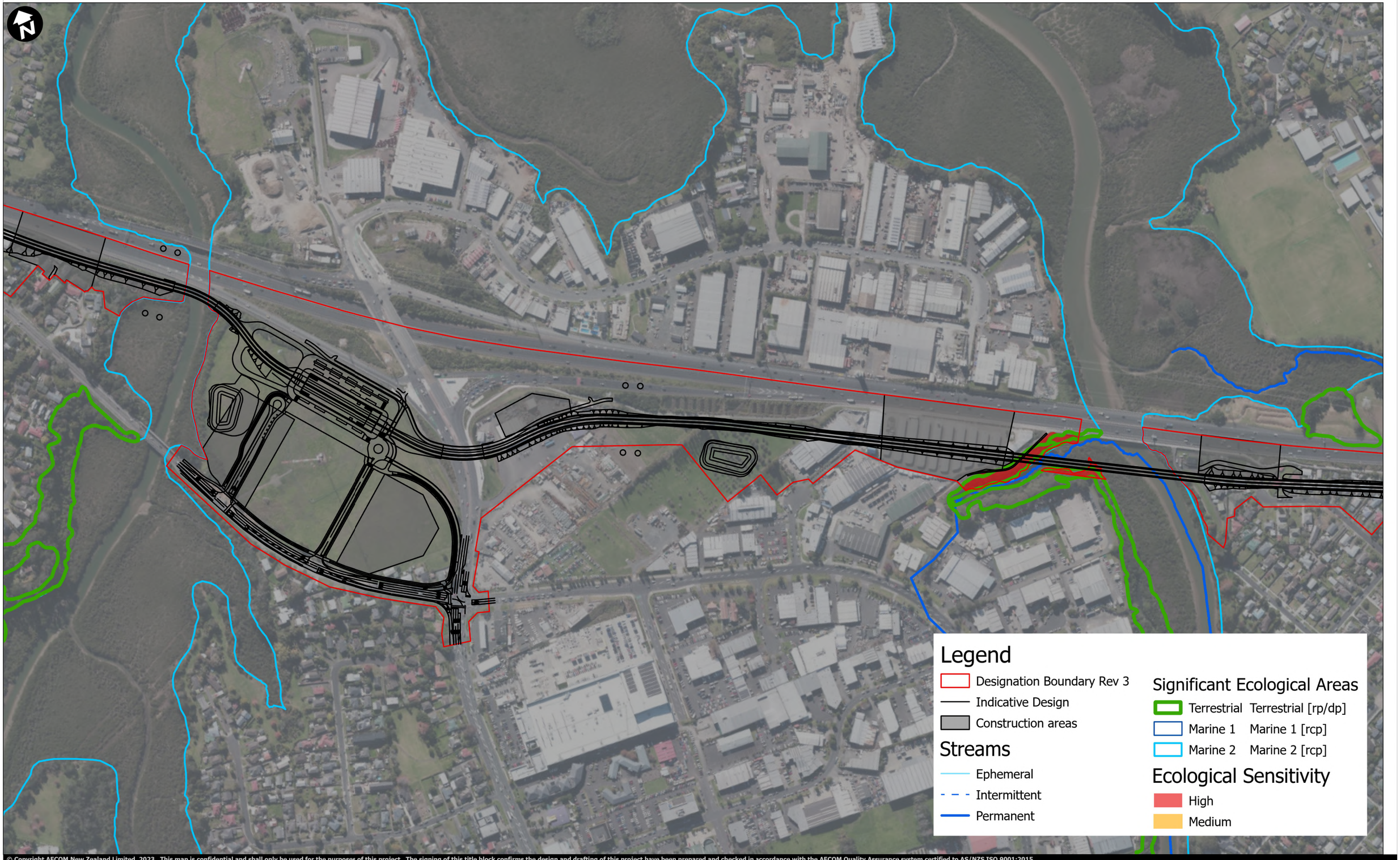

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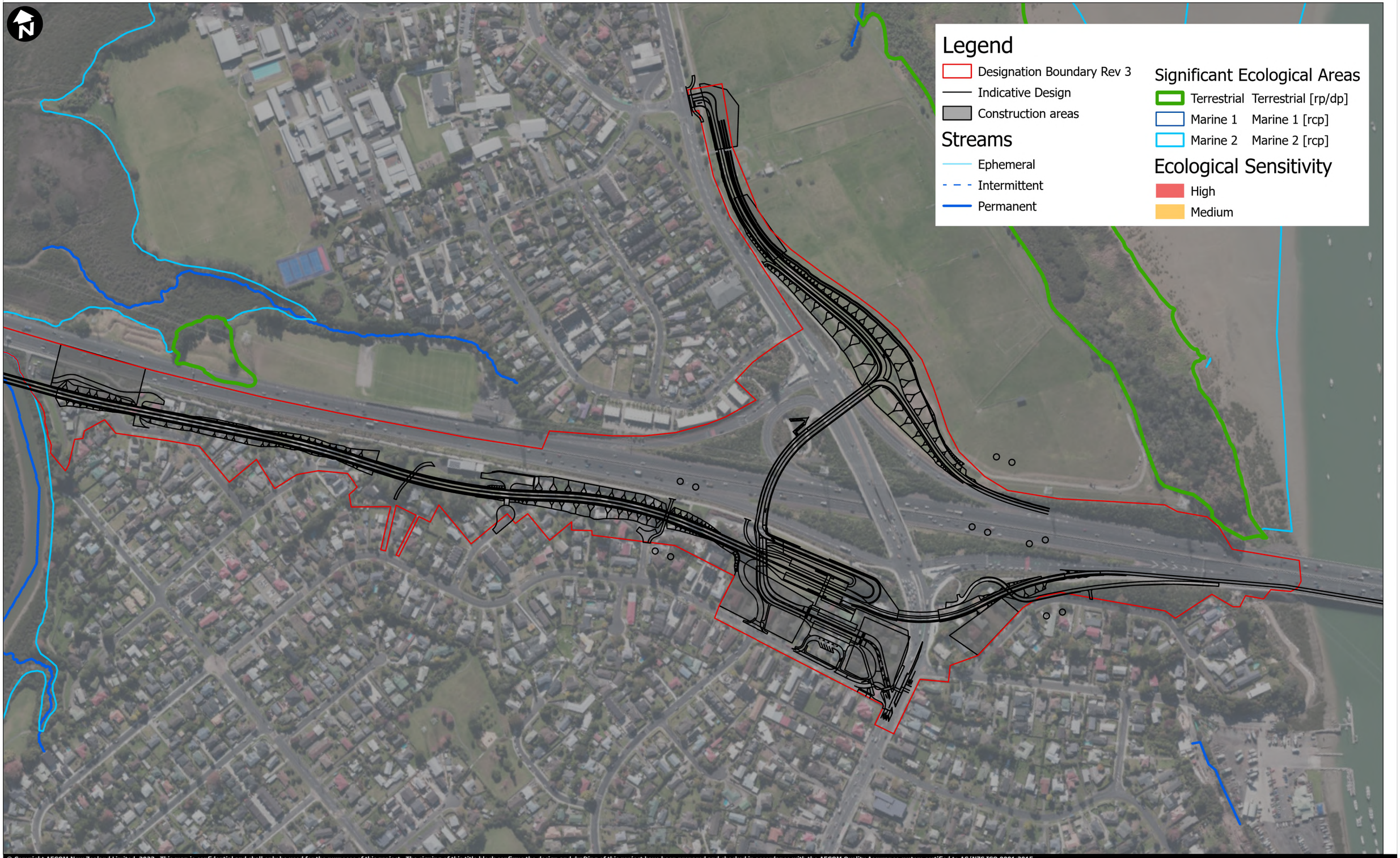

