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Rangitoopuni

Ecological Impact Assessment

for: Rangitoopuni Developments Limited Partnerships

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Cover Illustration: Riparian margins situated within exotic scrub and slash

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Code of Conduct

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I am a freshwater ecologist at Bioresearches (Babbage Consultants). I hold a Master of Science degree from the University of Auckland and have seven years' professional experience. I am a full member of the Environment Institute of Australia and New Zealand and Freshwater Sciences Society.

I specialise in freshwater ecology, including stream and wetland impact assessment and freshwater offset and compensation, and specialise in stream/river ecosystems and coastal ecosystems, including fish ecology and fish passage.

I confirm that, in my capacity as lead author of the EcIA, I have read and abide by the Environmental Court of New Zealand's Code of Conduct for Witnesses Practice Note 2023.

[redacted]

I am the Ecology Manager at Bioresearches (Babbage Consultants). I hold a Master of Science degree from Massey University and have 18 years' professional experience. I am a full member of the Environment Institute of Australia and New Zealand and am a current committee member and former President of the New Zealand Herpetological Society (2012-2015).

I specialise in terrestrial ecology, including biodiversity offset and compensation, and have particular expertise with native reptiles and amphibians. I hold multiple Wildlife Authorities to survey indigenous reptiles and amphibians throughout New Zealand, manage lizards within the Auckland Region as a mitigation tool, and hold indigenous lizards in captivity, including for "insurance" and "Breed for release" purposes. I have been an invited participant in Department of Conservation-led workshops for lizard mitigation research needs and co-authored Auckland Council's technical publications on the Conservation status of reptiles (Melzer et al. 2022a[1]) and amphibians (Melzer et al. 2022b[2]) in the Auckland Region. I have also co-authored a peer-reviewed paper on the application of a Biodiversity Compensation Model in New Zealand[3]

I confirm that, in my capacity as reviewer of the EcIA and EMP, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

[1] Melzer, S., R. Hitchmough, D. van Winkel, C. Wedding, S. Chapman, M. Rixon (2022a). Conservation status of reptile species in Tāmaki Makaurau / Auckland. Auckland Council technical report, TR2022/3

[2] Melzer, S., R. Hitchmough, D. van Winkel, C. Wedding, S. Chapman, M. Rixon, V. Moreno, J. Germano (2022b). Conservation status of amphibian species in Tāmaki Makaurau / Auckland. Auckland Council technical report, TR2022/4

[3] Baber, M.. Quinn, J., Craig, J., Bramley, G., Lowe, M., Webb, C., Ussher, G., Whiteley, C., Kessels, G., Davies, F., Markham, J., Miller, D., van Winkel, D., Wedding, C., Chapman, S. (2025). The Biodiversity Compensation Model: a framework to facilitate better ecological outcomes. New Zealand Journal of Ecology 49(1):3591

1 INTRODUCTION

1.1 Project Description

Ta Kawerau Iwi Settlement Trust (the Trust) owns 3,275 ha of Rangitoopuni-Riverhead Forest. The land is predominantly commercial pine plantation which is actively managed by Rayonier Matariki Forests. The site coverage is currently a mix of deforested, clear felled plantation, 6-year old rotation plantation and 26-year old rotation plantation, scheduled for harvest in October 2025. Following this felling, these portions of the site are proposed to be developed.

Rangitoopuni Developments Limited Partnership (the Applicant) proposes to develop approximately 395 ha of land owned by the Trust on the southern portion of Rangitoopuni-Riverhead Forest (the Project Area; Figure 1). The development proposes to create a 208, one-hectare average countryside living subdivision (CS-Lts) on 'Lot 1'; and a retirement village on Lot 2, providing 260 villas, 36 care units and associated amenities. Areas throughout these two lots will be ecologically restored, with extensive indigenous vegetation established throughout.

Figure 1. Map of the Project Area (yellow polygon) and the overland flow paths (blues lines) and scheduled Significant Ecological Areas (SEA) within and surrounding the site. Data sourced from Auckland Council Geomaps GIS viewer.

Roading networks will be established throughout the site, utilising existing forestry roads where possible. Water generated within the Project Area (wastewater and stormwater) will be managed on-site, utilising on-site wastewater disposal and rainwater collection for potable and non-potable water supply for the CS-Lts, with appropriate stormwater attenuation prior to discharge to existing water bodies. The retirement village proposed on Lot 2 will be supported by a communal wastewater treatment plant, and rainwater will be captured via roofing to provide a water supply and

supplemented as needed. Stormwater generated by Lot 2 will be discharged to a tributary of the Rangitoopuni River, east of the Project Area (Figure 2).

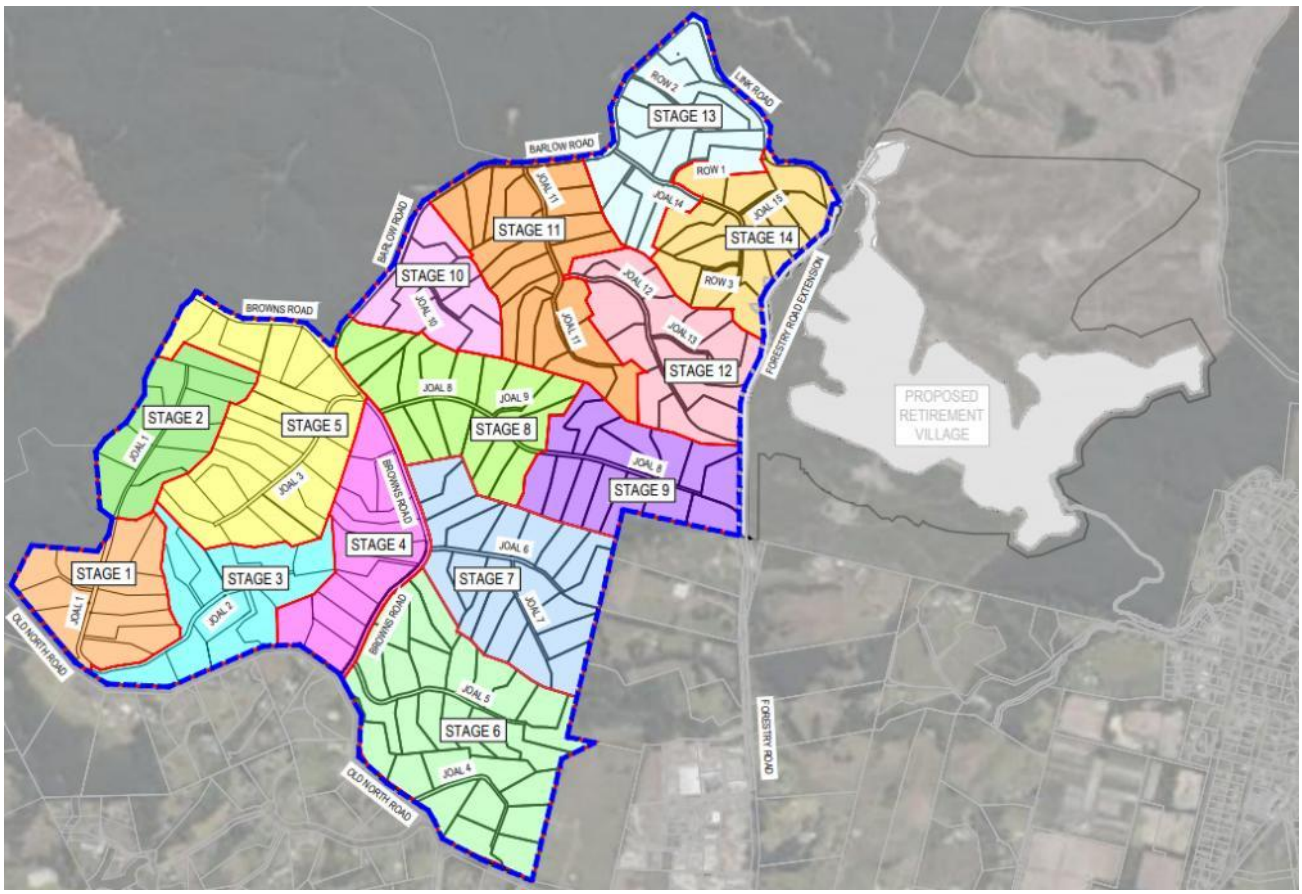


Figure 2. Overall scheme plan and associated staging.

1.2 Report Purpose

The Avant Group engaged Bioresearches, on behalf of the Trust, to undertake an Ecological Impact Assessment (EcIA), for a proposed development within the southern portion of Rangitoopuni-Riverhead Forest. The purpose of this report is to identify the actual and potential ecological values within the Project Area, and determine the potential adverse effects to those ecological values which may arise through the construction, and operation of the development.

Identification of terrestrial and freshwater ecological features was undertaken through the review of relevant databases to determine the likelihood of species of interest (i.e. indigenous flora and fauna, Threatened and At Risk (TAR) species) being present within the site, and the presence of streams and natural inland wetlands. This was followed by a site walkover to identify the potential habitats of those species, including streams and wetlands, opportunistic surveys of herpetofauna and avifauna, and a bat survey.

The assessment contained within this report considers relevant statutory context, with reference to the Auckland Unitary Plan – Operative in Part (AUP-OP), National Policy Statements for Freshwater Management (NPS-FM) and Indigenous Biodiversity (NPS-IB). This report describes the terrestrial and

freshwater ecological values of the Project area, provides a stepwise assessment of the actual and potential ecological effects that would be expected to result from the proposed development, and presents recommendations to avoid, remedy, minimise, offset or compensate those effects as appropriate.

Recommendations for specific management plans or actions to avoid, minimise, remedy, offset or compensate are identified, and these may include draft conditions for the application.

1.3 Commercial land use

The land area owned by the Trust is currently under a commercial forestry regime with a harvest cycle of approximately 26 years. Forest harvest is regulated by the provisions of the National Environment Standard – Production Forestry. The intended rotation cycle within the Forest is mapped in the attached harvest cycle plan shown in Appendix A.

The vegetation type discussed in Section 4.4.1.3 'Mature Exotic Forest' currently supports moderate to high ecological values. This area is scheduled to be felled over October 2025 – March 2026 as commercial forestry, prior to the implementation of the development. Whilst the vegetation type has been described as what is currently present, the actual baseline for the development will be harvested pines and deforested land. Subsequently, the ecological impact assessment for values associated with Mature -Exotic Forest has been undertaken with respect to baseline ecotype (deforested plantation) that will be present at the time of the implementation of the development. It is acknowledged that the proposed land use change would result in permanent removal of pine forest, rather than the temporary nature of rotation harvest.

2 STATUTORY CONTEXT

This section summarises the legislation, policy, plans, and strategies relevant to the protection, conservation, and enhancement of nature conservation interests associated with the Project area. The ecological values described in this report allow significant ecological issues and adverse impacts to be identified as they relate to the Resource Management Act 1991 (RMA). The identification of significant values and subsequent management recommendations to mitigate adverse effects are consistent with the standards and objectives of the following legislative, policy statement, and regional plan documents.

2.1 Legislation

2.2 Resource Management Act 1991 (RMA)

The purpose of the RMA is to achieve sustainable management. Important elements of this are the maintenance of indigenous biodiversity and the protection of significant indigenous vegetation and habitats. The RMA requires that any adverse impacts of the development be avoided in the first instance, and where avoidance is not reasonably practicable, impacts should be minimised, remedied, or mitigated. These elements are given effect in Sections 5, 6, and 7, and Schedule 4 sets out the requirements for effects assessments.

2.3 Wildlife Act 1953

The Wildlife Act (1953) provides statutory protection for native wildlife (e.g., lizard, frog, bat, bird, and some terrestrial invertebrate species), excluding those species listed in Schedules 1–5.

2.4 National Environmental Standards for Freshwater (NES-F, 2020)

The National Environmental Standards for Freshwater 2020 (NES-F) set requirements and regulations for carrying out certain activities that pose risks to freshwater and freshwater ecosystems.

Activities, such as earthworks and catchment alteration which impact natural inland wetlands is a Non-Complying Activity under Parts 52 and 54 of the NES-F ('Drainage of natural inland wetlands') if it were to result in the complete or partial drainage of a natural inland wetland. Any works proposed within, or within 100 m of, a natural inland wetland are required to be assessed as to whether they trigger the requirements to obtain resource consent to ensure that potential impacts to the wetlands are managed.

2.5 National Policy Statements

2.6 Indigenous Biodiversity

The National Policy Statement for Indigenous Biodiversity (NPS-IB) provides direction to councils to protect, maintain and restore indigenous biodiversity in the terrestrial environment, requiring at least no further reduction nationally. It is relevant to the proposal because the Project area is within the terrestrial environment, and it contains indigenous biodiversity as defined in Section 1.6 (Interpretation) of the NPS-IB.

The indigenous biodiversity within the project area includes indigenous biodiversity that does not meet the definition of an SEA and is not subject to a notified Significant Ecological Area (SEA) at the time of this report.

The NPS-IB requires that indigenous biodiversity that is not protected by an SEA:

a) is managed by applying the effects management hierarchy (avoid, minimise, remedy, offset, compensate), where those effects are significant;
b) is managed to give effect to its Objective and Policies, where those effects are not significant (Section 3.16 (2)).

The NPS-IB requires that adverse impacts on indigenous biodiversity within an SNA be avoided or adverse effects managed, with some limited exceptions, such as where provided for established activities.

2.7 Freshwater Management

The National Policy Statement for Freshwater Management 2020 (NPS-FM) provides direction under the RMA, to local authorities on managing activities that affect the health of freshwater, and provides protections to freshwater bodies, including natural inland wetlands, includes provisions for monitoring and reporting on freshwater quality and quantity, and for addressing the impacts of land use activities on freshwater resources.

2.8 Regional Plans and Policies

Auckland Council (AC) has multiple regional planning documents which have been prepared by AC to give effect to the RMA as a regional council. Regional planning documents relevant to this report include the Auckland Unitary Plan – Operation in Part and Regional Pest Management Plan.

3 METHODOLOGY

3.1 Assessment framework

This assessment generally follows the EcIA Guidelines for use in New Zealand published by the Environmental Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay et al., 2018). The EcIA Guidelines provide a standardised matrix framework that allows ecological effects assessments to be clear, transparent, and consistent. The EcIAG framework is generally used in Ecological Impact Assessments in New Zealand as good practice, and a detailed analysis of this methodology is presented in Appendix A.

3.2 Desktop review

A desktop review of various online GIS databases was undertaken to determine the extent of ecological protection overlays (e.g., covenants, conservation land, Significant Ecological Area's (SEA)), 'ecosystem type' classifications, and visualise historical land-use using historical aerial images. The scheduling of SEAs and classification of ecosystems provides a means for Councils to protect and maintain indigenous biodiversity within Districts and Regions. The desktop review also included a search for fauna records from various information sources.

Specifically, the following databases were reviewed:

- Department of Conservation Bioweb records for herpetofauna and bats[4];
- iNaturalist records for herpetofauna and birds within approximately a 5 km radius from the Project area[5];
- New Zealand Bird Atlas eBird database[6]. Bird data is recorded in 10 x 10 km grid squares. AA66 grid square was accessed as this is positioned over the Project area;
- NIWA's New Zealand Freshwater Fish Database records were accessed for affected stream catchments;
- Auckland Council Geomaps for overland flow paths, Biodiversity Extent and Significant Natural Area overlays[7];
- Department of Conservation Threat Classification Series[8];
- Retrolens historic aerial imagery[9]; and
- A classification of New Zealand's terrestrial ecosystems (Singers & Rogers, 2014).

3.3 Site Assessments

A site assessment was undertaken by an experienced ecologist over January and February 2025.

During the site assessments:

- The presence and extent of wetland and stream features of the project area were noted, and the quality of any freshwater habitat was visually assessed.

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

[5] https://inaturalist.nz/home

[6] https://ebird.org/home

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

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

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

- Terrestrial habitats within the project area were visually assessed, with information recorded on plant species. No formal fauna surveys were undertaken, although:
    - Incidental recordings were made on indigenous bird species observed or heard.
    - Three- person search hours were undertaken to search logs and debris for native skinks and lizard habitat on three separate site visits
- Habitat assessment of potential habitats of terrestrial fauna, including birds, lizards and bats.

Due to the on-site conditions, access throughout the area was highly limited due to extensive slash, unstable soils, dense vegetation (at various stages of maturation following harvests), therefore the stream and wetland surveys were undertaken using a combination of on-site assessments where possible, catchment and hydrology information from Auckland Council Geomaps and LINZ data layers, and high-quality drone surveys.

3.4 Watercourse Classification

The watercourses were assessed via a desktop review and site visit. The desktop assessment noted factors such as changes in land-use, vegetation and surface water on current and historical aerial images, and a review of data such as Current Biodiversity layers, predicted watercourses and contours on Auckland Council's Geomaps was undertaken.

During the site assessment, undertaken on during January and February, 2025, the flow paths were classified, the presence and extent of streams was noted, reference photos were taken and the stream habitats were marked using a handheld GPS unit. Watercourses were classified under the Auckland Unitary Plan – Operative in Part (AUP OP) to determine, in accordance with the definitions in these plans, the ephemeral, intermittent or permanent status of these watercourses (Table 1). Where stream access was not possible due to unsafe site conditions, stream classification was conservatively assessed using verified stream reaches, contours and hydrology as guidance. In addition, these watercourses were assessed as to whether they were natural or artificial, in accordance with the AUP OP definitions, using information from both desktop and site assessment.

Table 1. AUP OP criteria for permanent and intermittent streams and ephemeral overland flow paths.

Criteria	Definition
Permanent Stream	
1	The continually flowing reaches of any river or stream, excluding ephemeral reaches
Intermittent or ephemeral streams*	
1	Evidence of natural pools
2	Well-defined banks and bed
3	Retains surface water present more than 48 hours after a rain event
4	Rooted terrestrial vegetation not established across the entire channel width
5	Organic debris from flooding present on the floodplain
6	Evidence of substrate sorting, including scour and deposition
*** If three or more of the six criteria can be met with confidence, the watercourse is considered to be intermittent. If at least three criteria cannot be meet, the watercourse is considered to be ephemeral.**	

The quality of the aquatic habitat was assessed, noting ecological aspects such as channel modification, hydrological heterogeneity, riparian vegetation extent, substrate type and any fish or macroinvertebrate habitat observed. Riparian and catchment information was also reviewed.

3.5 Wetland Delineation

Potential wetland areas were assessed following the Ministry for the Environment's (MfE) wetland delineation protocols (MfE, 2022), to ascertain if the area presented with the physical characteristics to be considered a Natural Inland Wetland.

The definition of a Natural Inland Wetland (as per the NPS-FM) is:

> *"a wetland (as defined in the [Resource Management] Act) that is not:*
> *(a) in the coastal marine area; or*
> *(b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or*
> *(c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or*
> *(d) a geothermal wetland; or*
> *(e) a wetland that:*
> *(i) is within an area of pasture used for grazing; and*
> *(ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless*
> *(iii) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply."*

Consequently, the first step in delineating a Natural Inland Wetland is to ensure it meets the definition of a wetland under the Resource Management Act (RMA), referred to as 'the Act' in the above definition.

A wetland is defined by the RMA as:

> *'permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions'.*

If the potential wetland met the definition of an RMA wetland, then it was also checked to see if any of the exclusions in the Natural Inland Wetland Definition applied to the area. Finally, if the potential wetland did not meet any of the exclusions, the remainder of the MfE wetland delineation process was carried out to determine if the area was a natural inland wetland (Figure 3).