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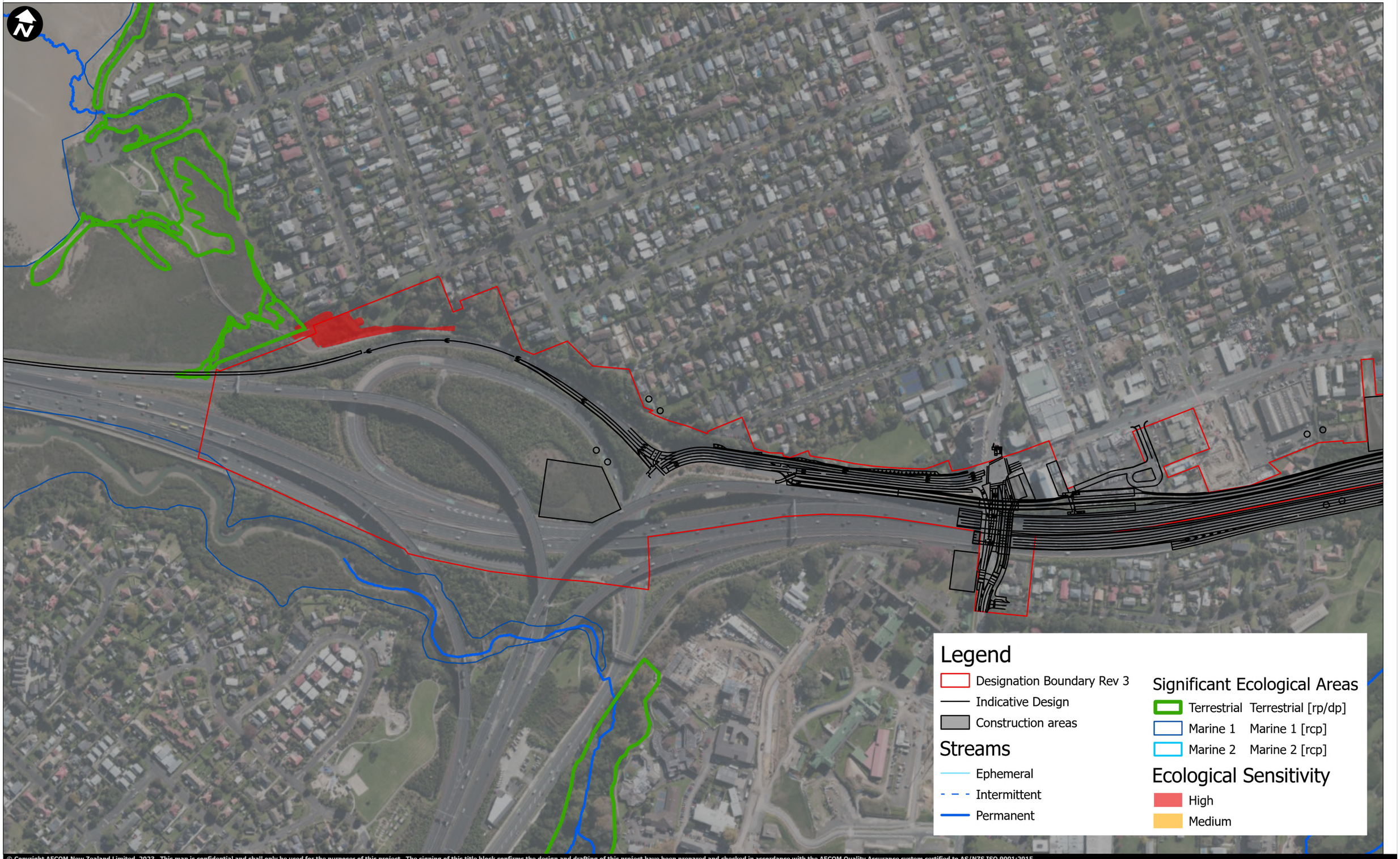

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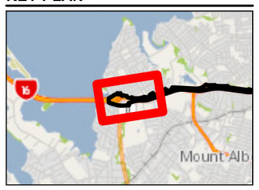