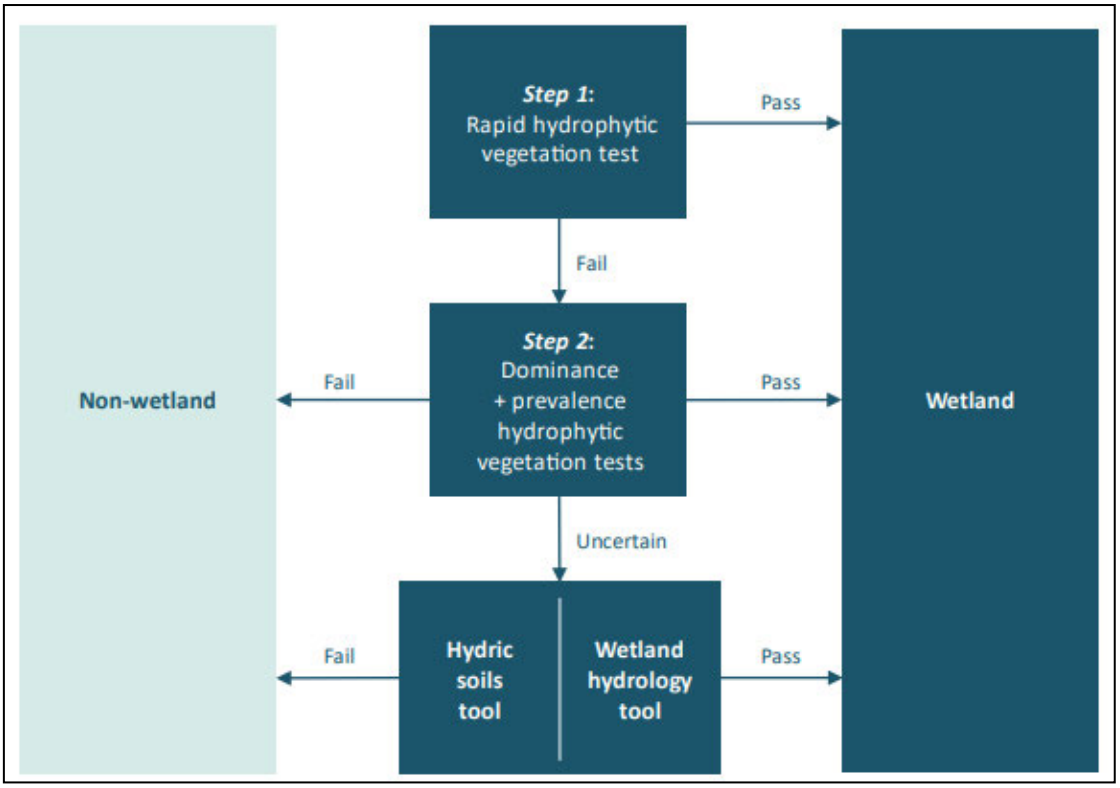


Figure 3. Simple flow chart of steps for delineating a Natural Inland Wetland using the hydrophytic vegetation, hydric soils and wetland hydrology tools. Reproduced from MfE (2022).

When following the MfE wetland delineation process, if the rapid test was not appropriate for determining if an area was an RMA wetland, vegetation assessment in accordance with Clarkson (2014) and Clarkson et al (2021), and was undertaken; based on the dominance and prevalence of plant species assigned the following 'wetland plant indicator ratings' within a vegetation plot:

- Obligate wetland vegetation (OBL) – almost always a hydrophyte, rarely in uplands;
- Facultative wetland (FACW) – usually a hydrophyte but occasionally found in uplands;
- Facultative (FAC) – commonly occurs as either a hydrophyte or non-hydrophyte;
- Facultative upland (FACU) – occasionally a hydrophyte by usually occurs in uplands; and
- Upland (UPL) – rarely a hydrophyte, almost always in uplands.

Where the dominance and/or prevalence tests applied to the vegetation plot results showed unclear results, hydric soils and hydrology tests were undertaken in accordance with the associated protocol (Ministry for the Environment, 2021; Fraser *et al.,* 2021). All wetland assessments were carried out within the Auckland region's 'growing season'.

3.6 Vegetation and Flora

Areas of indigenous and exotic vegetation within the project area were traversed, and their ecological features described using standard non-plot methods. The extent of each habitat type was mapped using a combination of walkover data, observations from vantage points, and observations from current and historic aerial imagery for the least accessible areas. During the site walkovers, incidental records were made of any nationally or regionally threatened plant species which were observed.

4 EXISTING ECOLOGY

4.1 Baseline Conditions

The Site is entirely within an exotic plantation pine forest. At the time of development, when earthworks commence, the environment will be consistent with a post-harvest, clear-felled site (e.g. Photo 1). Some exceptions to this situation are considered, where several relatively small areas of native plantings or native regenerating scrub occur within riparian margins, which have been identified and mapped (Figure 7), and would be protected and enhanced as part of the Project design.

Generally, the ecological values that persist within these environments are considered to be low overall. It is acknowledged, however, that some high-value species, such as threatened long-tailed bats (*Chalinolobus tuberculatus*), may still commute or forage over this space, and other at-risk species (e.g. NZ pipit, *Anthus novaeseelandiae*) may temporarily benefit from this change in habitat type, or otherwise potentially persist throughout rotation harvest (e.g. copper skink, *Oligosoma aeneum*).

Photo 1. Baseline conditions at Rangitoopuni-Riverhead Forest following clear-felling

4.2 Ecological Context

The Project Area straddles the boundaries of the Rodney Ecological District (E-D) and Tamaki E-D, with the entirety of the Project Area falling within the Auckland ecological region. The western 77.7 ha of Lot 1 falls within the Rodney E-D, and the eastern 318 ha of the Lot 1, and the entirety of Lot 2 is within the Tamaki E-D. Both the Tamaki and Rodney E-D have warm, humid summers and mild winters with annual rainfall of 1200 – 1400 - 1600 mm. Vegetation within the Tamaki E-D is characterised by typical North Island lowland indigenous forest with abundant taraire and pūriri, while the Rodney E-D originally consisted of extensive podocarp-hardwood forest (McEwan, 1987).

4.3 Desktop Investigation

4.3.1 Historic Vegetation Extent

Auckland Council Geomaps layer 'Potential Ecosystem Extent' provides a more detailed prediction of the historic vegetation and ecosystem extent, as recognised on Singers *et al* (2017). The 'Potential Ecosystem Extent' for the project area is predicted to be 'Kauri, podocarp, broadleaved forest' (WF11) throughout the majority of the site, with a section of 'Kahikatea, pūriri forest' (WF7-3), on the southern portion of the site (Figure 4). The 'Prediction of wetlands before prior to human arrival' layer predicted the site to be absent of wetlands (Figure 5).

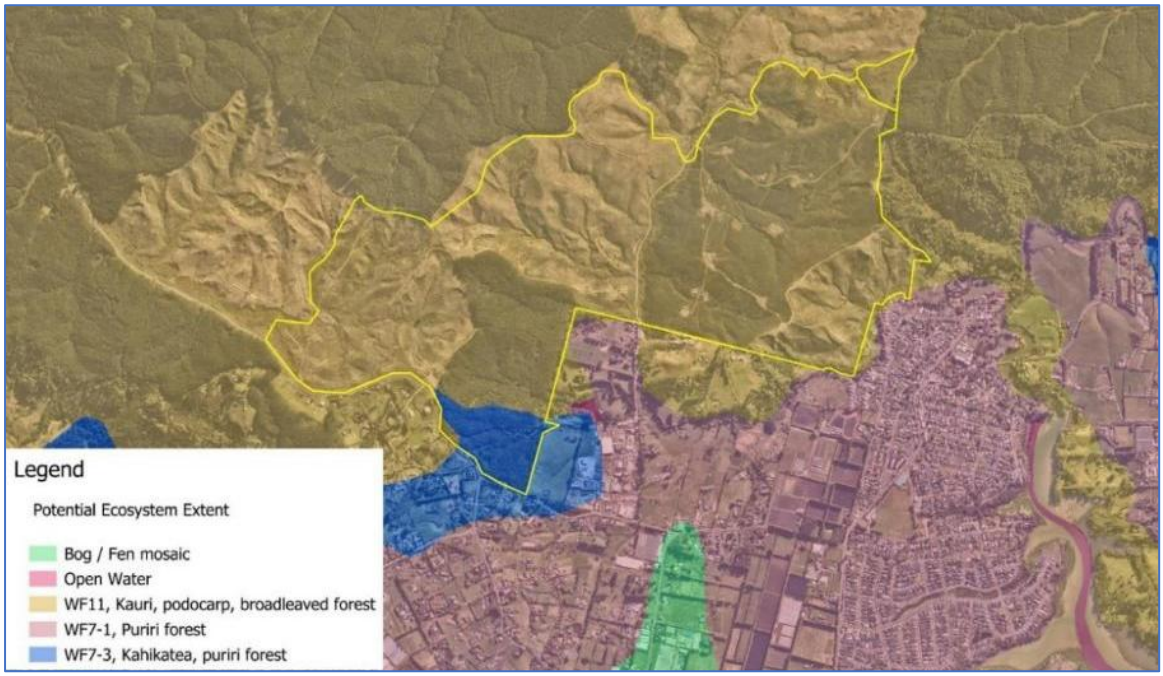


Figure 4. 'Potential Vegetation of New Zealand' mapping relative to the Project Area (yellow polygon). Basemap & context layers sourced from LINZ Data Service.

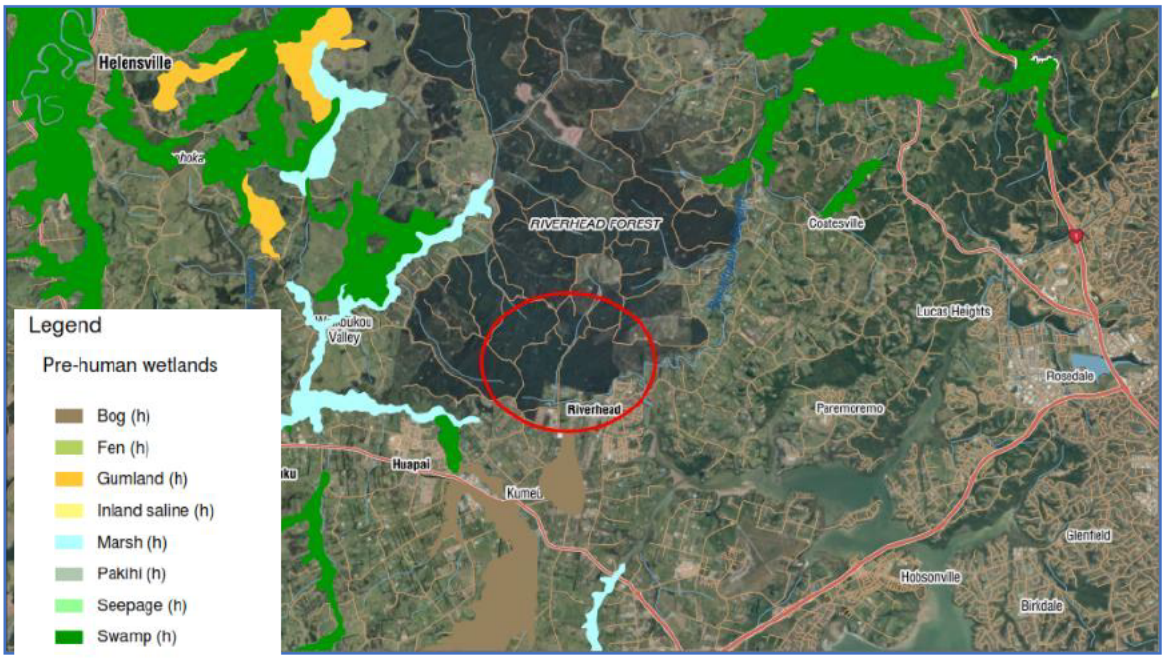


Figure 5. 'Prediction of wetlands prior to human arrival' layer relative to the project area (red circle).

Historic aerial imagery of the project area indicates that in the 1940's, the project area was being used for forestry, with haulage tracks established throughout stands of vegetation, indicating the land has been utilised for over 80 years. Deforestation is observable in aerial images from the 1970's with pine plantations again re-sown. It is estimated that at least two crops of pine have been felled and subsequently deforested on the site prior to the Te Kawerau Iwi treaty settlement.

4.3.2 Flora Records

The Riverhead area hosts the only known population of the forest flower *Veronica jovellanoides*, a Threatened – Nationally Critical species (de Lange *et al.*, 2018), which only occurs within 20 ha podocarp forest, occupying an area of 6 m^2 within the Riverhead area. This forest flower grows within cool, sheltered stream bank areas (de Lange, 2025). This forest area is within a protected reserve, located 2 km beyond the Project Area. Riverhead forestry blocks (including the Project Area), have been surveyed for the presence of *V. jovellanoides*, with no additional specimens found. Whilst it is in close proximity, *V. jovellanoides* is not expected to be present within the site.

4.3.3 Fauna Records

4.3.3.1 Avifauna

A desktop search for bird records, using iNaturalist and eBird databases, recorded 20 indigenous bird species, excluding coastal or marine bird species. This included 16 species which are nationally Not Threatened, two species considered nationally 'At Risk', and one species considered to be Threatened' (Robertson *et al.*, 2021). In terms of the Auckland Region, 15 species are Not Threatened, two species are 'At Risk', and two species are 'Threatened' (Woolly *et al.*, 2024).

Table 2. Desktop bird records for native bird species (excluding coastal birds) recorded within 5 km of the project area on iNaturalist and/or within the eBird grid square AA66.

Common name	Scientific name	New Zealand Threat Classification (Robertson *et al.*,2011)	Auckland Region Threat Classification (Woolly *et al.*, 2024)	Potential to occur on site based on habitat suitability
Bellbird	*Anthornis melanura*	Not Threatened	At Risk – Regionally Recovering	✓
Fantail	*Rhipidura fuliginosa*	Not Threatened	Not Threatened	✓
Grey Duck	*Anas superciliosa*	Threatened – Nationally Vulnerable	Threatened – Regionally Critical	
Grey teal	*Anas gracilis*	Not Threatened	Not Threatened	
Grey warbler	*Greygone igata*	Not Threatened	Not Threatened	✓
Kererū	*Hemiphaga novaeseelandiae*	Not Threatened	Not Threatened	✓
Miromiro (New Zealand Tomtit)	*Petroica macrocephala*	Not Threatened	Not Threatened	✓
Morepork	*Ninox novaeseelandiae*	Not Threatened	Not Threatened	✓
New Zealand pipit	*Anthus novaeseelandiae*	At Risk - Declining	Threatened – Regionally Vulnerable	✓
Paradise shelduck	*Tadorna variegata*	Not Threatened	Not Threatened	✓
Pūkeko	*Porphyrio melanotus*	Not Threatened	Not Threatened	✓
Royal Spoonbill	*Platalea regia*	At Risk – Naturally Uncommon	At Risk – Regionally Uncommon	
Sacred kingfisher	*Todiramphus sanctus*	Not Threatened	Not Threatened	✓
Shining cuckoo	*Chalcites lucidus*	Not Threatened	Not Threatened	✓
Swamp harrier	*Circus approximans*	Not Threatened	Not Threatened	✓
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	Not Threatened	✓
Waxeye	*Zosterops lateralis*	Not Threatened	Not Threatened	✓
Welcome Swallow	*Hirundo neoxena*	Not Threatened	Not Threatened	✓
White Faced Heron	*Egretta novaehollandiae*	Not Threatened	Not Threatened	✓

Of those recorded within the desktop assessment, it is possible that all species may be present within the Site, with the exception of three species of waterfowl; grey duck (*Anas superciliosa*), grey teal (*Anas gracilis*) and royal spoonbill (*Platalea regia),* for which the habitats on site are not considered suitable:

- Grey duck are broadly hybridised with introduced mallards to such an extent that few pure grey ducks may now exist;

- Grey teal inhabit shallow water lakes, which are not present on Site; and Royal spoonbill utilise extensive wetlands and estuaries within New Zealand, and such habitats are not present on site.

While its possible threatened Bellbird (*Anthornis melanura*) may be present on site, it's unlikely they use the site for any more than intermittent visitation. This is because the remaining local populations are limited to predator free Hauraki Gulf Islands, and higher quality habitat present within the surrounding landscape (i.e., Waitakere ranges, Shakespeare Regional Park).

New Zealand pipit (*Anthus novaeseelandiae*) could be found on site as they inhabit rough, open habitats, including farmland, and could be expected to use rough recently felled areas for foraging. Pipits are considered likely to have benefitted from forest clearance for pasture; however, have subsequently declined with land-use intensification (Beauchamp, 2013). Pipits require long grasses for breeding which are found along the edges of riparian margins on Site, and therefore may be present breeding within these areas.

Common forest bird species be found breeding, foraging and roosting within areas of forested vegetation such as the pine forest and riparian margins on Site.

Although wetland avifauna were not identified within a 5 km radius of the site within the desktop assessment, the wetland habitat on Site is considered suitable for wetland avifauna species. As most wetland birds are inconspicuous in nature, they may be present on Site, and have remained undetected. Species may include those with a 'Threatened' and 'At-Risk' conservation status such as Australasian bittern (*Botaurus poiciloptilus*) and fernbird (*Poodytes punctatus*), which may utilise such areas for breeding and foraging. North Island fernbird are often associated with wetlands, however also occur in parts of the Rodney district and beyond, in dry shrubland.

4.3.3.2 Herpetofauna

No native lizards have been recorded within Rangitoopuni-Riverhead Forest, however, a suite of six native lizard species is considered to have some potential to be present within and around potential habitats associated with mature and clear-felled pine environments. Three of these species have been recorded within 5 km of the project, although two of these (Pacific gecko and forest gecko) have strong associations with indigenous forest habitats that are not associated with the proposal.

All native reptiles and amphibians are legally protected under the Wildlife Act 1953, and its subsequent amendments, and vegetation and landscape features that provide significant habitat for native herpetofauna are protected by the RMA 1991.

It is considered that native lizard abundance throughout a harvested pine environment is likely to be very low, on the basis that their populations may persist within and around the edges of rotational harvest, however are unlikely to be abundant in these highly disturbed environments, particularly in the presence of a full suite of predators (birds, rats, mice, hedgehogs and mustelids). Some population expansion may occur as the forest matures, however all of these species are assessed as being in gradual decline throughout their range nationally (Hitchmough et al. 2021) and in Auckland (Melzer et al. 2022).

Of these species, **copper skinks (*Oligosoma aeneum*)** have not been recorded but are assumed to be present because they have been reported within or around the edges of other pine plantations and are widespread within the Auckland Region, including within young weedy vegetation such as rough roadside grasses. Copper skink numbers within earthworks areas throughout Lots 1 and 2 **are estimated to be less than 100 individuals.** This estimate considers that no native lizards were identified during onsite searches, and that no copper skinks or any other native lizards were recorded from systematic searches of pine plantation at Dome Valley, following 11 days of fauna habitat searches over February-March 2025 (Bioresearches, unpublished data).

Other species listed in Table 3 could potentially be expected to be encountered on an incidental basis, if at all. **Less than 20 individuals of other skinks or gecko species** are expected to be encountered within the project area. This estimate considers the above search results, and including that other species are less likely to be represented in any native lizard community at the site.

Table 3. Native herpetofauna potentially present within Rangitoopuni-Riverhead Forest

Common name	Scientific name	New Zealand Threat Classification (Robertson *et al.*, 2011)	Regional Threat Classification (Melzer *et al.*, 2022)	Recorded within 5 km of Project area
Copper skink	*Oligosoma aeneum*	At Risk - Declining	At Risk –Declining	✓
Ornate skink	*Oligosoma ornatum*	At Risk - Declining	At Risk –Declining	
Moko skink	*Oligosoma moco*	At Risk - Relict	At Risk –Relict	
Forest gecko	*Mokopirirakau granulatus*	At Risk – Declining	At Risk – Declining	✓
Elegant gecko	*Naultinus elegans*	At Risk – Declining	At Risk – Declining	
Pacific gecko	*Dactylocnemis pacificus*	Not threatened	At Risk –Declining	✓

4.3.3.3 Bats

Two endemic species of bats (pekapeka) are found in New Zealand, the long-tailed bat (LTB; *Chalinolobus tuberculatus*) and lesser short-tailed bat (STB; *Mystacina tuberculata*). STBs are represented by three subspecies (O'Donnell et al., 2023). Both species are listed as 'Threatened' or 'At Risk' under the New Zealand threat classification system (i.e., LTB - 'Nationally Critical' and Southern STB – 'At Risk – Recovering') (Townsend *et al.,* 2008; O'Donnell *et al.,* 2023). Their threat statuses reflect the drastic and ongoing decline in populations across much of New Zealand, due to the loss and fragmentation of habitats and adverse impacts of pest mammals (e.g., rodents, cats), with some population recovery from conservation management apparent in Southern STB populations.

A desktop search for bat records identified the presence of long-tailed bat (*Chalinolobus tuberculatus*) records both directly within, and within 500 m of the project area, to the north and east of the boundary. Specifically, the records outside, but close to the project area are located 150 m north of

the project area; 290 m east of the project area; and 4 km east north-east of the project area (Figure 6). Multiple other records are also present further to the north and south of the project area, within a 5 km buffer. As such, it is considered long-tailed bats would be present within the site.