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PROJECT MANAGEMENT

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EAST NOR
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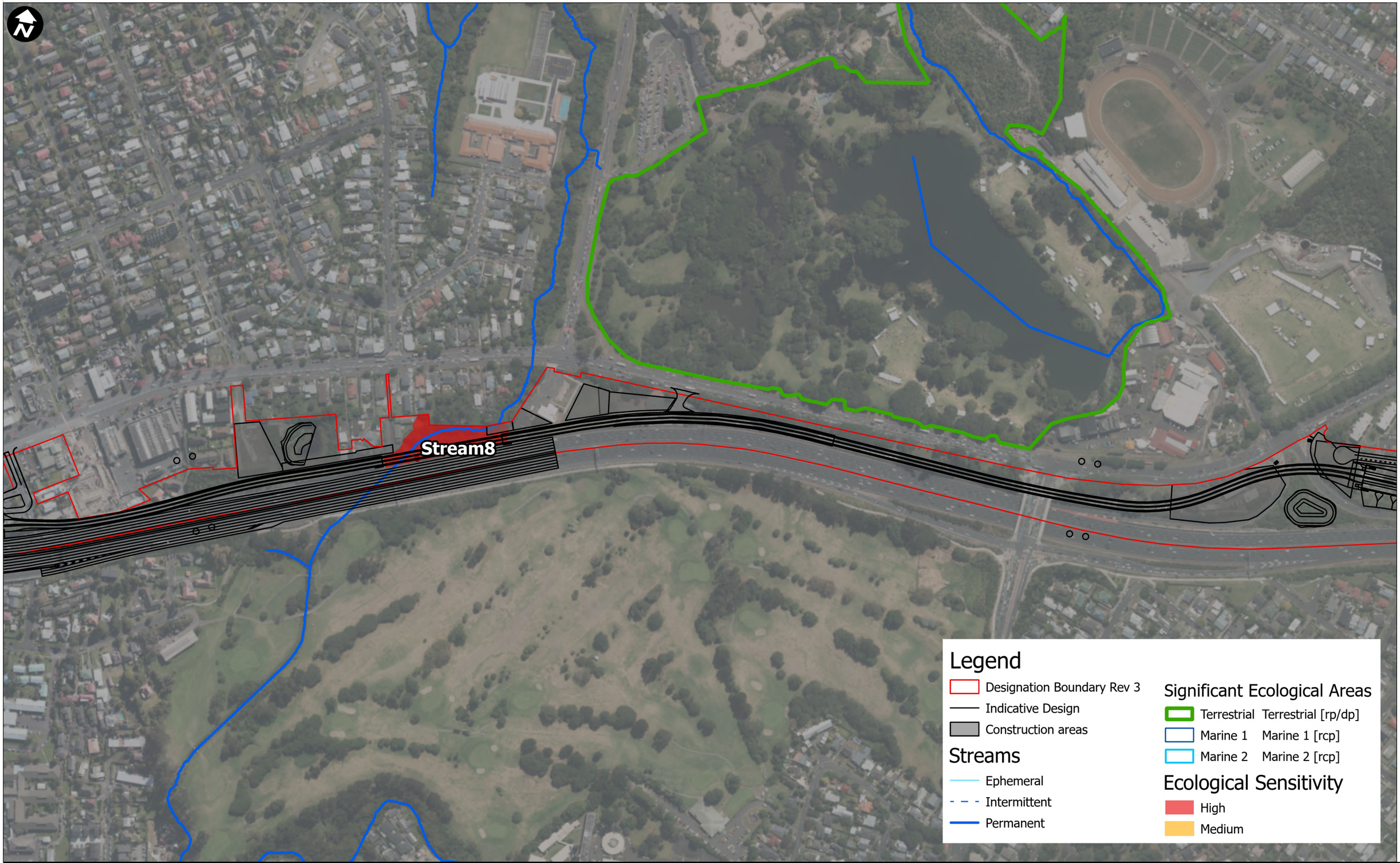