To confirm the intensity and areas of use by long-tail bats within the site, a bat survey utilising Acoustic Bat Monitors (ABM's) has been undertaken, with the ABM's deployed on the 13th March, 2025. The results of the bat survey will be provided in a standalone document post lodgement.

The closest records of STBs are in Little Barrier Island (71 km north-east of the project area) and Coromandel Forest Park (105 km south-east of the project area), and are not considered to be present on the mainland in the Auckland region. This species has far more specific habitat requirements than LTBs (mature forest with minimal introduced predators) and is far less mobile. Consequently, short-tailed bats are considered highly unlikely to be present within the Project area.

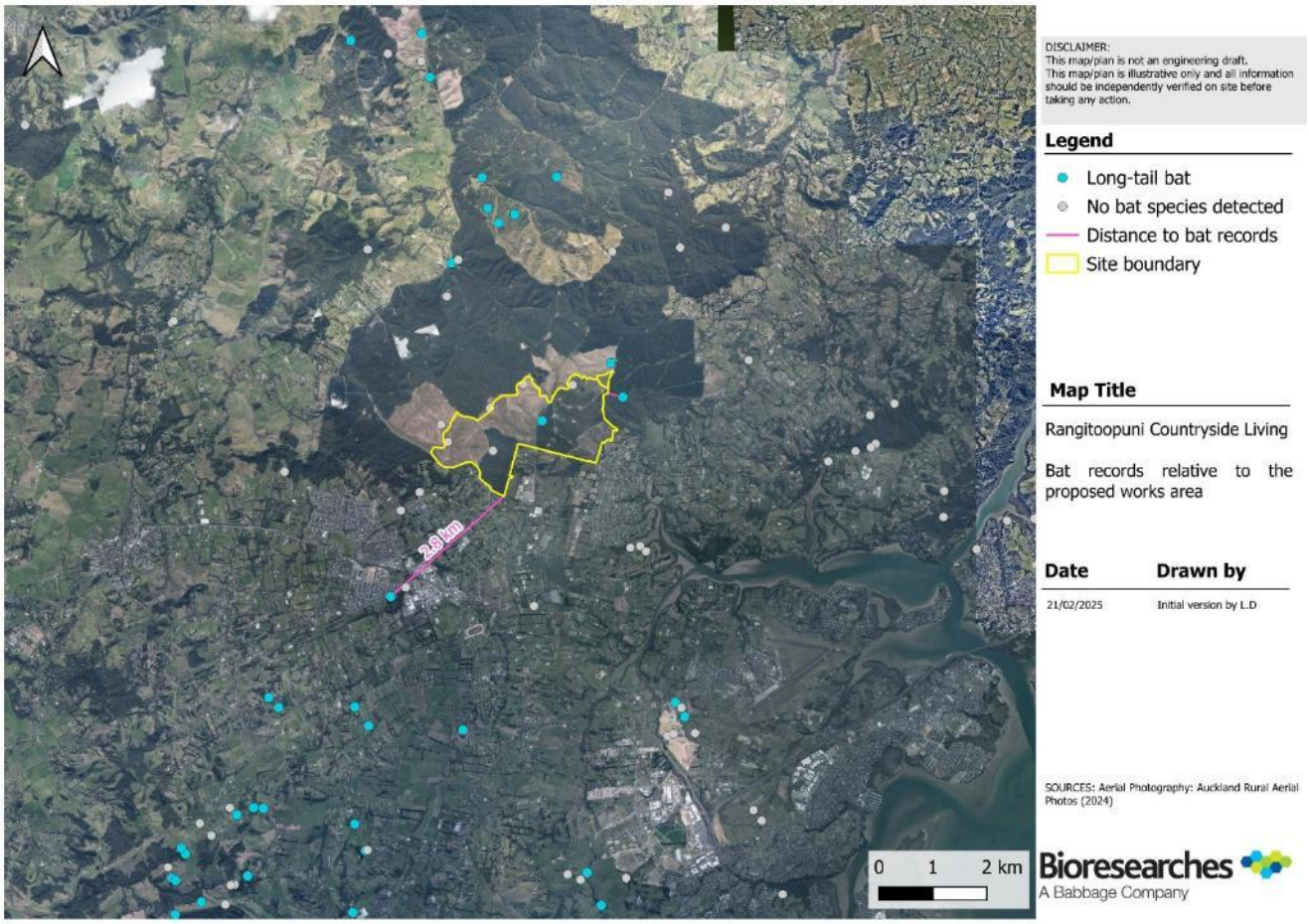


Figure 6. Long-tailed bat records, within the site and the surrounding area.

4.3.3.4 Freshwater fish

Desktop reviews shows the surrounding streams and catchment support a diverse range of indigenous fish. Records show shortfin eels (*Anguilla australis*), redfin bully (*Gobiomorphus huttoni*), common bully (*Gobiomorphus cotidianus*), īnanga (*Galaxias maculatus*) and torrentfish (*Cheimarrichthys fosteri*) have been recorded within close proximity to the site. Of the eight fish species identified, three species have a conservation status of 'At Risk – Declining' (Dunn *et al*., 2017) at a national scale, whilst

four species are considered 'At Risk' at a regional scale, and one species is considered 'Threatened' (Bloxham *et al.*, 2023) (Table 4).

Table 4. Native freshwater fish species recorded within 5 km of the project area from the New Zealand Freshwater Fish Database, and the corresponding threat status.

Scientific name	Common name	New Zealand Threat Classification (Dunn *et al.*, 2017)	Regional Threat Classification (Bloxham *et al.*, 2023)
Anguilla australis	Shortfin eel	Not Threatened	Not Threatened
Anguilla dieffenbachii	Longfin eel	At Risk – Declining	At Risk – Regionally declining
Cheimarrichthys fosteri	Torrentfish	At Risk – Declining	Threatened – Regionally vulnerable
Galaxias fasciatus	Banded kokopu	Not Threatened	Not Threatened
Galaxias maculatus	Inanga	At Risk – Declining	At Risk – Regionally declining
Gobiomorphus basalis	Cran's bully	Not Threatened	A Risk Declining
Gobiomorphus cotidianus	Common bully	Not Threatened	Not Threatened
Gobiomorphus huttoni	Redfin bully	Not Threatened	At Risk – Regionally declining
Paranephrops sp.	Koura	Not Threatened*	Not Threatened

*threat classifications of freshwater invertebrates from Grainger *et al.* (2018).

4.4 Ecological Characteristics

4.4.1 Terrestrial Environment

The composition of vegetation varies across the site, depending upon the land clearance and stages of forestry operations prior to land ownership transfer to the Trust. The vegetation forms discrete blocks throughout the project area. Key vegetation types are listed in Table 5 and mapped in Figure 7.

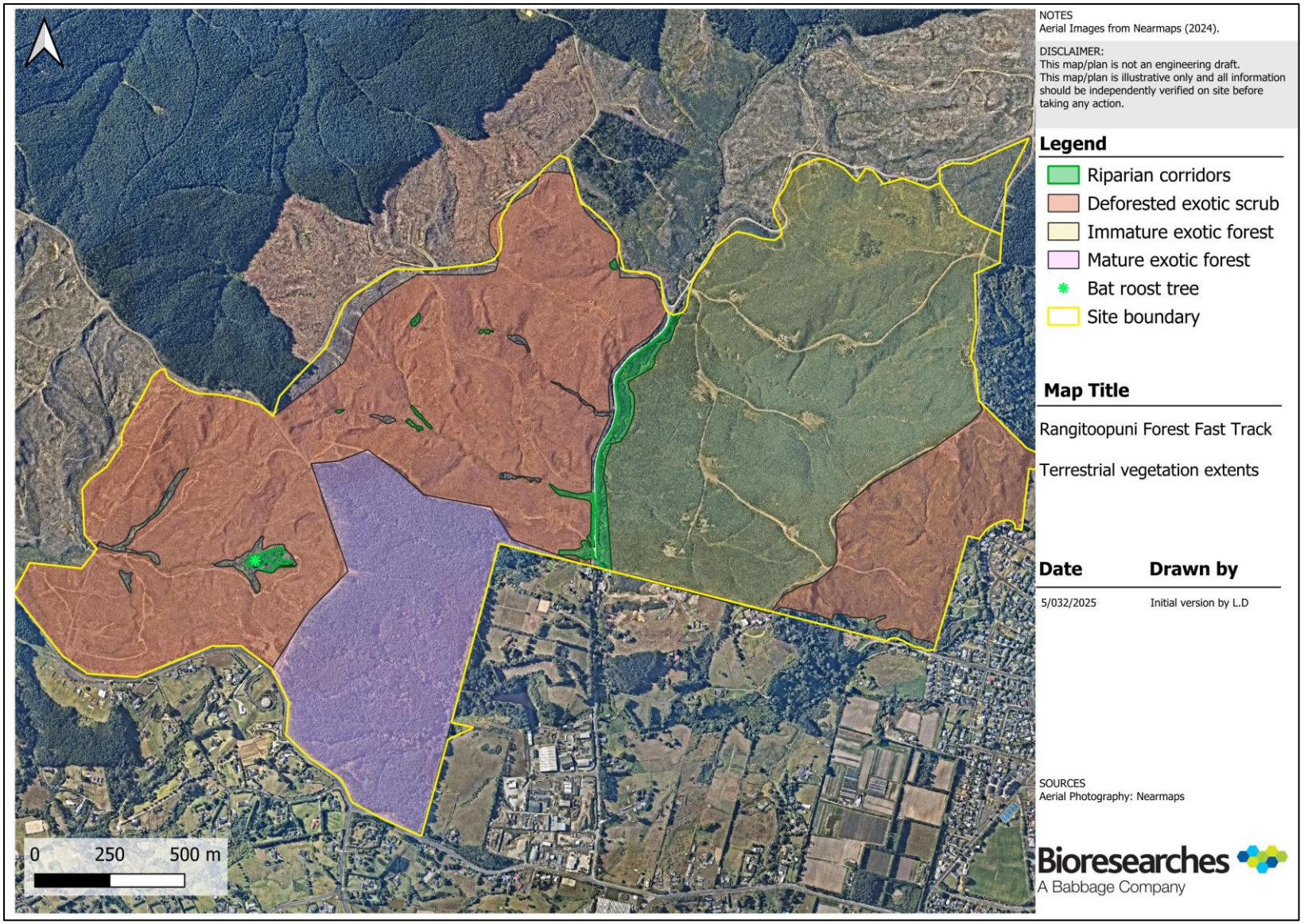


Figure 7. Identified terrestrial vegetation types within the Project Area.

Table 5. Vegetation type value and quantity within the Rangitoopuni development.

Vegetation composition	Quantity	Botanical value
Deforested exotic scrub	181 ha	Negligible
Riparian margins	5.9 ha	Moderate
Mature exotic forest	59 ha	Moderate
Immature exotic forest	125 ha	Low

4.4.1.1 Deforested exotic scrub

An extensive portion of the site consists of deforested exotic scrub (D-ES) vegetation, situated throughout the western and upper central portions of the wider property boundary and covers 181 ha of land (Photo 2). The D-ES is distinctive in that is consists of deforested pine forest with no successional plantation established, with extensive clear-felled pine stumps and slash covering the ground and loose soils. Within this slash, short gorses, less than 1 m tall covers the area (Photo 3 and Photo 4). Additional exotic vegetation present includes pampas (*Cortaderia selloana*), inkweed (*Phytolacca octandra*), and black nightshade (*Solanum nigrum*), thistle (*Carduus* sp.) with tūrutu (*Dianella nigra*) present throughout (Photo 5).

Pipit (*Anthus novaeseelandiae*) were observed on the existing margins of the exotic scrub and established forestry roads. As pipits require long, dense grasses for breeding, this habitat is likely to only support intermittent visitation, and/ or an ecological corridor to surrounding coastal and pasture environments, rather than permanent or breeding habitat. Pipit are recognised as 'specified highly mobile fauna' as per *Appendix 2* of the NPS-IB.

Photo 2. Extensive areas of Exotic Scrub covered the site.

Photo 3. Typical Exotic Scrub composition

Photo 4. Extensive slash in the Exotic Scrub

Photo 5. Exotic Scrub with a Riparian Corridor in background

Table 6. Terrestrial ecological value of the Exotic Scrub within the Project Area.

Matter	Justification and score
Representativeness	**Very Low** Areas of dead exotic scrub are representative of Exotic Scrubland (Singers et al., 2017). This is not an indigenous ecosystem type and these areas rate as low for this attribute.
Rarity/distinctiveness	**Moderate** Beneath this scrubland there is little to no groundcover and therefore this habitat is not suitable for native lizards. In addition, it provides low-quality foraging habitat for other native fauna and at may be occasionally utilised by native avifauna such as fantail and pipit, though is unlikely to support breeding opportunities. Rarity scores **moderate** due to the presence of Pipit.
Diversity and Pattern	**Very Low** These areas of vegetation types are dominated by exotic species and therefore have low indigenous diversity.
Ecological context	**Very Low** None of the small areas of exotic scrub within the Project Area extent are providing important linkages or stepping stone habitat within the local or wider landscape context. None are providing significant or important buffering to indigenous areas of vegetation. They have very low value for ecological context.
Ecological Value	**Negligible**

4.4.1.2 Riparian Corridors

Throughout the project area, isolated areas of woody vegetation are present and solely associated with riparian margins of the wetlands and permanent streams. These mixed exotic and native riparian corridors covered a cumulative 5.9 ha of land, with the largest being associated with the main watercourse (Deacon Road Stream), flowing through the centre of the site (Photo 6 and Photo 7). Vegetation within these areas consisted of a range of exotic and native vegetation, including pine (*Pinus radiata*), ginger (*Hedychium gardnerianum*), gorse, pampas, cabbage tree (*Cordyline australis*), kahikatea (*Dacrycarpus dacrydioides*), patē (*Schefflera digitata*), red matipo (*Myrsine australis*), karamū (*Coprosma robusta*), kānuka (*Kunzea robusta*), tōtara (*Podocarpus totara*), black matipo (*Pittosporum tenuifolium*), towai (*Pterophylla sylvicola*), whekī (*Dicksonia squarrosa*), mahoe

(*Melicytus ramiflorus*) and tūrutu (Photo 8). Due to the low complexity and relatively sparse outer edges, these sections of vegetation are exposed to edge effects with the outer portions lacking complexity and multiple vegetative tiers (Photo 9). Pest plant and animal infestation is present within the riparian corridors, with possum (*Trichosurus vulpecula*) actively observed, and areas of gorse and pampas present throughout.

These riparian margins provide green corridors, albeit narrow corridors from the predominantly rural surrounding landscape to the wider Rangitoopuni-Riverhead Forest. As such, it is highly likely LTB would utilise these riparian corridors, particularly along the deeper central watercourse (Deacon Road Stream), for foraging, commuting and drinking (Rockell *et al*., 2017; O'Donnell *et al*., 2023). A large pine tree is present within the riparian corridor in Lot 1, which would likely provide good roost habitat for bats. Grey warbler (*Gerygone igata*), fantail (*Rhipidura fuliginosa*) and pūkeko (*Porphyrio melanotus*) were observed actively within the riparian margins.

Photo 6. Riparian corridor on Deacon Stream.

Photo 7. Riparian corridor on Deacon Stream.

Photo 8. Riparian corridor within mixed Scrub

Photo 9. Riparian corridor within Exotic Scrub

Table 7. Terrestrial ecological value of the Riparian Corridors within the Project Area.

Matter	Justification and score

Representativeness	**Low** The riparian corridors are not representative of an intact forest ecosystem, however create green corridors through the site. The corridors lack complexity and structural tiers, with ecological integrity impacted by pest pressures.
Rarity/distinctiveness	**Very High** Rare and threatened flora species not recorded within the mixed vegetation. High likelihood Long-tailed bats utilise the riparian corridors for foraging and commuting. This ecosystem type scores **Very High** based on values for long-tailed bats utilising the area for commuting and foraging/feeding.
Diversity and Pattern	**Low** Although the damaged riparian corridors retain a moderate level of native plant species richness many species are in very low abundance, with low regeneration. Species will continue to be lost from the area due to lack of protective buffers and generally small perimeter to area ratios (maximum 0.44) and ecological patterns are severely compromised
Ecological context	**Low** Individual trees and small stands of trees have no buffering and are exposed to prevailing conditions in the plantation setting with pest infestation prevalent. Many are damaged by slash and clear felling and exhibit dieback and other symptoms of stress. Mature individual trees potentially provide food resources for native fauna however and may still act as a seed source
Ecological Value	**Moderate**

4.4.1.3 Mature Exotic forest

The Mature-Exotic Forest (M-EF) is located within the lower eastern side of Lot 1 of the covering 59 ha of land. This lot is characterised by the mature pine cover, being at least 20 years old. The subcanopy within this pine forest was predominantly indigenous and included whauwhaupaku (*Pseudopanax arboreus*), black matipo, pōnga (*Alsophila tricolor*), kiokio (*Parablechnum novae-zelandiae*), hangehange (*Geniostoma ligustrifolium*), mingimingi (*Leucopogon fasciculatus*), and karamū. Whilst the subcanopy was largely indigenous, groundcover consisted of basket grass (*Oplismenus hirtellus*), forest sedge (*Carex dissita*), with thick layers of exotic and indigenous leaf litter (Photo 10 and Photo 11).

Photo 10. Indigenous understory with exotic pine canopy.

Photo 11. Ground cover and trunk diameter of pine.

Long-tailed bats utilise interstitial spaces on trees, such as cavities, splits and peeling bark and hollows to roost during the day have been frequently observed roosting and utilising exotic vegetation such as pines, including within managed forestry (Borkin & Parsons, 2010).
Therefore, it is highly likely this mature pine forest would support long-tailed bat populations, given the previous records onsite and close proximity to multiple long-tail bat records.

Table 8. Terrestrial ecological value of the Mature Exotic Forest within the Project Area.

Matter	Justification and score
Representativeness	**Low** Areas of mature exotic forest are representative of an Exotic Forest with <50% native understorey and/or ground biomass (Singers et al., 2017). This is not an indigenous ecosystem type and these areas rate as low for this attribute
Rarity/distinctiveness	**Very High** Rare and distinct flora species were not recorded in the exotic forest type. Long-tailed bats have potential to roost in exotic trees such as pine. Given the proximity of the M-EF to existing Long-tailed bat records, it is highly likely these trees will be utilised for roost. Copper skinks, while neither rare or distinctive, have high value species and are expected to be present in areas of this vegetation, particularly where weedy scrub is regenerating around other indigenous forest types that they occur in. This ecosystem type scores **Very High** based on values for Long-tailed bat.
Diversity and Pattern	**Low** These areas of vegetation types are dominated by exotic species and therefore have low indigenous diversity. Sub-canopy dominated by indigenous vegetation creating some complexity in the canopy.
Ecological context	**Low** The areas of immature native vegetation within a mature exotic forest to be lost within the Project Area extent are limited in how they provide important linkages or stepping stone habitat within the local or wider landscape context. None are providing significant or important buffering to indigenous areas of vegetation. They have low value for ecological context.
Ecological Value	**Moderate**

4.4.1.4 Immature Exotic Forest

The immature exotic forest (I-EF) is located on the eastern side of the site, and covers 31 ha of ground. I-EF is characterised by recent cutover (within the past 6 years) and re-planted 5-year old radiata pine, largely forming a monoculture. Where radiata pine has been replanted, there is extensive and dominant gorse between the saplings (between 1 – 3 m in height). No native woody species were observed within the I-EF, however māpere (*Gahnia setifolia*) has established on the forest margins. The trees (pine and gorse) are semi-mature and generally have no native understorey or groundcover. Where some understorey is present it is generally composed of pest plants, particularly gorse (Photo 12 - Photo 15).

Photo 12.Skid pad within the Immature Exotic Forest

Photo 13. Gorse and māpere

Photo 14. Gorse and pine

Photo 15. Dense gorse and pine

The I-EF may support indigenous common insectivorous avifauna, such as fantail, however the vegetation is considered to be too immature to support those (including avifauna and bat), which utilise holes and cavities for roosting (Peterson & Hayman, 2018). Nectar feeders were considered unlikely to use the I-EF due to the lack of nectar/fruiting plants. As with the D-ES, pipit were observed within the margins of the vegetation and existing forestry roads.

Table 9. Terrestrial ecological value of the Immature – Exotic Forest within the Project Area

Matter	Justification and score
Representativeness	**Low** Areas of exotic forest are representative of EF2: Exotic Forest with <50% native understorey and/or ground biomass (Singers et al., 2017). This is not an indigenous ecosystem type and these areas rate as low for this attribute
Rarity/distinctiveness	**Moderate** Rare and distinct flora or fauna species were not recorded in the exotic forest type. Copper skinks are an At Risk species and therefore are a high value species and are expected to be present in areas of this vegetation, particularly where weedy scrub is regenerating around other indigenous forest types that they occur in. Pipit were present within the D-ES, though is likely to offer intermittent visitation rather than

	breeding opportunities as the habitat does not provide long grasses which are required for nesting. This vegetation type rates moderate based on values for copper skinks and presence of pipit.
Diversity and Pattern	**Negligible** These areas of vegetation types are dominated by exotic species and therefore have low indigenous diversity
Ecological context	**Low** None of the small areas of exotic scrub to be lost within the Project Area extent are providing important linkages or stepping stone habitat within the local or wider landscape context. None are providing significant or important buffering to indigenous areas of vegetation. They have low value for ecological context.
Ecological Value	**Low**

4.4.2 Freshwater Environment

The characteristics and morphologies of freshwater ecosystems, including streams and wetlands, throughout the Project Area was largely dependent upon the surrounding land use/vegetation and stages of plantation forestry operations, and thus have been described with respect to these factors (Figure 8).

Supplementary photographs of the streams are shown in Appendix C, with the corresponding photo locations shown in Appendix C - Figure 14.

4.4.2.1 Streams

In total, 28.8 km of stream flows through the Project Area, of which 11.3 km of stream is intermittent, and 17.5 km of stream is permanent. Key stream characteristics and their associated extents and stream order is shown in

Table 10. Summary of stream classifications within the prescribed area, length, wider catchment contributions and ecological value.

Context	Classification	Wider Catchment	Cumulative Length	Ecological value
Deforested streams	Intermittent	Kaipara Harbour	4,800 m	Low
	Permanent second order tributaries	Kaipara Harbour	6,070 m	Low
	Permanent third order	Kaipara Harbour	2,570 m	Moderate
Forested streams	Intermittent	Waitemata Harbour	1,915 m	High
	Permanent	Waitemata Harbour	1,550 m	High
Immature plantation streams	Intermittent	Waitemata Harbour	4,440 m	Low
	Permanent	Waitemata Harbour	6,280 m	Moderate
Deacon Road Stream	Permanent fourth order	Waitemata Harbour	1,080 m	High

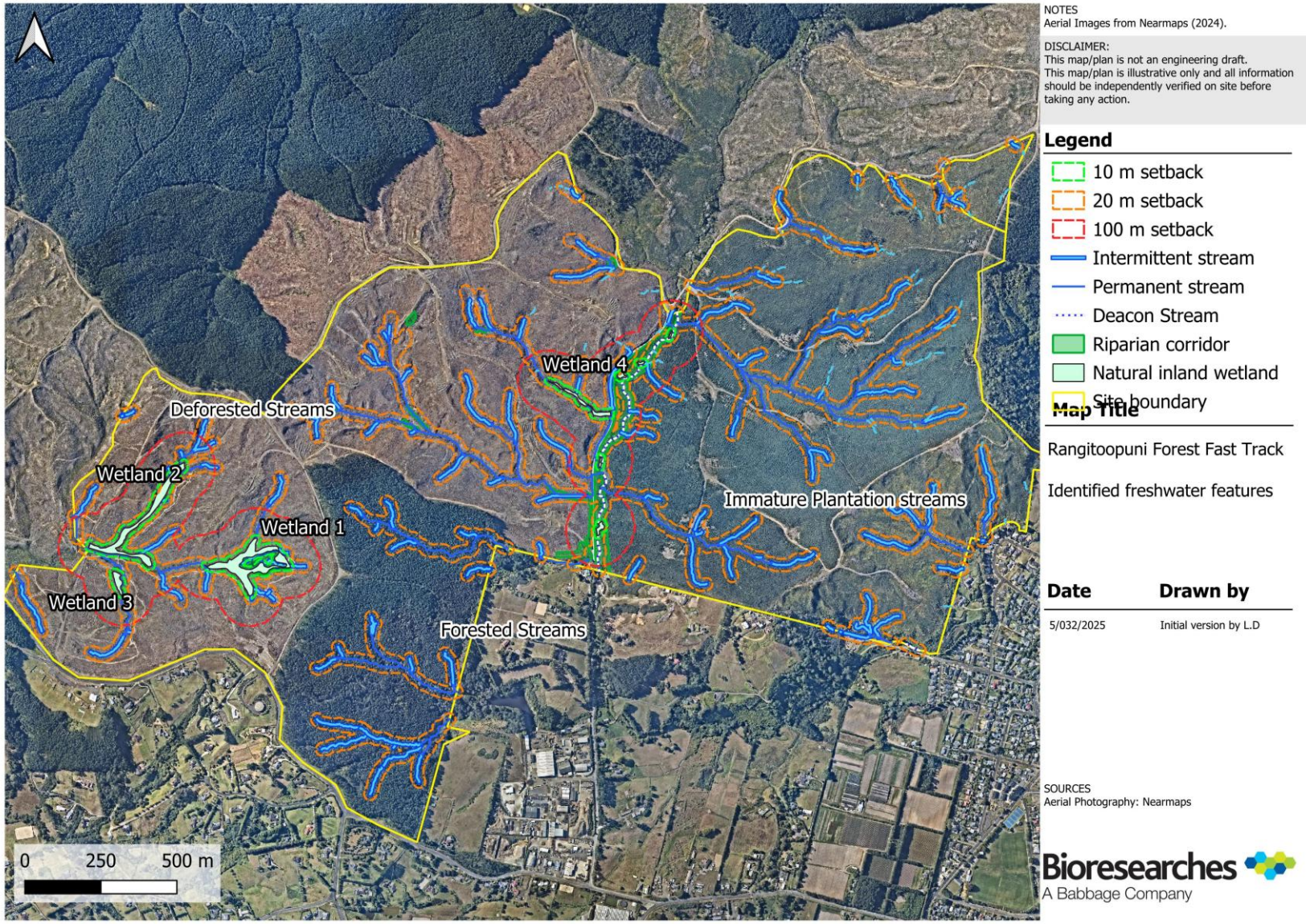


Figure 8. Freshwater features identified within the Project Area, and their associated naming system.

4.4.2.1.1 Deforested streams

Throughout the exotic deforested scrub, approximately 13.4 km of stream extent is present, divided between 4.7 km of intermittent stream and 6 km of permanent second order tributaries and 2.5 km of larger third order permanent streams. Two catchments are represented by the Deforested streams, with 6.5 km of stream, located on the western side of the Project Area draining in an east to westerly direction, and flowing for 25 km before entering the marine environment at a southern arm of the Kaipara Harbour. On the northern central area of the Project Area, 6.4 km of stream drains in a west to eastern direction, flowing into the Deacon Stream and entering the Waitemata Harbour 3.4 km downstream of the site boundary.

The intermittent streams were of second order and highly degraded, with extensive slash overlaying the stream bed, and it is likely intermittent flows would be significant altered due to the degree of slash and channel alteration present. The upper ephemeral headwaters were distinguished based on the lack of all six intermittent criteria to ensure a conservative measure of intermittent stream. The permanent second order streams were similar to the intermittent streams, in which the bed and banks were extensively damaged from slash and mobilised sediment. Water flow through the streams was shallow, averaging <0.05 m in depth, and were significantly altered by slash, blocking and damming flows, or forcing flow underneath slash (Photo 16 and Photo 17).

The exposed areas of stream bed showed the substrate to remain soft bottomed. Within these intermittent and second order streams, there was a significant lack of aquatic habitat due to the extensive slash damaging the bed and banks. It is likely no freshwater fish would reside within the degraded streams, and available macroinvertebrate habitat included woody debris from the slash and some overhanging scrub (Photo 18 and Photo 19). As described in D-ES, there was an extensive lack of vegetation and corresponding riparian yard to these two stream types, with the riparian yard predominantly consisting of dried gorse and slash. The scrub provided little riparian yard function to the stream, particularly shade, filtration and bank stability.

Photo 16. Typical intermittent stream within the deforested catchment

Photo 17. Typical intermittent stream within the deforested catchment

Photo 18 Typical permanent stream within the deforested catchment

Photo 19. Typical permanent stream within the deforested catchment

The intermittent streams and second order permanent streams were considered to be of **Low** ecological value. These streams were highly modified through forestry operations and lacked both abundance and diversity of aquatic habitat types and it is expected there would be a lack of abundance and diversity in aquatic fauna. There is no functioning riparian yard to the streams.

The larger, third order permanent streams were in slightly better condition than the intermittent and second order streams, however extensive areas of slash have entered these streams. The third order streams were relatively wide (0.8 m to 2 m) with deeper water (0.12 m- 0.65 m) with water largely able to flow over and through the slash and debris (Photo 20 and Photo 21). These streams were largely soft bottomed with occasional hard substrates observable. It is likely these areas have been subject to extensive siltation from the previous land use and would support greater proportions of hard substrates if land cover was mature forest. There was a low to moderate degree of aquatic habitat present within the larger watercourses, with pools and slow runs present throughout. The banks of these watercourses were highly incised, reducing the amount of overhanging vegetation to the stream, and significant undercut banks were observed. Riparian vegetation throughout the majority of the third-order streams was similar to the second order and intermittent tributaries, however isolated stands of riparian corridor vegetation (Section 4.4.1.2) remained, providing limited shade, filtration and bank stability to those areas.

Photo 20. Third order deforested stream with slash

Photo 21. Third order forested stream

The third order permanent streams were conservatively considered to be of **Moderate** ecological value. These streams were relatively degraded and modified through forestry operations with extensive siltation, however fragments of natural character remain. Likely provide modified habitat to tolerant aquatic fauna with isolated and fragments of native riparian vegetation remain, however majority consists of short, exotic scrub.

4.4.2.1.2 Forested streams

Throughout the M-EF, 3.5 km of stream is present, of which 1.9 km is intermittent, and 1.5km is permanent. The forested streams flowed in a west to east direction, entering the Waitemata Harbour approximately 3 km downstream. These streams had an overall average width of 0.5 m to 0.6 m, and were variable in depth, with runs ranging between 0.11 m to 0.45 m, with deep pools, up to 0.92 m deep. These streams were soft bottomed forested streams with occasional hard substrates such as gravels and bedrock, common throughout the Auckland Region. There was a good degree of organic matter such as leaf litter and woody debris, with no damming or clogging as a result of slash. The M-ES vegetation cover provided good shading and filtration to the streams, and no obvious or extensive bank erosion and scour was visible. The riparian yard was considered to be intact and functional.

Photo 22. Upper intermittent reach

Photo 23. Lower intermittent reach

A range of habitats were present throughout the permanent streams, and it is expected the intermittent tributaries would support good habitat diversity during periods of flow. Habitat included pools, slow runs, minor (<0.2 m) undercut banks, overhanging vegetation and instream organic matter. Unidentified galaxiid species, likely banded kōkopu (*Galaxias fasciatus*) was observed within one of the stream channels (Photo 25), and it is likely a variety of freshwater fauna species such as koura (*Paranephrops* sp.), and eels (*Anguilla* sp.) would access and reside within these reaches provided no downstream barriers were present. These stream banks were relatively natural with some incision and erosion from flood flows and historic forestry practices, however they retained connectivity to the floodplain.

Photo 24. Example of permanent reach

Photo 25.Unidentified galaxiid (red circle)

Overall, the Forested streams, bother intermittent and permanent, were considered to be of **High** ecological value. The streams, situated under mature pine forest with indigenous understory, are relatively unmodified and show natural characteristics in the bed, banks and substrates throughout. Juvenile galaxiids were observed utilising the streams and it is likely a good diversity and abundance of aquatic fauna, including fish and macroinvertebrates could be present.

4.4.2.1.3 Immature plantation Streams

The immature plantation streams (ip-streams) were located within Lot 2, within the terrestrial vegetation type 'Immature – Exotic Forest'. These streams were partially assessed via high quality drone survey due to inaccessibility. The ip-streams consisted of 4.3 km of intermittent and 6.2 km of permanent stream, assessed from catchment information and ground-truthing were possible.

The intermittent streams were situated within wide gullies and were relatively free of slash with defined channels. The channels were soft bottomed, albeit dry, with no hard substrates present in the channels. Whilst no flow was present due to the time of assessment, it is likely the streams would be overall shallow and narrow, forming slow runs and the occasional pools. Additional aquatic habitat likely to be present within the intermittent ip-streams included overhanging vegetation and woody debris. The intermittent flow paths frequently flowed under bankside herbaceous vegetation, such as māpere, fan-flowered rush (*Juncus sarophorus*), Yorkshire fog (*Holcus lanatus*), and bracken (*Pteridium esculentum*), with gorse frequently established.

Due to the presence of rushes within close proximity to streams, a wetland vegetative plot was undertaken to determine whether the channels supported natural inland wetland. The bankside vegetation failed both the dominance test and prevalence index and were not classified as natural inland wetlands (Table 11).

Photo 26. Typical gully intermittent streams were situated in

Photo 27. Dry intermittent stream base.

Table 11. Representative wetland delineation plot results for the intermittent ip streams

Strata	Scientific name	Common name	Wetland rating	Cover (%)	Dominant
Tree	*Pinus radiata*	Pine	FACU	40	Yes
Subcanopy	*Ulex europaeus*	Gorse	FACU	60	Yes
Groundcover	*Juncus effusus*	Soft rush	FACW	30	Yes
	Juncus pallidus	-	FACW	10	
	Cortaderia selloana	Pampas	FAC	15	
	Gahnia setifolia	Māpere	FACU	10	
	Pteridium esculentum	Bracken	FACU	30	Yes
	Ulex europaeus	Gorse	FACU	3	
	Galium aparine	Cleavers	FACU	3	
	Machaerina tenax	-	FACW	2	
Percent Dominant that are OBL, FACW or FAC					**25%**
Prevalence Index					**3.5**

The permanent reaches of these streams were partially degraded due to the degree of slash and debris altering the flows and reducing habitat quality. The stream banks were relatively incised and steep, limiting the connectivity to the floodplain. The dominant substrates throughout these permanent streams appears to be mixed soft and hard bottomed, with some cobble substrates observed however a heavy loading of fine sediment it present. Flowing water could be easily heard, and it is expected pools, fast and slow runs, and some cascades may be present. Connectivity throughout the ip-streams, including permanent and intermittent, is somewhat restricted due to the presence of perched and/or undersized culverts, limiting the abundance and diversity of aquatic fauna throughout both the intermittent and permanent streams. It is likely only eels and potentially banded kōkopu would be able to access and reside within the im-streams due to the limited connectivity throughout.

The immediate riparian margin of the permanent streams supported narrow bands (<2 m) of mixed native and exotic vegetation before transitioning to the immature pine and gorse. Vegetation observed within these bands included mixed exotic and common native vegetation. The intermittent streams were largely framed by the pine and gorse matrix, with some ampere. The riparian yard for

both the intermittent and permanent streams provided a good degree of shade, filtration and bank stability.

Photo 28. Permanent stream bed

Photo 29. Permanent stream within the wider area with slash in the stream bed

The intermittent ip-streams were considered to be of **Low** ecological value as they have been modified through forestry operations and are expected to lacked diversity and abundance of aquatic habitat during periods of flow, with barriers to fish passage present. The permanent ip-streams were considered to be of **moderate** ecological value due to the permanent presence of aquatic habitat, however evidence of channel and stream modification is present from forestry operations.

4.4.2.1.4 'Deacon' stream

Deacon Stream is a large permanent stream, flowing adjacent to Deacon Road. The stream was wider, 2.5 m in width on average with water depth ranging between 0.2 m to 0.8 m where measurable. Deacon Stream largely flowed through an incised channel base for 1 km, flowing from north to south, before exiting the site. Substrates were predominantly soft bottomed, a common occurrence in the Auckland region, however some heavy loading of fine sediments has likely occurred following the forestry land use.

Photo 30. Deep pool in Deacon Stream.

Photo 31. Good overhanging vegetation and mixed exotic and native riparian yard.

Flow through Deacon Stream was good, with no areas of stagnant or impounded water. No slash was observed within this stream. There was a range of aquatic habitat observed within the Deacon Stream, including deep and shallow pools, fast and slow runs, undercut banks, overhanging vegetation and woody debris. Native fish likely to be present within Deacon Road Stream includes eels, banded kōkopu, and bullies (*Gobiomorphus* sp.) with no obvious barrier to fish passage observed within the stream.

The riparian yard of the Deacon Stream consisted of vegetation described in Section 4.4.1.2 'Riparian Corridors' with some pest infestation occurring due to the lack of buffering/edge effect protection and pine and gorse vegetation associated with the 'Immature Exotic Forest' on the outer (11 m – 20 m) riparian margins. Occasional and discrete sedgelands established on the floodplain. These sedge wetlands are described in Section 4.4.2.2.2. Overall, the riparian yard to Deacon Stream provides high filtration, bank stability and organic matter inputs to the permanent watercourse.

Deacon Stream was considered to be of **High** ecological value due to the permanent abundance of a variety of aquatic habitat, which would be able to support a diverse range of freshwater fauna.

4.4.2.2 Wetlands

4.4.2.2.1 Swamp wetlands

Within Lot 1, four natural inland wetlands vegetated by indigenous hydric vegetation were identified within the site. The indigenous wetlands have a total cover of 25,200 m^2 and range between 1,190 m^2 and 11,490 m^2 in size. The indigenous wetlands were situated within the flow paths of the third order permanent streams, with high volumes of water flowing though the wetland, providing permanently saturated and standing water year-round. There was a minimal degree of slash within the wetlands, compared to the surrounding streams.

The indigenous wetlands passed the Rapid Test due to the dominance of OBL and FACW plants. The vegetation included cutty grass (*Carex geminata*), swamp millet (*Isachne globosa*), swamp kiokio (*Parablechnum minus*), flax (*Phormium tenax*), small (i.e. < 2 m^2) patches of raupō (*Typha orientalis*), tangle fern (*Gleichenia* sp.), soft rush (*Juncus effusus*), pūkio (*Carex secta*), pūrei (*Carex virgata*), jointed rush (*Juncus articulata*), giant rush (*Juncus pallidus*), and giant umbrella sedge (*Cyperus ustulatus*). These indigenous wetlands within the flow paths of permanent streams would provide a high degree of filtration and retention of fine sediments and nutrients present within the water flows. This filtration would greatly improve the quality of water discharged to the receiving environment.

Two wetlands largely have no effective riparian buffer, with the surrounding margins consisting of slash, dried gorse and short herbaceous plants, making the wetlands highly susceptible to edge effects, including pest plant infestation, drying winds, temperature fluctuations and light. Two wetlands contain narrow indigenous buffers with vegetation consistent with the 'Riparian Corridor' vegetation type, however these margins were somewhat damaged and would be limited in how they provide protective services to these wetlands.

North Island fernbird *(Megalurus punctatus)* have been recorded within approximately 15 km of the Site[10], and may inhabit these wetlands. In regard to aquatic fauna, it is expected shortfin and long fin eels, and galaxiid species adapted to wetland conditions would be able to reside within the indigenous wetlands.

Photo 32. Wetland 1

Photo 33. Wetland 2 - northern arm

Photo 34. Wetland 2 – eastern arm

Photo 35. Wetland 3

[10] https://inaturalist.nz/observations?place_id=6803&subview=map&taxon_id=980144

Photo 36. Wetland 4

4.4.2.2.2 Floodplain Sedgelands

The five floodplain sedgelands were situated on the floodplain of Deacon Stream, covering a cumulative area of 1,415 m^2 and ranging between 126 m^2 to 575 m^2 in size. The sedgelands were dominated by herbaceous sedge vegetation, passing the rapid test and meeting the definition of a natural inland wetland. This vegetation was dominantly cutty grass, with giant umbrella sedge, and pampas also present. The sedgelands were formed within shallow basins on the stream edge, where high flood flows would overtop the banks and saturate the area.