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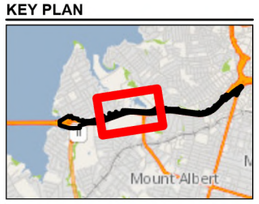
NORTHWEST BUSWAY

CLIENT
NZ TRANSPORT AGENCY WAKA KOTAHI

KEY PLAN



SPATIAL REFERENCE

Scale: 1:5,400 (A3 size)

40 20 0 40 80 120 Meters

Map features depicted in terms of NZTM 2000 projection.

Data Sources:
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2016

PROJECT MANAGEMENT

Approved	IB	Date	10.12.25
Checked	IB	Date	10.12.25
Drawn	LY	Date	10.12.25

ISSUE/REVISION

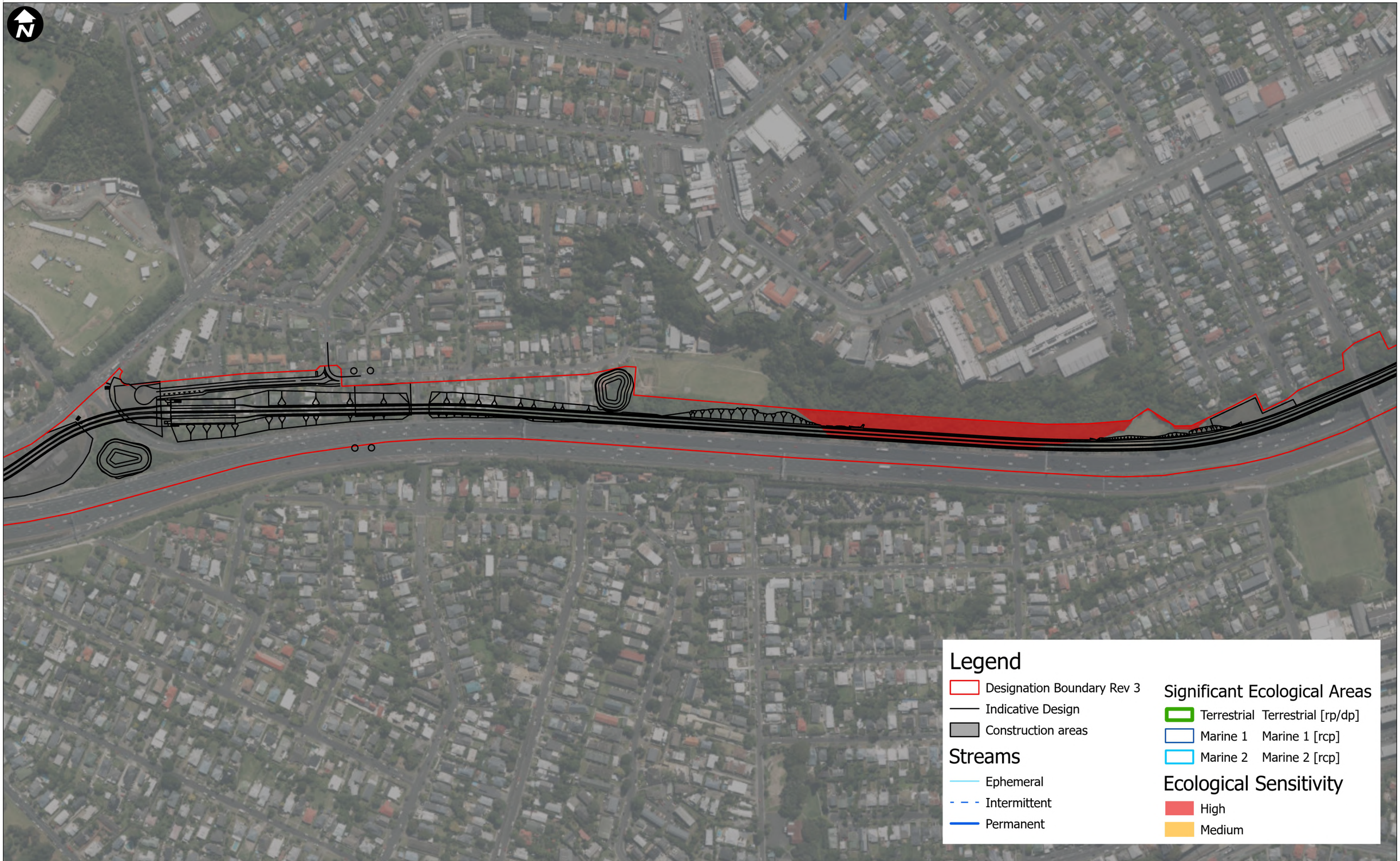
Rev	Date	Description
C	10.12.25	Final with Designation Revision 3
B	25.09.25	Draft with Designation Revision 2
A	29.08.25	Draft with Designation Revision 2

PROJECT NUMBER
60721855

SHEET TITLE
NORTHWEST BUSWAY
EAST NOR
ECOLOGICAL SENSITIVITY

MAP NUMBER
Page 8

ISO A3 297mm x 420mm



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PROJECT

NORTHWEST BUSWAY

CLIENT

NZ TRANSPORT AGENCY WAKA KOTAHI

KEY PLAN

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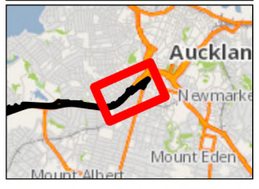

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Page 10

Appendix G. Biodiversity Compensation Models

SEA_T_5124

Model Inputs		
Input descriptors	**Input data**	**Comments**
Project/reference name	NWRT	
Biodiversity type	TL2 in SEA_T_5124	
Technical expert(s) input	Ian Bredin	
Benchmark	5	
How many habitat types OR sites are impacted	1	While the Indicative Design will result in a loss of current bare ground (weed dominated) and ES, only the TL.2 (the loss of which was determined to have a Moderate effect) was taken into consideration.
Number of proposed compensation actions	1	Restoration planting and pest plant management within the SEA.
Net gain target	5%	Generally, a Net Gain of 10% is considered appropriate. However, a 5% target was deemed appropriate for this project (the focus was on no net loss).
Habitat/Site Impact(s)	**TL2**	
Impact risk contingency:	1	Low risk contingency - as it was considered unlikely that the adverse effects will result in the permanent and irreplaceable loss of significant biodiversity value.
Impact uncertainty contingency:	1	Low uncertainty – not a complex habitat and the primary focus of the SEA is to maintain a migration pathway.
Areal extent of impact (ha):	0.235	Approximate area of TL.2 that is likely to be removed. This can be adjusted at detailed design, if applicable.
Value score prior to impact:	2	While the TL.2 includes a range of exotics, the understorey includes karamu, tree ferns, kanuka, and harakeke. This habitat was assessed to have a Moderate value.
Value score after impact:	0.1	Most of the footprint within the Indicative Design was anticipated to be cleared. However, some portions of vegetation could possibly remain under the bridge crossing (thus still having value, albeit marginal).
Compensation Action(s)	**Restoration to VS5 and pest plant control**	
Discount rate:	3.0%	Recommended rate retained.
Finite end point (years):	20	Restoration planting to native dominated vegetation (VS5) guided the selection of a 20-year timeframe.
Compensation confidence contingency:	3	Moderate level of confidence.
Areal extent (ha) of compensation type:	0.792	Extent of offset restoration planting within the remaining portion of the SEA and directly adjacent to the SEA within the Project Area. This can be adjusted at detailed design (if applicable). This extent aims to achieve a no net loss.
Value score prior to compensation:	0.8	The broader extent of the SEA was taken into consideration. An average of the different

		vegetation types was used to determine this value (average of BG, ES, PL.3, and TL.2).
Value score after compensation:	2.6	Successful restoration of regenerative native broadleaved forest/scrub (VS5) was considered to increase the value of the restoration site(s) to Moderate (higher than the initial value).