No water or damp ground, or flow paths from the surrounding landscape were observed during the assessment period, and as such it is expected that these wetlands would be intermittently, rather than permanently saturated and thus limited in how they provide habitat for aquatic fauna. However, it is likely avifauna would frequently utilise these sedgelands for foraging and resting. It is likely the sedgelands would provide a high degree of filtration of sediments and nutrients for water which flows through the catchment, either from the Forestry Stream or overland flow paths.

Photo 37. Sedge wetland

Photo 38. Sedge wetland

The sedgelands were considered to be of **Moderate** ecological value due to the presence of indigenous wetland vegetation, and good wetland services (i.e. filtration and scour protection) in regards to their size.

5 ECOLOGICAL IMPACT ASSESSMENT

This section focuses on assessing project-related effects on terrestrial and freshwater ecological values, based upon the following activities which will be associated with the proposed works Figure 9). The potential magnitude of these effects and consequent level of effects of each of these activities is described in the sections that follow. Magnitude of effects are described below and based off criteria described in Appendix A Table 23 (EIANZ, 2018) and level of effects as described in Table 24. A summary of magnitude of effects from this proposed project, and subsequent level of effects is provided in Table 16 and Table 17.

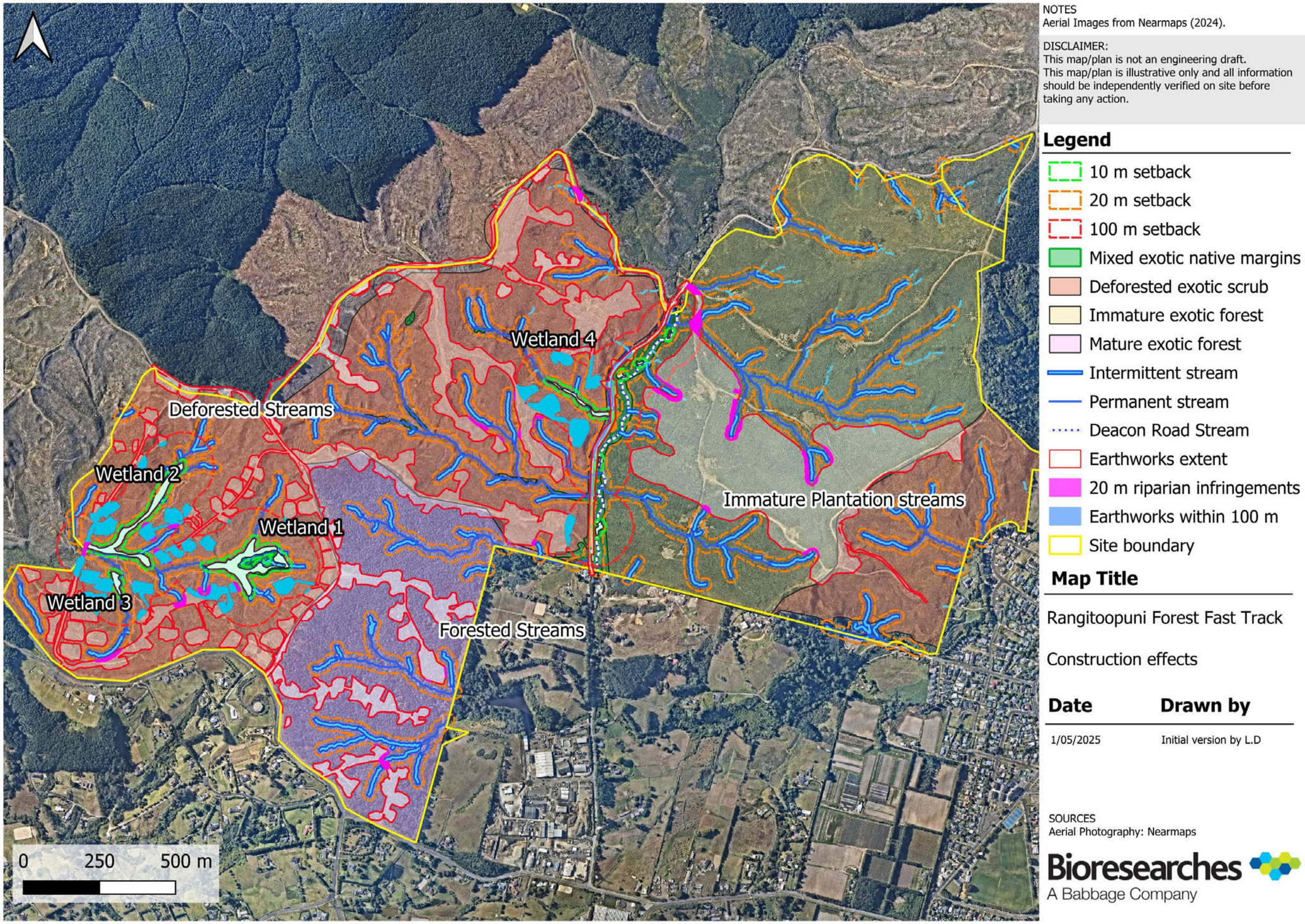
5.1 Proposed works

The proposed development involves the subdivision of Lot 1 to create 208countryside living lots, and Lot 2 to create 260 retirement villas, 36 care units and associated facilities. The plans indicate the residential lots will be sparsely situated within the clear-felled areas of the Project Area, outside of the riparian corridor vegetation and avoiding streams and wetlands. The Lot 2 development will be replacing immature pine plantation, avoiding streams, wetlands and indigenous vegetation extents, and minimising works within the freshwater 20 m setbacks.

Earthworks are proposed across the Project Area, which will be undertaken in 14 stages, to minimise the overall level of disturbance occurring at once (Maven, 2025). These earthworks will result in the removal of vegetation within Lot 1 and Lot 2, which may have subsequent adverse effects on terrestrial fauna including loss of habitat, disturbance during breeding season, displacement into the surrounding environment, injury and/or mortality. Stream reclamation and works within wetlands has been avoided, however streamworks are proposed as part of the earthworks to facilitate the upgrading and/or installation of culverts. These, streamworks, and adjacent earthworks have the potential to result in adverse effects from sedimentation in the adjacent aquatic habitats if unmanaged.

The operation phase of the development (i.e. residential stage) will result in the presence of impervious surfaces via roading and building platforms situated within the 20 m riparian yard, and the presence of culverts within the stream reaches (Figure 10). For simplicity, the land use effects and water infrastructure maps have been illustrated on separate figures. During this operational phase, the discharge of treated wastewater and stormwater on-site within close proximities to waterbodies, including streams and wetlands will occur (Figure 11). Extensive re-vegetation of indigenous plants being undertaken throughout the site. However, the countryside living lots and retirement facilities, and the associated activities surrounding these proposed lots and retirement village has the potential to increase the level of disturbance within the area through light, noise, movements, and predators.

Post-development, the Project Area will be densely revegetated with a range of indigenous forest vegetation, essentially replacing rotation pine plantation with a native forest ecosystem. This revegetation will provide significant increase in the ecological values of flora, streams, wetlands and both terrestrial and freshwater fauna. Considering the size and location of the site, re-vegetation will provide significant ecological linkages through stepping stones and corridors to the wider Auckland area (Boffa Miskell, 2025; Appendix D).



NOTES
Aerial Images from Nearmaps (2024).

DISCLAIMER:
This map/plan is not an engineering draft.
This map/plan is illustrative only and all information should be independently verified on site before taking any action.

Legend

- 10 m setback
- 20 m setback
- 100 m setback
- Mixed exotic native margins
- Deforested exotic scrub
- Immature exotic forest
- Mature exotic forest
- Intermittent stream
- Permanent stream
- Deacon Road Stream
- Earthworks extent
- 20 m riparian infringements
- Earthworks within 100 m
- Site boundary

Map Title

Rangitoopuni Forest Fast Track

Construction effects

Date	Drawn by
1/05/2025	Initial version by L.D

SOURCES
Aerial Photography: Nearmaps

Bioresearches
A Babbage Company

Figure 9. Proposed construction works within the Project Area and the proximity to ecological features.

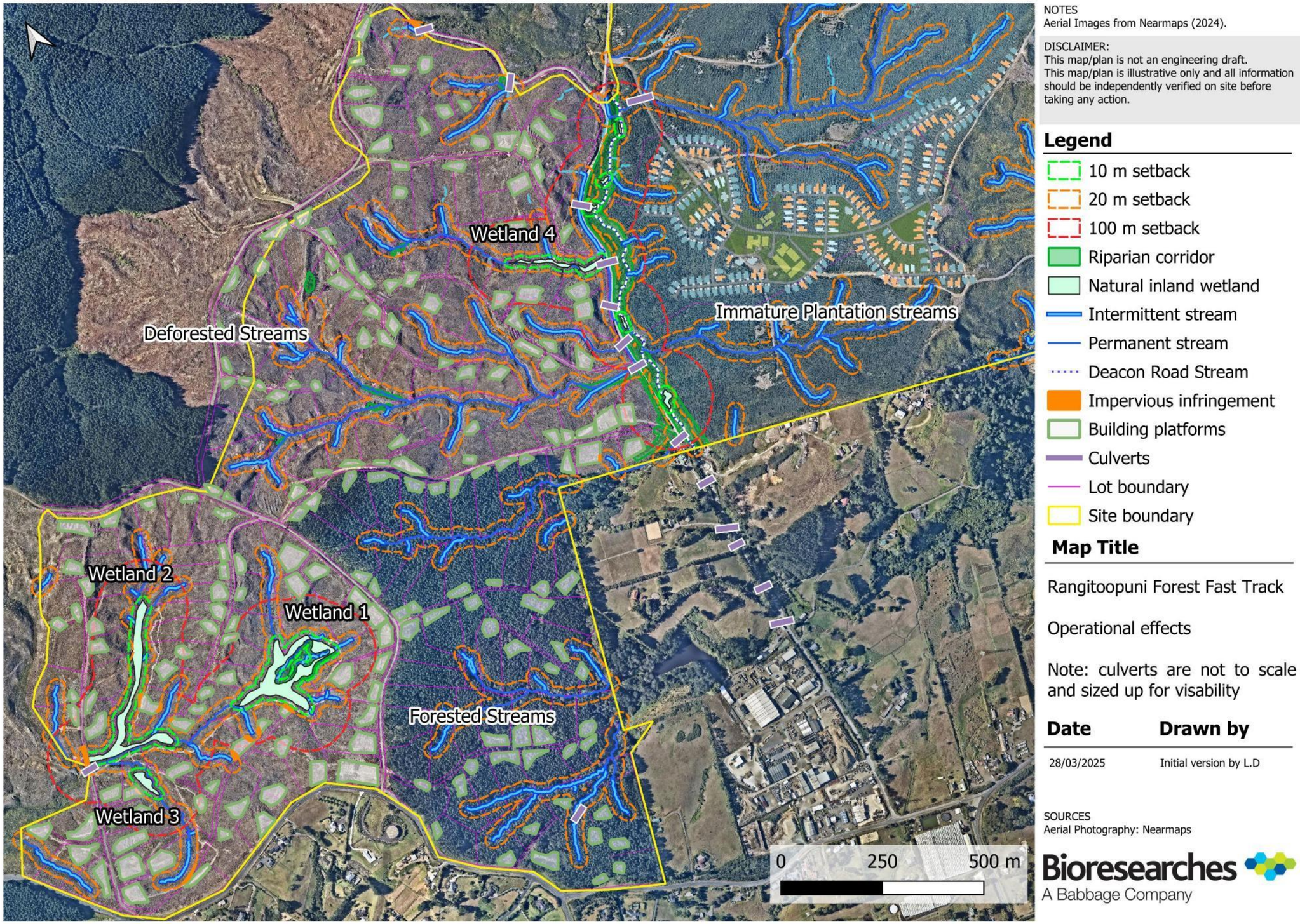
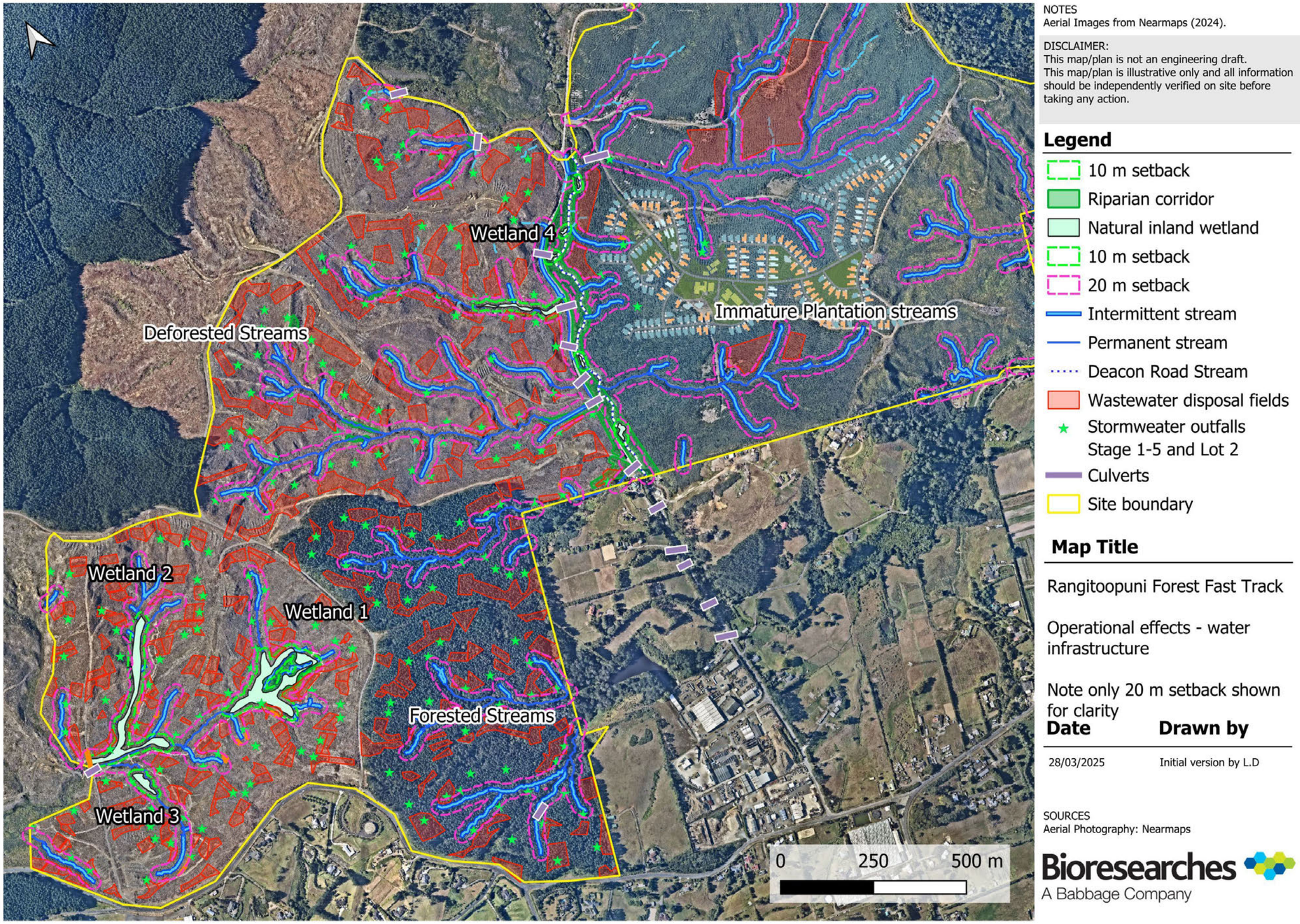


Figure 10. Operational effects of the Rangitoopuni Development on identified ecological features.



NOTES
Aerial Images from Nearmaps (2024).

DISCLAIMER:
This map/plan is not an engineering draft.
This map/plan is illustrative only and all information should be independently verified on site before taking any action.

Legend

- 10 m setback
- Riparian corridor
- Natural inland wetland
- 10 m setback
- 20 m setback
- Intermittent stream
- Permanent stream
- Deacon Road Stream
- Wastewater disposal fields
- Stormweater outfalls Stage 1-5 and Lot 2
- Culverts
- Site boundary

Map Title

Rangitoopuni Forest Fast Track

Operational effects - water infrastructure

Note only 20 m setback shown for clarity

Date	Drawn by
28/03/2025	Initial version by L.D

SOURCES
Aerial Photography: Nearmaps

Bioresearches
A Babbage Company

Figure 11. Associated water infrastructure within the development, and their proximity to identified ecological features.

5.2 Terrestrial Ecology

Within the Project Area, small areas of indigenous vegetation which remain along the riparian corridors have been avoided. The majority of terrestrial vegetation to be removed consists of exotic vegetation with common herbaceous native plants.

Habitats of the following high value fauna could be removed

- Copper skink (At Risk – declining);
- Pipit (At Risk – declining); and
- Long-tailed bats (Threatened – nationally critical).

It is understood Matariki Forests continues to own the mature pine trees, and these pines are scheduled to be felled from October 2025 through till March 2026, independent of the proposed development (Appendix A). The pines will be felled in accordance with the rules and regulations of the National Environmental Standard for Commercial Forestry (NES-CF). Because it is planned that the mature forestry will be felled prior to works on this project commencing, the baseline environment under which this effects assessment has been completed accounts for this, and assumes that in all areas where the vegetation is currently mature exotic forest, that at the time of development will instead be vegetated with Deforested – Exotic Shrub.

For this assessment, the appropriate scale at which to determine the magnitude and level of effects is the local landscape, where there are large, albeit somewhat fragmented, areas of protected (SEA) indigenous vegetation surrounding the Project area, including the wider Riverhead Forest.

5.2.1 Deforested Exotic Scrub

5.2.1.1 Direct Effects

Direct effects of removal of the exotic scrub patches are restricted to the loss of any indigenous vegetation, such as tūrutu, interspersed amongst exotic weed species and slash. These plants are of low ecological value and do not form a cohesive forest tier or ecosystem type.

Their loss comprises a **negligible** magnitude of effect.

5.2.1.2 Indirect Effects

Removal of areas of exotic scrub along the eastern edge of the Project Area may result in loss of some buffering for native ecosystems.

The magnitude of indirect effects are considered to be **Negligible**.

5.2.2 Riparian Corridors

5.2.2.1 Direct Effects

The proposed works will not result in the removal of riparian corridors, as works will be setback from the identified freshwater systems. As such, no adverse impacts should occur to this vegetation type. Mature native trees have values as sources of seed for regeneration in nearby forest areas and as a potential source of food and nest sites for mobile native fauna such as birds. As the loss of these

corridors have been avoided, it will provide a valuable source of food and nest sites for mobile native fauna such as birds, and commuting pathways for long-tailed bats through the site during the construction phase.

These riparian corridors are largely isolated, or connected to areas of recognised/registered pest vegetation (gorse and pine). Works surrounding the corridors should not result in an increase in edge effects from loss of buffering function. Following the development, pest plant and animal management be undertaken, which will result in a reduction of exotic plant species, and promotion of indigenous vegetation.

The magnitude of effect is **Negligible.** However, with the proposed pest plant and animal control, and revegetation of the surrounding area, the development will result in a **net positive** gain in regards to botanical values.

5.2.2.2 Indirect Effects

The indirect effects of the loss of these individual trees and small stands will not affect buffering of remaining forest areas. They could act as minor stepping stone habitat across the deforested matrix of open, disturbed ground for birds.

The magnitude of indirect effects is considered to be **Low**.

5.2.3 Mature Exotic Forest

5.2.3.1 Direct Effects

As described above, no mature exotic forest will remain on site at the time of the commencement of this project, and this habitat will have been replaced with deforested exotic scrub. Therefore, effects to this habitat type associated with this project have not been considered further.

Their loss comprises a **negligible** magnitude of effect.

5.2.3.2 Indirect Effects

Removal of areas of exotic forest along the south-western block of the Project Area will not result in loss of buffering for native ecosystems, as this vegetation type will be removed prior to the implementation of the development.

Their loss comprises a **negligible** magnitude of effect.

5.2.4 Immature Exotic Forest

5.2.4.1 Direct Effects

Direct effects of removal of the exotic scrub patches are restricted to the loss of any indigenous vegetation, such as gahnia, interspersed amongst exotic weed species and young commercial plantation. These plants are of low ecological value and do not form a cohesive forest tier or ecosystem type.

Their loss comprises a **negligible** magnitude of effect.