Model outputs		
	Total impact score	TL2
Impact score	-0.09377	-0.09377
	Total compensation score	Restoration to VS5 and pest plant control
Compensation score	0.09867	0.09867
Net gain outcome	5.2%	

SEA_T_4938

Model Inputs		
Input descriptors	Input data	Comments
Project/reference name	NWRT	
Biodiversity type	VS5 in SEA_T_4938	
Technical expert(s) input	Ian Bredin	
Benchmark	5	
How many habitat types OR sites are impacted	1	Loss of VS5 within the SEA, within the Indicative Design.
Number of proposed compensation actions	1	Restoration planting and pest plant management within the SEA.
Net gain target	5%	Generally, a Net Gain of 10% is considered appropriate. However, a 5% target was deemed appropriate for this project (the focus was on no net loss).
Habitat/Site Impact(s)	VS5	
Impact risk contingency:	2	Moderate risk contingency – Taking into consideration the existing value of the habitat, it was considered plausible that the project could result in a reduced biodiversity value. Marginal but still plausible.
Impact uncertainty contingency:	1	A contingency for impact uncertainty was low. Not a complex habitat (regenerating vegetation type - habitat type supports typical species richness).
Areal extent of impact (ha):	0.033	Approximate area of VS5 that is likely to be removed. This can be adjusted at detailed design, if applicable.
Value score prior to impact:	2.2	VS5 - this habitat was assessed to have a Moderate value.
Value score after impact:	0.1	Most of the footprint within the Indicative Design was anticipated to be cleared. However, some portions of vegetation could possibly remain under the bridge crossing (thus still having value, albeit marginal).
Compensation Action(s)	Restoration to VS5 and pest plant control	

Discount rate:	3.0%	Recommended rate retained.
Finite end point (years):	20	Restoration planting to native dominated vegetation (VS5) guided the selection of a 20-year timeframe.
Compensation confidence contingency:	3	Moderate level of confidence.
Areal extent (ha) of compensation type:	0.212	Extent of offset restoration planting within the remaining portion of the SEA. This can be adjusted at detailed design (if applicable). This extent aims to achieve a no net loss.
Value score prior to compensation:	1.5	The broader extent of the SEA was taken into consideration, particularly the edge habitat where there is opportunity for enhancing value
Value score after compensation:	2.6	Successful restoration of regenerative native broadleaved forest/scrub (VS5) was considered to increase the value of the restoration site(s) to Moderate (higher than the initial value).

Model outputs		
	Total impact score	**VS5**
Impact score	**-0.01528**	-0.01528
	Total compensation score	**Restoration to VS5 and pest control**
Compensation score	**0.01614**	0.01614
Net gain outcome	**5.6%**	

Appendix H. Fish Salvage and Relocation Protocols

Fish Salvage and Relocation Protocols

Permitting requirements

Permitting requirements for fish relocation depend on the species and location of transfer. In order to capture and relocate native species, the following will be required:

- Fisheries New Zealand Special Permit pursuant to section 97(5) of the Fisheries Act 1996 for the following purposes:
  - investigative research (section 97 (1)(a)(ii)); and
  - to allow persons or agencies to take aquatic life and relocate it to a suitable habitat where this is necessary or required to mitigate adverse effects of habitat modification on the aquatic life (section 97(1)(c)).
- Fisheries New Zealand Authorisation pursuant to section 26ZM (2)(a) of the Conservation Act 1987 to:
  - Transfer from: Any freshwater waterbody (as defined in the Conservation Act 1987) in the North Island of New Zealand.
  - Release to: Appropriate freshwater waterbodies in the same catchment as the capture/transfer site.
  - The following: Any native freshwater aquatic life.
- Fish & Game New Zealand permit to take sports fish from the Auckland/Waikato Fish and Game Region pursuant to Regulation 4A.(1)(a) of the Freshwater Fisheries Regulations 1983 and Regulations 26ZR 2(b) and 26 ZI 2 of the Conservation Act 1987.

Additional authorisations from Department of Conservation (DOC)[25] and Fish and Game[26] are required for the transfer of fish to other catchments (if required).

The implementing Freshwater Ecologist(s) will undertake the fish capture and relocation and will be present on-site during dewatering to rescue and relocate any remaining fish present.

Experience

The implementing ecologist(s) will undertake the fish capture and relocation and will be present on-site during dewatering to salvage and relocate any remaining fish present. The implementing ecologist(s) will need to have completed several fish salvages across the country and have experience in the relocation of fish, including the supervision of the mucking out process. They will have experience in completing passive capture methods as outlined in the New Zealand Fish Sampling Protocols (Joy, et al, 2013) and EFM certified user(s) will need to be accredited by NIWA as being proficient in electrofishing.

Methods to capture and relocate aquatic fauna

Timing of works

If stream works are to be undertaken during March to June (peak inanga and spawning season), a suitably qualified and experienced freshwater ecologist must undertake a survey (prior to construction) to identify migratory inanga spawning within the area of stream works. If any areas of inanga spawning habitat is identified, instream works must not be undertaken within or downstream of any spawning habitat areas during the spawning season (March to June).

[25] Consultation with DOC to confirm whether a Freshwater Authorisation- Application for the Transfer/Release of Aquatic Life for the transfer of fish to other stream locations.

[26] Approval from/consultation with Fish and Game New Zealand for the movement of fish.

Fish capture and relocation

Native fish capture must be started at least three working days prior to any instream earthworks to allow a minimum of three nights of traps/nets. Fish capture should continue until the number of fish caught is reduced to an acceptable level (80% removal rate for common species and > 90% for At-Risk species as a target by using basic regression analysis).

Instream earthworks or de-watering should also take place during a period of low flow to minimise the amount of aquatic habitat available and thus the likelihood of native fish being present.

Ecology supervision during early works and site preparation

Ecology supervision during early works and site preparation may be required where construction activities are located adjacent to the affected streams. In these instances, consultation with the supervising ecologist will be required to determine the methods necessary to prevent effects on native freshwater fish.

Phase 1: Pre-dewatering

Site isolation

Fish barriers will be installed upstream and downstream of the impact reach immediately prior to commencement of construction to ensure fish cannot enter the works area. An example of fish barrier construction is included in Figure 1 below and further detailed in the bullet points below.

Figure 1: Example of fish barrier construction

Site isolation works will include the following:

- Fish barriers will include the erection of fish stop nets which span the width of the channel and extend well above the water surface by a minimum of 2 metres of the wetted edge (if possible) to prevent both migrating Anguilliformes traveling terrestrially, as well as flood migration in high flow events.

- The fish barriers will preferably be constructed using 4 mm mesh sheets (or two layers of shade cloth). The sheets will be installed across the stream and pinned to the stream bed using waratahs, and weighed down (e.g. bricks, sandbags etc) to prevent any in-stream migration from occurring. If possible, the mesh sheets will be extended across the stream bank (as described above).
- Fish barrier design may be modified by the implementing ecologist where opportunity exists to exploit instream structures such as culverts, stream pinch points or bankside-structures which may occur within the impact reach.
- Fish barriers will be inspected daily or after heavy rainfall (e.g. >25 mm in 24 hours) and maintained to ensure they do not become compromised, allowing fish migration into the impact reach.

Fish capture protocol

Prior to any instream earthworks/reclamation and dewatering, fish salvage methods using a combination of gee minnow traps (GMTs) (6.4 mm mesh), fyke nets, and electrofishing is recommended. Capture procedures for trapping and electrofishing will be in accordance with the New Zealand Freshwater Fish Sampling Protocols (Joy et al., 2013).

Fyke nets will be deployed in between the GMTs, only if sufficient water depth is available. The following methodology will be used:

- If the works area is suitable for electric fishing, then electric fishing (minimum of three passes) will be completed during the following periods:
- Initial pass of the stream works area (prior to deployment of traps);
- Following each fish trap check (fyke nets, GMTs);
- Following the last fish trap check (immediately prior to dewatering); and
- During dewatering, electric fishing of remnant pools.
- Where there is sufficient water, fyke nets will be placed at 4 m intervals along the entire reach to be dewatered. Two GMTs will be placed within 1 m of each fyke net.
- The opening of fyke nets will face downstream to prevent trapping debris. All nets/traps will be partially submerged so atmospheric air is accessible to fish captured.
- Where water is insufficient for fyke nets, GMTs will be placed with a maximum of 10 m intervals along the entire reach.
- Traps/nets will be baited to increase the possibility of capturing fish within the reach.
- Traps/nets will be deployed overnight and checked daily for a minimum of three nights prior to dewatering. Checks will be undertaken early in the morning to reduce mortality from increasing temperatures in exposed traps.
- Trapping should continue until the number of fish caught is reduced to an acceptable level (80% removal rate for common species and > 90% for At-Risk species as a target by using basic regression analysis).
- Traps/nets are to be counted prior to and post-salvage to ensure they have all been removed from the site at the end of the works.
- Where it is safe to do so and if deemed effective by the project ecologist, the fish salvage team may carry out multiple pass electric fishing along the reach to be dewatered. This shall occur prior to the deployment of traps and immediately prior to dewatering.
- All captured fish will be handled and transported following the Fish Relocation Protocols outlined in the section below.