5.2.4.2 Indirect Effects

Removal of areas of exotic scrub along the eastern edge of the Project Area extent may result in loss of some buffering for native ecosystems.

Their loss comprises a **negligible** magnitude of effect.

5.2.5 Effects on fauna

5.2.5.1 Habitat Loss and displacement

Earthworks would result in the removal of predominantly exotic scrub, slash and immature pines which have limited habitat value. The avifauna and herpetofauna values, identified by desktop and site observations, reflect this degradation, being generally low diversity and comprised of species that are tolerant of highly modified environments, including those 'high value' species (copper skink and pipit) that supported 'moderate' assessments for lizard and bird fauna values respectively. Additionally, long-tailed bats have been previously recorded within the site and are known to utilise pine forestry, although the long-term impacts of forestry operations on this population are unknown.

Copper skink, while assessed as a declining species, remains common and widespread in the Auckland region, including urban gardens. Copper skinks also readily colonise newly growing vegetation along the edges, including areas that are not maintained for several months, such as rough grasses. Similarly, pipits are widespread in rough, open habitats such as pasture and rough farmland throughout the Auckland Region and would not otherwise be expected to be present with forest or scrub vegetation cover. As vegetation removal is not proposed within the wetland habitats, wetland avifauna are not considered further. Exotic trees within the forestry blocks may be used for foraging, roosting or nesting, however the loss such trees within the surrounding landscape is considered a negligible magnitude effect on avifauna.

Long-tailed bats are expected to be present in the area, as a highly mobile species with a known population in Riverhead Forest. They may see alteration to commuting routes, with potential non-permanent loss of foraging and roosting habitat. Works will be set back from streams, which are commonly used by bats as flyways and for foraging/ drinking. However, long-tailed bats may also forage over open areas of the site where proposed works could influence prey populations. Operational impacts such as increased predator populations, artificial lighting, and noise could further degrade bat habitat if not managed.
The majority of trees of sufficient size to support roosting habitat are within the pine block, which is to be felled independently of the proposal as part of normal forestry operations. There are isolated exotic trees scattered across the site that support potential roost features, although these are very limited and likely to have features with poor thermal stability due to exposure.

The magnitude of loss of these highly modified environments to avifauna and herpetofauna is **low.** The magnitude of loss to long-tailed bats is **moderate** given there is a known population associated with Riverhead Forest, of which the 395 ha site comprises approximately 8 %.

5.2.5.2 Mortality and displacement during vegetation removal

Unmanaged removal of vegetation (both native and exotic) and habitat is expected to result in displacement and mortality to fauna, including, lizards, flightless birds (such as unfledged chicks) and roosting bats, which are protected under the Wildlife Act (1953). The site offers breeding opportunities for pipit within long grasses, and nesting habitat for other common avifauna within trees proposed for removal. The rank grassland on site may provide habitat for copper skink, which could be harmed during removal of this vegetation.

The works within the site, including vegetation removal and earthworks, is proposed to be staged, minimising the overall level of disturbance occurring within the site, and restricting this level of disturbance to a smaller "direction/orientation" to these habitats.

Displaced fauna have a lower likelihood of survival where the carrying capacity of adjacent habitats is stressed through increased competition for fewer resources. Displaced animals have a higher probability of risk of predation by both exotic and native predators. For 'At Risk' and 'Threatened' species, this effect can be significantly greater, and greater still during important seasonal periods such as breeding.

With the planned removal of the mature exotic forest habitat, it is assumed that all long-tailed bat (Threatened – Nationally Critical) habitat within the site will be removed prior to works commencing and thus there will be very minimal potential roosting habitat remaining within the site. However, it is possible that LTBs will continue to utilise flight corridors or foraging habitat within the site and therefore could still be subject to disturbance effects associated with the proposed development. This could result in temporary avoidance or abandonment of the site by bats, leading to habitat fragmentation and a loss of foraging habitat for the local bat population. Without mitigation, this could have a **moderate** level of effect to bats.

It is highly recommended that the felling of the mature exotic forest, undertaken by Matariki Forest is undertaken in accordance with the relevant requirements in the NPS-CF in regards to bats.

These potential effects would be avoided or minimised, in accordance with the effect's management hierarchy, by way of fauna management, detailed in fauna management plans (i.e. lizard, bird and bat) and bat mitigation measures as described in Section 6.3. Effects management measures would adopt standard controls prior to, and / or during vegetation removal works, and also ensure that ongoing impacts to these species are minimised.

5.2.5.3 Indirect/operational effects

Lighting

The subdivision will introduce additional light to the local area, increasing the impact upon the nearby ecological habitats. For example, in Auckland, artificial lighting at night (ALAN) has been shown to have a significant negative effect on migratory seabirds (Heswall *et al*., 2022), disorientating them, consequently causing hundreds of collisions and mortalities annually. Long-tailed bats have been found to avoid ALAN, potentially disrupting natural behaviours and habitat use, and even leading to effective habitat loss through avoidance of areas (Schamhart *et al.,* 2024).

Effects management recommendations are discussed in Section 5.4.2.

Predation

Given the level of housing that will be introduced into the area, compared to current pressures, there is the high potential for high populations of predators being introduced, increasing pressure on both lizard, bird and bat populations within the site, and within the surrounding area. Given the likelihood of 'threatened' and 'at risk' fauna found on site, having been detected within the area and within

desktop assessments, domestic animal restrictions are recommended and pest animal controls implemented, and discussed in Section 5.4.2

Noise and vibration

Construction and human habitation will alter the soundscape of the area. Current forestry operations involve noise from machinery during management and felling. Earthworks and construction of the proposed development will similarly produce temporary, high-intensity noise and vibration, but urbanisation of the area can be expected to lead to a permanent increase from typical baseline sound levels. This includes noise from roads and human activity throughout the area which may negatively impact fauna including birds, bats, and lizards. Potential negative effects include avoidance of areas, decreased ability of fauna to detect auditory cues/ signals (influencing communication, foraging, predator detection, etcetera), stress, and alteration of vocal communication which may impose greater metabolic costs.

Research in this space is very limited in Aotearoa and has mostly focused on chronic, high-intensity noise such as motorway traffic. Effects of vibration on native fauna have not been tested in isolation. There are limited options for management of noise that comes with human habitation, but it is worth noting that the roads associated with the proposal are not high-speed and can be expected to mostly be used by residents and therefore not highly trafficked.

5.3 Freshwater Ecology

Effects to freshwater ecological features, including streams and wetlands, arise construction effects, being disturbance via earthworks and vegetation removal, and operational effects from infringements of impervious surfaces and discharge of stormwater and wastewater. With the exception of culvert upgrading and installation, streamworks have been avoided, minimising direct impacts to water bodies.

5.3.1 Construction effects

5.3.1.1 Vegetation Removal

The proposed earthworks will result in vegetation removal within 20 m of rural streams, particularly those streams which are forested by mature and immature pines, and Wetland 2. Vegetation to be removed largely consists of exotic vegetation with some indigenous bush. Vegetation removal within 10 m of natural inland wetlands will be restricted to exotic gorse and weedy vegetation. Part of this vegetation removal will include the commercial harvest of pines by Matariki Forest. The NPS-CF requires the retention of the riparian zone of 5 or 10 m (dependent upon stream width), which should provide some protections to the freshwater values within the ‘Mature Exotic Forest’.

A total of 23,745 m^2 of vegetation is proposed to be removed (9,930 m^2 from Lot 1 and 14,314 m^2 from Lot 2) from the riparian yards throughout the entirety of the site, equating to 2.6% of the total 20 m riparian yard, which covers a total area of 90 ha. This vegetation removal will be largely temporary to enable to bulk earthworks for levelling Lot 2 and building platforms and accessways in Lot 1.

In regards to individual stream reaches, <1% to 38% of vegetation within the riparian yard will be removed. Table 12 summarises the area of vegetation removal, and the associated proportion of riparian yard for the affected stream reaches.

Table 12. Extent of vegetation removal within the 20 m setback of streams and wetlands, and the proportion of riparian yard this removal represents.

Stream group	Classification	Riparian yard size (m^2)	Earthworks extent (m^2)	Representation of riparian yard (%)
Deforested streams	Intermittent	4,045	317	7
	Intermittent	3,603	62	2
	Intermittent	6,263	1,575	37
	Intermittent	6,706	2,307	34
	Intermittent	7,759	1,879	28
	Intermittent	6,706	363	12
	Intermittent	6,707	322	5
	Intermittent	8,492	1,033	12
	Permanent	19,444	15	<1
	Permanent	13,356	868	6
Forested streams	Intermittent	25,130	24	<1
	Permanent	23,281	16	<1
	Intermittent	5,550	76	1
	Permanent	28,036	13	<1
	Intermittent	8,324	561	6
Immature plantation streams	Intermittent	5,047	816	16
	Intermittent	8492	195	2
	Intermittent	3,603	61	2
	Intermittent	6,263	2,364	38
	Intermittent	7,759	2,490	32
	Intermittent	8,144	561	7
	Intermittent	6,706	2,560	38
	Permanent	9,336	3,116	33
	Permanent	11,336	14	<1
	Permanent	19,444	15	<1
	Permanent	13,356	868	7
Wetland 1	Permanent	34,484	233	<1
Wetland 2	Permanent	33,464	532	1.5
Wetland 3	Permanent	5,960	489	8

The removal of vegetation within the relevant setbacks will be exotic with no indigenous vegetation to be removed, with the exception of tūrutu. The vegetation proposed to be removed predominantly consists of exotic gorses and 6-year old pines with occasional herbaceous terrestrial vegetation. This vegetation removal will result in a reduction in the filtration capacity of 1% - 38%, dependent upon the degree of vegetation being removed, which may result in decreased water quality within the streams.

The vegetation removal representing 30% or less of the 20 m riparian yard was considered to be of **Low** magnitude, as this would result in minor changes to the functioning of the riparian yard. The

removal of vegetation greater than 30% of the riparian yard was considered to be of **Moderate** magnitude as this would have partial change in the riparian yard functions, particularly filtration and stabilisation, however factors such as shade and organic matter inputs will be largely unchanged. This vegetation removal will have a **Very Low** to **Moderate** level of effect, depending upon the stream classification.

5.3.1.2 Earthworks

Earthworks are proposed within 100 m of the natural inland wetlands. These earthworks cover a total area of 76,023 m^2 of ground within the 100 m wetland setbacks. Table 13 displays the area of earthworks within the 100 m setback, distance from the wetland margins, and the proportion of contributing catchment these earthworks represents.

Table 13. Summary of earthworks within 100 m of the natural inland wetlands.

Wetland	Wetland size (m^2)	Catchment Size (m^2)	Area of earthworks (m^2)	Distance from earthworks (m)	Representation of catchment (%)
Wetland 1	11,489	31,314	11,200	12	35
Wetland 2	9,513	89,960	23,000	16	21
Wetland 3	1,191	66,820	10,300	2	15
Wetland 4	1,871	176,644	4,200	16	8.4
Sedgelands*	126-575	290,6969	27,323	9	0.9%

*sedgelands considered cumulatively

Earthworks will be undertaken in stages, with discrete areas for future housing platforms levelled within the setbacks (Table 14). These earthwork sections range up to 4,810 m^2 of ground cover, and includes works on the existing forestry roads. These earthworks blocks will be formed through a combination of cut and fill to create level housing platforms for future development. The majority of cut and fill earthworks within the 100 m setback will be shallow, with alteration of ±1 m ground level. Given the degree of cut depths, the earthworks are not anticipated to intercept groundwater, or result in the drawdown of groundwater. As the earthworks will be staged and undertaken within discrete blocks at shallow levels, it should not result in the alteration of waterflow from the upper reaches to the streams and subsequently to the wetlands. Additionally, as the development is proposed to be undertaken in stages, the degree of earthworks occurring within the 100 m setbacks will not occur cumulatively, rather will be staged over a period of time.

Table 14. Proposed staging of works in relation to wetlands and wetland catchments

Wetland	Staging	Earthworks area (m^2)	Representative catchment (%)
Wetland 1	Stage 3	4,784	15
	Stage 4	3,145	9
	Stage 5	3,218	10
Wetland 2	Stage 1	3,256	3
	Stage 2	8,761	8
	Stage 3	2,294	2
	Stage 5	8,687	8
Wetland 3	Stage 1	7,100	11
	Stage 3	3,120	5

Wetland 4	Stage 14	4,151	8.4

Earthworks within 100 m of the sedgelands is proposed for the purpose of ground levelling for the retirement village, and cut and fill for the upgrading of the existing Deacon Road. The sedgelands are situated on the floodplain of Deacon Stream, and hydrologically supported by this watercourse. Whilst the earthworks associated with the Deacon Road upgrading will be located within 10 m of the sedgelands, the activity of fill earthworks on the existing upslope should not result in a reduction or significant alteration of contributing catchment to the sedgelands. The earthworks within the 100 m setback for the purpose of housing and roading upgrades would affect a negligible proportion of the contributing catchment.

The majority of earthworks will be undertaken adjacent to, or on the downstream extents of the wetlands, with the upstream catchments being relatively unmodified. These downstream extents are located 40 m away from the wetland margins, and therefore should not alter the levels of the lower catchment to encourage greater volumes and velocities of flows from the wetlands. As the earthworks will be undertaken outside of these watercourses and particularly for Wetland 1, largely downstream of the contributing flow paths and wetland margins, the flow of water into, and through the wetlands should not be affected. Whilst up to 37% of the total contributing catchment of the natural inland wetlands will be affected through the earthworks, the overall alteration of land within the wetlands 100 m setback will result in up to 15% of the contributing catchment being modified at one time through ground level changes of ± 1m.

Overall, while there is a large extent of earthworks proposed within 100 m of natural inland wetlands, representing up to 37% of the contributing catchment of some wetlands, these earthworks were considered to be of **Low** magnitude, as they are shallow earthworks which will minimally manipulate the ground level to form level housing platforms. These earthworks and should only have a minor alteration surrounding hydrology of the area, which should not result in the changes to the existing natural character of the wetlands.

5.3.1.3 Sedimentation and streamworks

Earthworks within the site has the potential to generate Works within the site could generate sediment, which would negatively impact freshwater habitats adjacent to the works areas. The release of excess fine sediment into streams through changing land use is recognised as a major impact on stream health. Increased fine sediment input to aquatic habitats can reduce visual clarity, clog respiratory structures of animals (such as the gills of fish), degrade benthic habitats and may result in burial and suffocation of aquatic biota (Clapcott *et al.,* 2011).

The potential magnitude of sedimentation effects without management to minimise or mitigate adverse impacts is considered to be **High** due to potential adverse impacts to the immediate downstream receiving environment.

5.3.1.4 Fauna effects

Streamworks associated with the culvert works has the potential to result in the loss, mortality, or harm to indigenous fauna, including 'At Risk' species. Barriers to fish passage (natural and man-made) can limit density and diversity of fish expected to be present throughout the site.

The magnitude and level of the potential effect on native freshwater fauna is without management is considered to be **Moderate** due to the nature of the activity, extent of habitat loss/alteration, the density and threat status of impacted species, and the ability of fauna to escape the disturbance. There is a high potential for injury or mortality of native freshwater fauna during the streamworks in the absence of controls.

5.3.2 Operational effects

5.3.2.1 Riparian yard infringement

Minor infringements into the riparian yard are proposed on Lot 1 and Lot 2. These surfaces will consist of the proposed roading and building platforms. Whilst the full extent of the building platforms may not encompass impervious surfaces, whilst also noting that the proposal is not for dwellings and solely subdivision in relation to Lot 1, the entirety of the building platforms which fall within the 20 m setback has been conservatively assessed as impervious infringement.

The project will introduce a cumulative 1,340 m^2 of impermeable surfaces to the 20 m riparian yard, consisting of roading and housing platforms. This infringement represents 0.5% -4% of the 20 m riparian yard of each affected stream within the Project Area (Table 15). Currently, the floodplain and riparian zone immediately adjacent to the relevant streams predominantly consists of bare ground and exotic scrub vegetation or immature pine plantation and thick gorse cover.

Table 15. Degree of riparian yard infringement by impervious surfaces, and the percent of riparian yard this infringement represents.

Stream group	Classification	Riparian yard size (m^2)	Infringement (m^2)	Representation of riparian yard (%)
Deforested	Intermittent	17,707	104	0.5
	Intermittent	6,249	281	4
	Intermittent	4,872	156	3
	Intermittent	3,050	24	0.7
	Intermittent	3,011	98	3
	Intermittent	5,803	60	1
	Permanent	24,324	421	1.7
	Permanent	7,743	108	1.3
	Permanent	24,324	51	0.2
Immature forested	Intermitted	6263.000	40	0.6

As such, the introduction of impervious surfaces, and subsequent "reduction" in filtration and groundwater connectivity will result in a minor shift from the current baseline conditions. The impervious surfaces, equating to <5% of the 20 m riparian yard, was considered to be of **Low** magnitude, resulting in an overall **Very Low - Low** level of effect.

5.3.2.2 Wastewater Discharge

Wastewater disposal fields associated with Lot 2 will be placed within a separate catchment to the wetlands, in which the Deacon Stream acts as a hydrological barrier between the wetlands the disposal fields. One Sedgeland is located on the Deacon Road bank adjacent to the Retirement Village. This wetland is located over 100 m from the closest wastewater disposal field. However, wastewater disposal fields will be located within 15 m of streams within the site. Wastewater disposal fields within

Lot 1 will be situated within close proximity to waterbodies, at least 15 m from the edge of wetlands and streams (GWE, 2025). The location of the wastewater disposal fields are illustrated in Figure 11.

Wastewater will be treated on-site in accordance with Auckland Council's guideline documents for on-site wastewater management in the Auckland Region (TP58). The wastewater treatment system (WTS) will include primary (septic tank) and tertiary (UV disinfection) treatment, as described by GWE (2025). The land application system has been designed to provide adequate treatment of effluent within the dispersal field despite peak wet weather conditions, in accordance with TP58. The effluent flows are discharged via PCDI pipes which will be surface laid, covered by a layer of mulch and planted (GWE, 2025). Various aspects of this design (e.g., slope, soil permeability, planting, etc.) prevent excess rainfall from reaching the wastewater and prevent the effluent discharging directly to the nearby wetland as surface runoff.

The design of the WTS ensures that only low concentrations (and loads) of nutrients remain in the wastewater, which will be discharged to land via PCDI pipes in in, mulch and planting. As the treated wastewater percolates through the dispersal field, the effluent experiences additional treatment through a range of catabolic processes that will reduce contaminant concentrations below the values outlined GWE (2025). The wastewater dispersal fields will provide further treatment and reduce the concentration of contaminants within the discharge. Under aerobic conditions, soil microbes break down and consume organic materials, thus reducing the effluent's BOD_5 content further. Due to the hostile conditions of the soil (high temperature or moisture content), any remaining pathogens will either perish or be consumed by other organisms. Similarly, phosphorus content will be reduced via adsorption to soil minerals and hydrous oxides. The binding of phosphates to these sorption sites within the soil reduces the risk of phosphates leaching to groundwater.

The total nitrogen content of the effluent is also reduced during processes of nitrification and denitrification. During nitrification, ammonia-oxidising bacteria convert remaining ammonia into nitrite, which is then oxidised by nitrite-oxidising bacteria into nitrate. Denitrification is carried out by anaerobic bacteria located within compact soil closer to the water table. In this biological process, nitrate is reduced to inert nitrogen gas, which is slowly returned to the atmosphere via diffusion. As a result of these naturally occurring processes that take place within a septic dispersal field, any effluent that reaches the nearby wetland is expected to be of a much lower nutrient content than that predicted by GWE (2025) &, TP58. Multiple studies have shown that a properly functioning dispersal field is able to attenuate the contaminant content between 60-90% below the concentration of effluent exiting the WTS (Washington State Department of Health, 2014; Lusk, *et al* (2018).

The disposal fields will be planted with a variety of indigenous plants (Appendix F - Table 27), which will further assist in the uptake of any residual contaminants such as nitrogen and phosphorus, prior to water tricking from the disposal fields. Additional treatment of the wastewater by the disposal fields and surrounding vegetation will further reduce the level of contaminants present.

Whilst some disposal fields are located in close proximity to the wetlands, the treatment level and disposal field processes should ensure the level of contaminants entering these wetlands is low, and at an acceptable level per TP158, which should not result in adverse impacts to the quality of water

within the wetlands. Some water may enter these wetlands due to the close proximity, however this should not result in the hydrological interference, or change in water levels of the wetlands.