Phase 2: Dewatering

Site isolation

The fish barriers will be maintained in place throughout the dewatering process. The fish barriers will be inspected daily to ensure they are functioning effectively. Prior to dewatering, the impact reach will be hydrologically isolated, to prevent water draining into the reach from upstream and/or downstream. These

fish barriers will be installed directly downstream of the upstream fish barrier and immediately upstream of the downstream fish barrier. Downstream flow will be maintained by over pumping.

Dewatering and Mucking out During Excavation:

- Dewatering of each reach is to be undertaken via a submerged portable pump. All pump intakes are to be screened with 3 mm mesh and be elevated to prevent fish from entering the pump;
- Downstream flow will be maintained by means of over pumping;
- During dewatering, the fish salvage team will actively search and capture any residual or emergent fish observed in the impact reach using handheld dip nets (aka 'mucking out');
- As water recedes any residual pools remaining after dewatering will be actively fished; and where necessary, small sumps may be excavated and allowed to fill with water to attract emergent fish. Sumps will be actively monitored and fished using handheld dip nets to ensure any fish residing are removed as quickly as possible;
- Following dewatering material will be removed using toothed excavator buckets and the fish salvage team will search each bucket load for fish as well as the stock pile of stream bed material for any fish; and
- All captured fish will be handled and transported following the Fish Relocation Protocols outlined in the section below.

Phase 3: Post Works

Fish barriers can be removed once works within the stream are complete (or stream successfully diverted) to prevent fish moving into the works area.

Fish Relocation Protocols

These fish relocation protocols detail the handling, holding and release of fish. All fish handling shall be in accordance with the fish welfare recommendations detailed in the New Zealand Fish Sampling Protocols (Joy et al., 2013). If fish are captured during salvage activities the following procedures will be followed:

- After capture, native fish shall be placed in a lidded container of appropriate volume for the number of fish and part-filled with clean stream water. Fish will be held in containers for as short a time as practicable;
- If release cannot occur immediately, the fish will be stored in the shade and water temperatures kept below 20°C. Fish density and behaviour shall be monitored regularly for any signs of distress (e.g., air gulping). Water shall be changed at least every hour and battery-operated aerators will be used to oxygenate the water. Fish will typically be relocated within an hour, and they shall not be kept in containers for more than 2 hours;
- Containers shall not be overstocked, and larger eels (>500 mm) shall be kept in separate containers to other captured fish to avoid injury or predation;
- Native fish will be relocated to suitable habitats within the same stream with similar hydrological conditions and similar or better habitat. To avoid further permitting requirements, fish must be able to move between sites on their own (i.e., sites must not be separated by any natural or man-made barriers);
- Fish will be gently transferred into low flowing areas (preferably pool habitat) downstream of works. Large numbers of fish shall not be released in the same location to minimise the risk of short-term overstocking or predation; and
- Any diseased or pest fish captured will be euthanised;
- All fish captured shall be handled with wet hands or gloves to reduce the risk of injury to fish.

Relocation site description

Fish can be relocated immediately downstream (within the same watercourses) of the salvage sites within appropriate habitat. However, if this is not suitable, fish should be relocated to suitable habitat within the same catchment of the salvage site. Exact locations for relocation will be determined when on site to ensure there is suitable habitat availability. Construction methodology should also be considered, for example, it is

not recommended that fish are relocated to watercourses where future instream works are planned to take place as part of the Project.

Diseased or pest fish

Diseased or pest fish may be captured during the fish salvage. If this occurs, they are to be humanely euthanised. The preferred methods include adding clove oil (50 ml per 10 L water) to a container holding the fish. Likely pest fish may include rudd (*Scardinius erythrophthalmus)*, koi carp (*Cyprinus carpio*), brown bullhead catfish (*Ameiurus nebulosus),* goldfish (*Carassius auratus*), and gambusia (*Gambusia affinis*).

Salvage Report

A Fish Salvage Report detailing the relocation site, the species, and number of freshwater fauna relocated prior to and during dewatering, will be submitted to Auckland Council. Timing of the reporting, post competition of construction, will need to be agreed with Auckland Council. Results will also be uploaded into the New Zealand Freshwater Fish Database (NZFFD).