The space between the wastewater disposal field and the waterbodies will be revegetated with indigenous vegetation. It is likely the vegetation present within close proximity to the dispersal fields will adapt to the low levels of wastewater loading and may show signs of accelerated growth due to the slight increase in the supply of nutrients (Meister, *et al*., 2022). Trees and shrubs are less capable of intercepting and filtering contaminants associated with surface water flows (as the stems and trunks are too coarse to trap contaminants). However, groundcover and forest floor organic matter (humus) will provide a high degree of filtration function of treated wastewater as it sheets flows over land. Additionally, water which infiltrates soils will be "filtered" by nitrogen uptake of the larger trees and shrubs. This natural infiltration and interception processes within the forest vegetation via soils, and groundcover and humus will likely to uptake residual nutrients after treatment and the disposal field, before the discharge can enter surface water environments. Land application to indigenous forest reduces the nutrient loading in water bodies due to the infiltration of water through soils, and subsequent uptake by plants.

As such, the proposed wastewater disposal fields and the discharge of highly treated wastewater within 100 m of natural inland wetlands, and 15 m of streams, was considered to be of **Low** magnitude, as this discharge should not result in the decline of water quality and ecosystem health. Overall, the wastewater discharge will have an overall **Very Low** to **Low** level of effect.

5.3.2.3 Stormwater Discharge

No existing stormwater infrastructure is present on site, therefore the project proposes to construct a stormwater line to service the proposed lots, as detailed in Maven (2025b). Stormwater on Lot 1 is proposed to be discharged to the existing streams and wetlands, including within 100 m, while Lot 2 will discharge stormwater to streams. The stormwater outfalls will be located at minimum, 10 m from the edge of streams and wetlands (Maven, 2025b), avoiding direct discharge to these water bodies. The location of the stormwater outfalls are illustrated in Figure 11.

Stormwater is proposed to be treated via grass swales on Lot 1 and rain gardens on Lot 2, with native revegetation and stream planting being situated between the proposed discharge points and waterbodies. This should ensure the quality of water being discharged from the outfalls will be of acceptable quality and should not compromise water quality within the streams and wetlands.

Erosion and control measures (rip rap) will be installed on the outlet to reduce the potential for scour and erosion into the watercourse. The rip-rap will reduce the velocity of stormwater discharge and disperse flows, appropriately mitigating for erosion and scour in the 10 m setback. Additionally, the downslope of the outfall beyond the rip-rap will be lined with coconut matting, or equivalent, and planted to provide further stabilisation and erosion and scour protections.

As the stormwater will be collected on site, and discharged back into the same catchment, the development should achieve hydrological net neutrality. The discharged stormwater will be discharged to land; however, sheet flows may recharge the wetland via groundwater, in much the same way rainfall currently would enter the wetland. As such, this discharge should not change the hydrology or water level within the wetlands.

The discharge of stormwater into the streams and wetlands was considered to be of **Low** magnitude, as the stormwater should not result in noticeable changes to the ecological function of these water bodies. As such, the discharge of stormwater was considered to have an overall **Very Low** to **Low** level of effect.

5.3.2.4 Culverts and fish passage

Existing culverts, associated with the forestry operations will be upgraded, and additional culverts installed where required to facilitate the roading. A total of sixteen culverts, of which fifteen will replace existing culverts, and one new culvert, will be installed as part of the development, as illustrated in Figure 10 and Figure 12. The culverts will range between 17 and 29.9 m and be placed along the same alignment as the existing culverts, parallel to stream flow.

The culverts will consist of box culverts with one-barrel culverts, dependent upon the flood capacity and roading requirements, with the box culverts ranging from 1.5 m to 6 m in width, and the barrel culvert having a diameter of 1.5 m. The width of the culverts will span the bankfull width of the streams, and achieve the 1.3x bankfull width requirement of the NES-F. This sufficient width should minimise the erosion on the banks and the constriction of flow. The culverts will be embedded 25% into the ground which will ensure sufficient depth and transportation/movement of sediment and debris is achieved. To minimise the degree and duration of the disturbance the culvert installation, the replacement culverts will not be placed on the same gradient as the existing culverts. These forestry culverts are perched and would require a greater degree of streamworks to re-level the stream bed.

Within the culverts, a low flow channel will be installed with reference to “stream simulation”. This will allow for the installation of stream substrates such as cobbles, gravels and small boulders, providing for a variety of hydrological requirements, such as resting pools, and provide passage pathways on stream edges and mid water column. The extent of embeddedness and low flow channel should maintain the cross-sectional water depth of the upper and lower reaches. Within culvert 6, this low-flow channel may be designed to create organic flexi-baffles, or a similar velocity control, to provide for fish passage.

Due to the current state of the existing culverts (i.e. perched), culvert placement on the same gradient cannot be achieved without extensive streamworks to re-grade the stream bed. As such, the culverts will be placed along a steeper gradient than what is currently present. The low flow channel and substrates will be embedded into the channel to provide low-flow areas, resting pools and wetted margins, in much the same way natural stream channels are formed (Figure 12). These features will allow for fish to travel upstream (Franklin *et al*., 2024), and will likely replicate the sloping natural stream channels which area present throughout the Project Area and wider catchment.

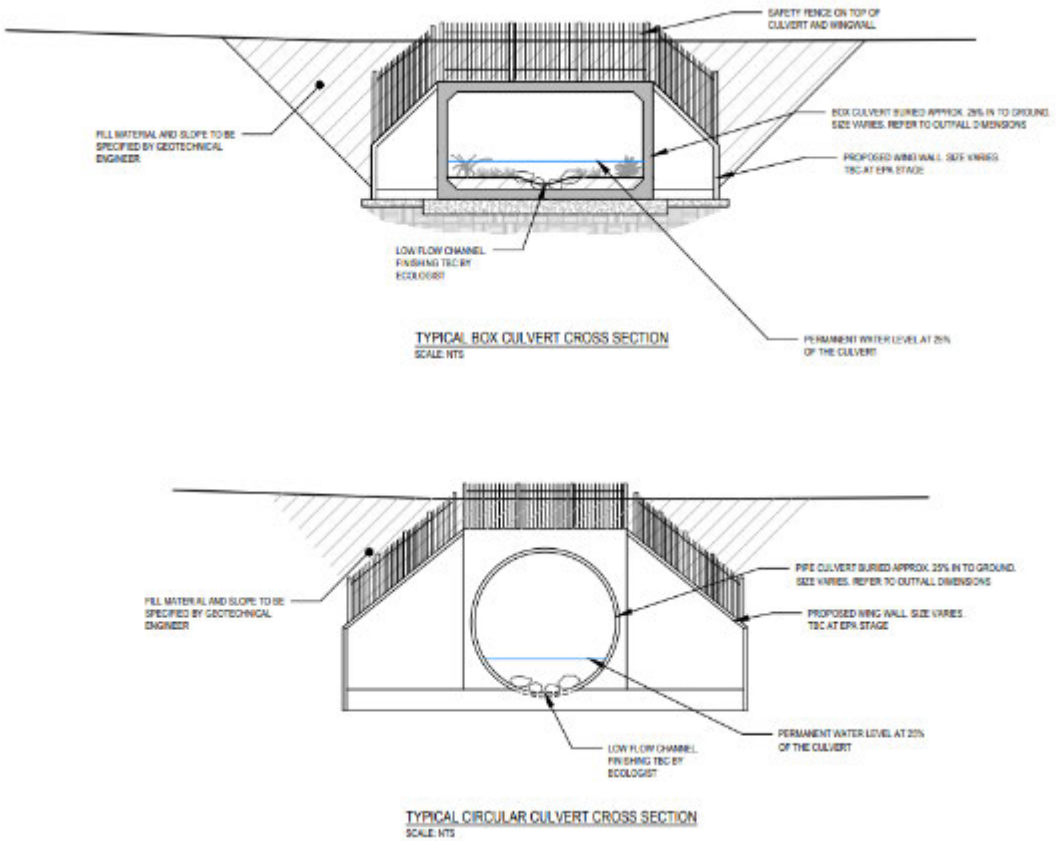


Figure 12. Typical barrel and box culvert design proposed throughout the Project Area showing the stream simulation low-flow channel, replacing fifteen existing forestry culverts. Prepared by Maven.

Currently, extensive slash and forestry debris within the streams likely restricts the degree of passage present, with the existing culverts throughout the Project Area consisting of perched forestry culverts, restricting fish passage. The sixteen proposed culverts will result in an overall increase in the connectivity throughout the catchment compared to the current conditions. The stream simulation will create low-flow zones and resting pools which will allow for the permanent movement of fish through the culverts. Therefore, approval under 'Standard Fisheries Activity' is not applicable as fish passage will not be impeded. The replacement and installation of new culverts, as it relates to fish passage will have an overall **Low** magnitude of effect, resulting in a **Very Low** to **Low** level of effect.

5.4 Proposed measures to reduce severity of adverse impacts

5.4.1 Terrestrial vegetation

No adverse impacts to indigneous terrestrial vegetation should arise from the proposed development. Alteration or impacts to indigenous vegetation has been avoided.

5.4.2 Terrestrial fauna

Measures to reduce adverse effects on terrestrial fauna have been addressed during the construction phase (i.e. habitat removal and disturbance) and the operational phase (i.e. light, anthropogenic pressures).

5.4.2.1 Construction Phase

Habitat loss: Clearance of the site will result in a permanent loss of this roosting, nesting and feeding habitat for native birds, lizards and bats within the site. The Site is proposing to revegetate the harvested pine plantation to indigenous vegetation, albeit throughout a 208-lot subdivision, will provide significant increase in the indigenous biodiversity throughout the area. This restoration planting is expected to manage the loss of habitat for native birds and lizards, and therefore the habitat loss will only be a temporary effect. Once the trees are established, there will be an increase in the habitat available to native birds and lizards. This revegetation will cover extensive areas of the Project Area (), and consist of a diverse range of indigenous vegetation with recognised roost and food resource trees to long-tail bat; including kauri, tōtara, kānuka, pūriri and rimu (Borkin & Martin, 2018; Appendix D, Appendix F - Table 25).

Fauna Management Plans for birds, bats, and lizards should be implemented to minimise adverse effects from the proposed development. The relevant fauna management plans have been prepared and detailed within the Ecological Management Plan (2025).

The Ecological Management Plan, as it pertains to terrestrial fauna includes and details:

- **Lizard management plan:** will minimise the effect of vegetation clearance to ensure that there is no overall reduction in the size of populations of At-Risk lizard species (copper skink and other potentially-present species) and occupancy across their natural ranges. The LMP should provide details on how injury and mortality to any high-value lizards within the footprint will be minimised to ensure that there is no overall reduction in the size of populations of At-Risk lizard species (copper skink and other potentially-present species) and occupancy across their natural ranges. The Native LMP will provide methods for capture, including trapping and / or search effort, timing of implementation, an assessment of the release locations, any habitat enhancement required and monitoring methods.

  The LMP addressed the following (where relevant):
  - Credentials and contact details of the ecologist/herpetologist who will implement the plan;
  - Timing of the implementation of the LMP;
  - A description of methodology for survey, trapping and relocation of lizards rescued including but not limited to: salvage protocols, relocation protocols (including method used to identify suitable relocation site(s)), nocturnal and diurnal capture protocols, supervised habitat clearance/transfer protocols, artificial cover object protocols, and opportunistic relocation protocols;
  - A description of the relocation site(s); including discussion of:
    - provision for additional refugia, if required e.g. depositing salvaged logs, wood or debris for newly released native skinks that have been rescued;
    - any protection mechanisms (if required) to ensure the relocation site is maintained (e.g.) covenants, consent notices etc;
    - any weed and pest management to ensure the relocation site is maintained as appropriate habitat.
  - Monitoring methods, including but not limited to: baseline surveying within the Site; baseline surveys outside the Site to identify potential release sites for salvaged lizard

populations and lizard monitoring sites; ongoing annual surveys to evaluate translocation success; pre and post – translocation surveys; and monitoring of effectiveness of pest control and/or any potential adverse effects on lizards associated with pest control;
    - A post-vegetation clearance search for remaining lizards.
- **Avifauna Management Plan**: As the native forest bird breeding season generally occurs from September to March (inclusive), whilst pipit breeding season occurs from August to March (inclusive), vegetation removal must be undertaken outside August to March inclusive, except where a suitably qualified ecologist has confirmed that vegetation (including trees and long, dense grasses) is clear of any native nesting birds, eggs, or chicks. This vegetation check should be done within 24 hours of the proposed vegetation clearance. Should an active nest be found, a 15 m exclusion zone must be demarcated, and works must remain outside of this zone until the chicks have fully fledged.
- **Bat Management Plan:** At the time of development, long-tailed bats will have highly limited options for roosting within the site. Whilst the removal of mature trees by the development has been largely avoided, in the circumstance a tree with bats roosting inside was felled, this could lead to the death or injury of native bats. Desktop assessment shows past long-tailed bat records within the project area and this must therefore be considered a potential risk of the project if effects management for bats is not undertaken. To reduce this risk, the Department of Conservation (2024) 'Protocols for minimising the risk of felling occupied bat roosts' (the 'Bat Roost Protocols', or BRP) must be followed. This process is summarised in Figure 13.

  The Bat Management Plan (BMP) is to be implemented to address effects of the projects to bats and ensure that appropriate effects management measures are in place. This should include:
    - Controls on artificial lighting;
    - Pest management;
    - Noise and vibration management;
    - Management of alteration, fragmentation, or loss of commuting ,foraging and potential roosting habitat through native revegetation;
    - Protection of large trees that support/ may in future support potential roost features such as cavities; and
    - Procedure to be followed if any trees within the site are confirmed to be used for roosting. Note removal of such trees would be a final resort and would require remediation in accordance with the Department of Conservation's Artificial Bat Roost Advisory note (DOC -6734955).

  If these effects management measures are followed, it is considered that the magnitude of effects of the development compared to current rotation-harvest pine forestry would be **Low** during the construction period and **Positive** once plantings and pest control is established. Overall, it is expected that the proposal would achieve a **Net Gain** level of effect for long-tailed bats in the medium to long-term.

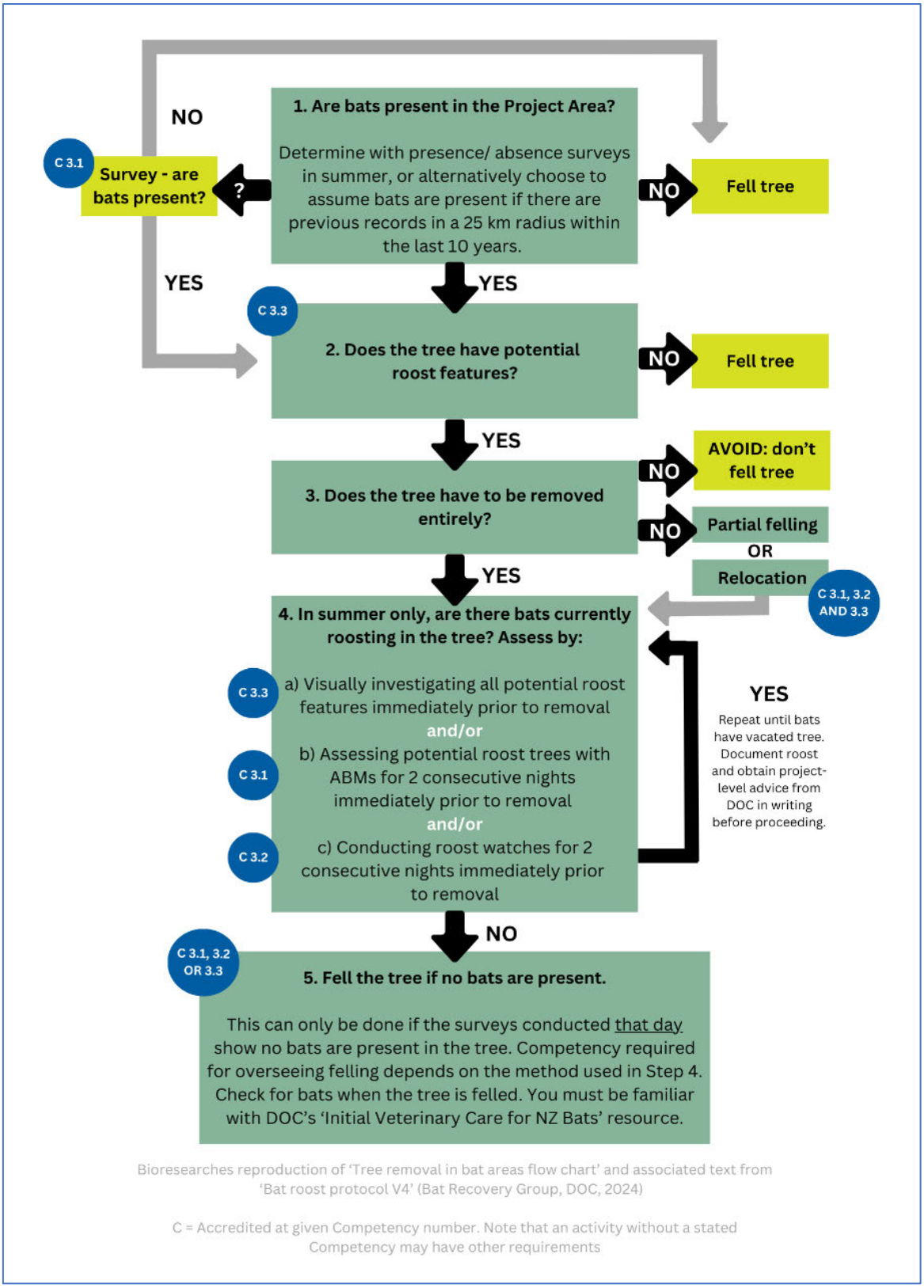


Figure 13. Proposed procedure for assessing if bats are present within the Project area prior to tree felling. Figure reproduced from Bat Recovery Group, DOC (2024).

5.4.2.2 Operational Phase

- **Sensitive residential luminaries:** Effects on fauna should be mitigated by placing hoods on lights, directing lights downward to reduce the upward light 'spill' from urban areas and by using motion sensors in areas that are not consistently needing illumination (Rodríguez et al, 2017). Operating lights with colour temperatures 3000k or below are also recommended to reduce the negative effects of blue light exposure to avifauna and bats.
- **Reflective surfaces**: Operation effects on bats can be minimised through the use of non-reflective and dark roofing surfaces.
- **Pest animal management plan: targeted** control of pest animals (including feral cats, rats, mustelids, and possums) within the surrounding vegetation to create an ecological halo, protecting local biodiversity within the surrounding environments (i.e. wetland bird habitat, bats within forestry block).
- **Domestic animal curfews:** Increased housing, and therefore potential for an influx of pets will result in the predation of indigenous fauna, both within the development and wider area, including 'threatened' or 'at risk' species. To mitigate/minimise these pressures, it is recommended controls on the introduction of pets, particularly cats is included. Controls may include limits on pets allowed, restrictions/curfews or containment within the property.
- **High-risk bat tree retention:** The large pine within the riparian corridor of Lot 1 and the large pine within Wetland 1 is to be retained to minimise the loss of potential roosting habitat for bats.

Table 16. Summary of terrestrial ecological features, values and effect within the Project Area and the proposed effects management

Ecological component	Ecological Value	Magnitude of effect	Level of effect (without management)	Recommended Management	Level of effect (with management)
Deforested – Exotic Scrub	Negligible	Negligible	Very Low	No management of effects required	**Very Low**
Riparian corridors	Moderate	Negligible	Very Low	No management of effects required. Enhancement planting as part of the wider revegetation strategy will significantly increase ecological value and function.	**Very Low**
Mature Exotic Forest	Moderate	Low	Low	No management of effects required	**Low**
Immature Exotic Forest	Low	Negligible	Very Low	No management of effects required	**Very Low**
Avifauna	Moderate	Moderate	Moderate	Implementation of an avifauna management plan including timing of vegetation removal to avoid the main bird breeding season (or preclearance nesting surveys). Management of light effects through design, and conditions on pet ownership within the area to minimise anthropogenic and residential effects and implementation of pest management throughout the site.	**Low**
Herpetofauna	Moderate	Moderate	Moderate	Implementation of a lizard management plan to capture and relocate skinks from within the Project footprint, undertake habitat enhancement and revegetation to replace loss of low-value habitat. Conditions on pet ownership within the area to minimise anthropogenic and residential effects and implementation of pest management throughout the site.	**Low**
Bats	Very High	Moderate (mature pine trees to be felled independent of the development)	High	Implementation of a bat management plan including adoption of bat tree-felling protocol to avoid mortality to any bats potentially roosting in trees (site wide, including indigenous and exotic) at time of removal. Provision of multiple artificial roosts in accordance with DOC advice note -DOC-6734955 for any single bat roost discovered. Artificial design would be detailed in a bat management plan and in consultation with DOC, and provide for multiple roost designs and placement, to support robust research into the effectiveness of artificial roosts at replacing natural roosts. Operation effects to bats minimised through lighting	**Low** short-term, **Net Gain** medium-term onwards

				design restriction, pet ownership conditions and the use of non-reflective roofing surfaces	

5.4.3 Freshwater values

Adverse effects identified within the Project Area will arise through the removal of vegetation and encroachment into the riparian yard, potential sedimentation, harm and/or mortality to aquatic fauna

5.4.3.1 Vegetation Removal

The removal of vegetation within the 20 m setbacks was considered to have a Low to Moderate level of effect of freshwater systems. Of this overall activity, three streams were considered to have a moderate level of effect, due to the removal of 38% of the riparian yard. This will be temporary in nature, with the exotic riparian yard to be replaced with indigenous vegetation, encompassing at least 95% of the riparian yards. A cumulative 1,340 m^2 of impervious surfaces will encroach into the 20 m riparian yard of watercourses within the site. This represents, at maximum <5% of the corresponding riparian yard.

The baseline vegetation within the stream and wetland margins is to be removed and replaced with indigenous vegetation. As the proportion of impervious surfaces is minimal throughout the site, between 95% to 100 % of the 20 m riparian yards, of both streams and wetlands, will be re-vegetated with indigenous plants; including a diverse mix of vegetation with canopy, sub-canopy and groundcover vegetation (Appendix F; Table 26). The proposed development will provide a positive gain in ecological value to the site through an increased biodiversity and ecological connectivity to the wider ecological area. The native riparian yard will provide significant uplift in freshwater ecological values through high increases in shade, filtration, organic matter inputs and bank stability. The restoration planting will provide a permanent food source and habitat to indigenous avifauna.

Additionally, as this riparian planting will be undertaken throughout headwater streams and wetland for two catchments, the downstream receiving environment, beyond the Project Area boundaries will benefit from this planting, as the overall quality of water in the lower catchments would be greatly improved (Alexander *et al*., 2007).

Following the restoration of 90% - 100 % of the 20 m riparian yards with indigenous plant specimens, replacing exotic and weed species, the level of effect of the vegetation removal is considered to be a **net gain** in freshwater ecological values.

5.4.3.2 Freshwater Fauna and Streamworks

Potential adverse effects can be minimised through timing of the stream and wetland works, and native fish recovery and relocation immediately prior to streamworks. The Native Fish Recovery and Relocation Plan has been prepared within the Ecological Management Plan, and includes, at a minimum, methods to capture fish, measures to prevent fish re-entering the reach, fishing efforts, relocation sites, storage and transportation to prevent stress and death/predation.

Fish management will be implemented within one week prior to streamworks/reclamation. Implementation of native fish recovery protocols, will reduce the magnitude of effect on freshwater fauna to ‘Low’, therefore a Native Freshwater Fauna Management Plan (NFFMP) is recommended.

5.4.3.3 Sedimentation

To minimise the potential for excess fine sediment entering the catchment, an Erosion and Sediment Control Plan (ESCP) will be conditioned as part of the consent, and should be prepared and

implemented by an appropriately qualified professional using the industry best practice. The plan details methods on managing sediment in discharges of water as well as dust. No works should occur without the ESCP recommendations being in place. With regard to protection of aquatic health, maintenance and management of the controls adjacent to the streams should be stringent, with erosion and sediment controls checked prior to and immediately following heavy rain events to minimise the potential for failure and sedimentation of the downstream receiving environment.

During streamworks, a Streamworks Management Plan (SMP) has been prepared which outlines the methodology for protecting the streams during works, appropriately mitigating for adverse impacts to freshwater ecological values. With the appropriate measures in place, would the potential magnitude of effects to the streams will be appropriately minimised.

The potential adverse effects of sedimentation will be limited both in time and magnitude. Erosion, and the consequent mobilisation of sediment will primarily occur during the initial stages of the development during earthworks and streamworks. The implementation of the ESCP and SMP will appropriately minimise and mitigate potential adverse impacts to the ecological values within the site. The magnitude of effect will be **Low,** resulting in an overall **Very Low** to **Low** level of effect**.**

Table 17. Summary of freshwater ecological features, values and effects within the Project Area and the proposed effects management.

Activity/effect	Ecological component	Ecological Value	Magnitude of effect	Level of effect (without management)	Recommended Management	Level of effect (with management)
Vegetation removal	Streams and wetlands	Negligible to moderate	Low - Moderate	Very Low - Moderate	Replanting of remainder of riparian yard with indigenous vegetation, with high connectivity throughout the site	Net gain
Riparian yard encroachment	Streams and wetlands	Negligible to moderate	Low to Moderate	Moderate	Revegetation of 90 – 100% of the riparian yard for streams and wetlands within the site.	Net gain
Earthworks	Wetlands	Moderate	Low	Low	-	-
Stormwater discharge	Streams and wetlands	Negligible to high	Low	Very Low – Low	-	-
Wastewater discharge	Streams and wetlands	Negligible to high	Low	Very Low – Low	-	-
Sedimentation	Streams and wetlands	Negligible to High	High	Very Low – Very High	Implementation of Erosion and Sediment Control Plan and Streamworks Management Plan	Low
Culvert installation and fish passage	Streams	Negligible to Moderate	Low	Low	-	Low
Fauna effects	Streams	Moderate	High	Moderate	Implementation of Fish Management Plan prior to streamworks	Low

6 RESIDUAL EFFECTS MANAGEMENT

6.1 Adverse impacts are avoided, where practicable

- The protection of native avifauna should be achieved by avoiding vegetation clearance during the bird breeding season (August to March, inclusive), as far as practicable, or where not achievable, conducting a pre-vegetation clearance bird nesting survey and associated nest protection measures where required.
- With the exception of culvert upgrades and installation, the avoidance of streams and wetlands by the development has been undertaken.

6.2 Adverse impacts are minimised, where practicable

- Adverse effects to lizards will be minimised through implementation of a lizard management plan.
- Adverse effects to bats will be minimised through implementation of a bat management plan.
- Adverse effects to fish will be minimised through implementation of a fish management plan.
- Effects on fauna are minimised by implementing pest control, sensitive luminary designs within the development, and domestic animal restrictions.
- Adverse effects from sedimentation are minimised through the implementation of an Erosion and Sediment Control Plan and Streamworks Management Plan prior to works commencing.
- Infringement into the riparian yard has been minimised as far as practicable.

6.3 Adverse impacts are remediated, where practicable

- Vegetation removal of up to 38% of the riparian yard will be remedied through the remaining 95% riparian yard being restored with indigenous vegetation, resulting in an overall net-gain.
- Inclusion of culverts and impacts to in-stream connectivity remediated through fish friendly design (i.e. baffles or natural fishway) to allow for the provision of fish passage through the culvert.

6.4 Residual effects that are offset

No adverse impacts are proposed to be offset, as all adverse effects can be appropriately managed by avoidance and minimisation and through remediation.

6.5 Residual effects that are compensated

No adverse impacts are proposed to be compensated, as all adverse effects can be appropriately managed by avoidance and minimisation and through remediation.

6.6 Net Gain

The project will result in long-term rotational pine plantation being replaced with indigenous ecosystems, restoring terrestrial forest, natural inland wetlands, and riparian margins. This restored indigenous vegetation will be subject to extensive pest plant and animal control, protection and maintenance, which will lead to significant ecological gains, with 222 ha of managed revegetation (excluding indigenous planted wastewater and stormwater fields) occurring, with a 185% increase in indigenous vegetation (current indigenous vegetation on site = 8.4 ha or 2% of the site area).

By returning commercial plantation land to indigenous ecosystems, the project will provide a significant uplift ecological function and biodiversity gains on a regional scale through the promotion of native forests within an exotic dominant landscape, indigenous stepping stone habitat and migration pathways, freshwater connectivity and provision of fish spawning habitat, increases in water quality through restoration of headwater streams and wetlands. Additionally, the revegetation will provide permanent food and resting, and breeding resources for indigenous birds (both forest and wetland), bats and lizards, with extensive pest animal and plant control allowing for these fauna populations to persist and grow during a period of biodiversity decline and degradation.

7 ACTIVITY STATUS

This section provides information on the relevant consents which may be sought as they relate to ecology.

Under the Auckland Unitary Plan – Operative in Part, Activity Table E3.4.1 (E3; lakes rivers, streams and wetlands) applies to potential works within the site. The rules apply to all intermittent, permanent streams and wetlands within the site:

- (A23) – Replacement, upgrading or extension of existing structures complying with the standards in E3.6.2.12 is a **permitted** activity.
- (A24) – Demolition or removal of existing structure complying with standards in E3.6.2.12 is a **permitted activity**.
- (A32) – Culverts or fords less than 30m in length when measured parallel to the direction of water flow complying with standards in E3.6.1.18 is a **permitted activity**.
- (A33) – Culverts or fords more than 30m in length when measured parallel to the direction of water flow is a **discretionary** activity.
- (A34) – Erosion control structure less than 30 m in length when measured parallel to the direction of water flow is a **permitted** activity.
- (A39) – stormwater or wastewater outfall complying with the standards in E3.6.1.14 is a **permitted activity**
- (A53) – Any activity that is undertaken in, on, over or within the bed of an ephemeral river and streams complying with the standards E3.6.1.1 is a **permitted** activity.

The following rules in the AUP OP, relating to vegetation removal near freshwater bodies (Activity Table E15.4.1; Vegetation Management and Biodiversity) may apply to the development of the site:

- (A2) – Dead wood removal is a **permitted** activity
- (A6) – Pest plant removal is a **permitted** activity.
- (A17) – Vegetation alteration or removal within 20m of rural streams, other than those in Rural – Rural Production Zone or Rural – Mixed Rural Zone is a **restricted discretionary** activity.
- (A18) – Vegetation alteration or removal within 20m of a natural wetland or in the bed or a river or stream (permanent or intermittent) is a **restricted discretionary** activity.

Under the National Environmental Standards for Freshwater Management, the following consents may be triggered:

52 (1) Earthworks outside, but within a 100 m setback from, a natural inland wetland is a **non-complying** activity if it –

a) Results, or is likely to result, in the complete or partial drainage of all or part of a natural inland wetland

(2) The taking, use, damming or diversion of water outside, but within a 100 m setback from a natural inland wetland is a **non-complying** activity if it –

a) Results, or is likely to result, in the complete or partial drainage of all or part of a natural inland wetland

54 – the following activities are **non-complying** if they do not have another status under this subpart

a) Vegetation clearance within, or within a 10 m setback from, a natural inland wetland;
b) Earthworks within, or within a 10 m setback, from a natural inland wetland;
c) The taking, use, damming, or diversion of water within, or within a 100 m setback from a natural inland wetland if
    i. There is a hydrological connection between the taking, use, damming, or diversion and the wetland; and
    ii. The taking, use, damming, or diversion will change, or is likely to change, the water level range or hydrological function of the wetland.
d) The discharge of water into water within, or within a 100 m setback from, a natural inland wetland if –
    i. There is a hydrological connection between the discharge and the wetland; and
    ii. The discharge will enter the wetland; and
    iii. The discharge will change, or is likely to change, the water level range or hydrological function of the wetland.

70 (1) – the placement, use, alteration, extension or reconstruction of a culvert, in, on, over, or under the bed of any river or connected area is a permitted activity if it complies with the conditions

70 (2) The conditions are that –

a) the culvert must provide for the same passage of fish upstream and downstream as would exist without the culvert, except as required to carry out the works to place, alter, extend, or reconstruct the culvert; and
b) the culvert must be laid parallel to the slope of the bed of the river or connected area; and
c) the mean cross-sectional water velocity in the culvert must be no greater than that in all immediately adjoining river reaches; and
d) the culvert's width where it intersects with the bed of the river or connected area (s) and the width of the bed at that location (w), both measured in metres, must compare as follows:
    i. where $w \leq 3$, $s \geq 1.3 \times w$:
    ii. where $w > 3$, $s \geq (1.2 \times w) + 0.6$; and
e) the culvert must be open-bottomed or its invert must be placed so that at least 25% of the culvert's diameter is below the level of the bed; and
f) the bed substrate must be present over the full length of the culvert and stable at the flow rate at or below which the water flows for 80% of the time; and
g) the culvert provides for continuity of geomorphic processes (such as the movement of sediment and debris).

71 (1) The placement, use, alteration, extension, or reconstruction of a culvert in, on, over, or under the bed of a river is a discretionary activity if it does not comply with any of the conditions in regulation 70(2)

The proposed activities and their consent triggers and status are outlined in Table 18.

Table 18. Proposed activities and their activity status under the appropriate legislation

Activity		Rules and regulations	Status	
Earthworks	Earthworks within 100 m of natural inland wetlands	NES FM (52(1))	Not applicable	Earthworks within 100 m of natural inland wetland represent small portion of contributing catchment. Earthworks should not result in the complete or partial drainage of natural inland wetlands, therefore regulation 52 should not apply.
	Earthworks within 10 m of natural inland wetland	NES FM 54 (b)	Non-complying	Earthworks within 10 m of natural inland wetland will consist of fill earthworks and should not divert water away from wetland as wetlands are primarily stream fed. The proportion of catchment affected by wetlands minimised through staging of earthworks and should not result in the complete or partial drainage of wetlands,
Vegetation Clearance	Vegetation removal within 20 m of watercourses and wetlands	AUP OP E15.4.1 (A19)	Restricted discretionary	Vegetation clearance of short gorses and tūrutu within 20 m of streams and wetlands
	Vegetation removal within 10 m of natural inland wetlands	NES FM 54 (a)	Non-complying	Vegetation clearance restricted to short gorses or tūrutu. Removed vegetation will be replaced with indigenous revegetation throughout 95 – 100 % of the 20 m setback.
Culvert installation	Culvert length	AUP OP E3.4.1 (A32)	Permitted	Culvert length on each reach less than 30 m
	Erosion controls	AUP OP E3.4.1 (A34)	Restricted Discretionary	Does not comply with standard E3.1.14. Some erosion controls greater than 5 m in length.
	Fish passage	NES-FM 70	Discretionary	Does not comply with standard 70(2). The proposed replacement culverts will not be placed on the same *gradient* as the existing streambed/culverts. As such, mitigation through flexi-baffles or alternative measures is required to provide fish passage
Discharge of water	Discharge of stormwater and wastewater	NES FM 54(d)	Permitted	The discharge of stormwater and wastewater will be to land, at least 10 m from the edge of streams and wetlands where there is not a hydrological connection to the natural inland wetlands, and the discharge will not change the water level or hydrology of the wetland.
	Stormwater outfall construction	AUP OP E3.4.1 (A39)	Permitted	Complies with standard E3.1.14. Erosion controls for stormwater outfalls less than 5 m in length and will not cause stream bed erosion due to 10 m setback.

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APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of Rangitoopuni Developments Limited Partnerships as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk.

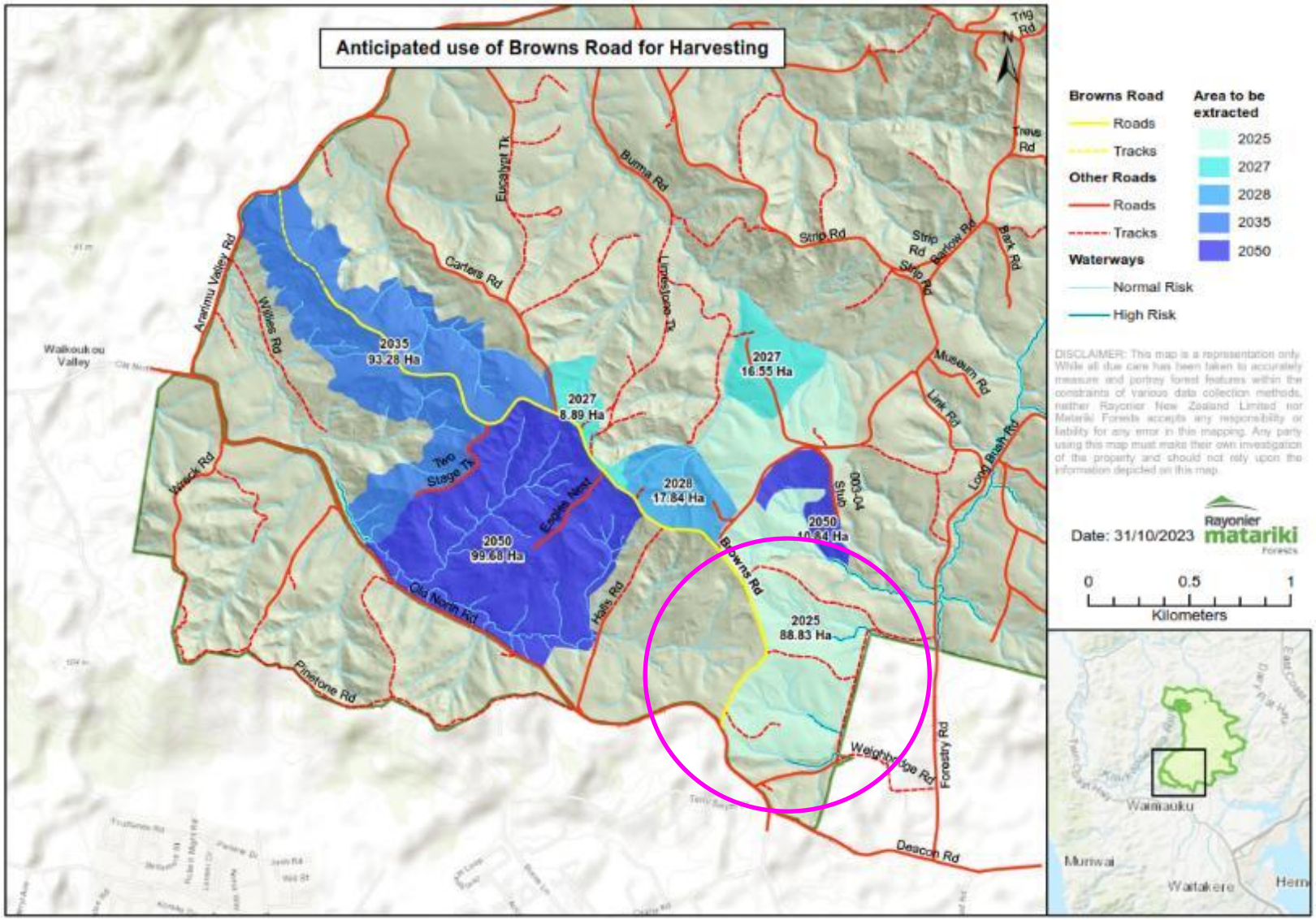
Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts. Do not scale any of the maps, plans or figures in this report. Any information shown here on maps, plans and figures should be independently verified on site before taking any action. Sources for map and plan compositions include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Bioresearches.

Appendix A Commercial Forest Harvest Schedule within the Rangitoopuni Development. Magenta circle indicates 'Mature Exotic Forest' Vegetation



Appendix B Ecological Impact Assessment Methodology

The ecological assessments undertaken for the proposed subdivision of Rangitoopuni generally follow Ecological Impact Assessment guidelines for use in New Zealand (EcIAG) published by EIANZ[11] (Roper-Lindsay *et al.* 2018). The EcIAGs provide a standardised matrix framework that allows ecological effects assessments to be clear, transparent and consistent. The EcIAG framework is generally used in impact assessments in New Zealand as good practice.

The EcIAGs provide a three-step process for undertaking terrestrial and freshwater assessments as follows:

Step 1: Assess the **value** of the area (terrestrial and/or freshwater), taking into consideration species (Table 19) and other attributes of importance for fauna, vegetation or habitats (Table 19, Table 20 and Table 21) to assign an overall ecological value (Table 22).

Step 2: Determine the **magnitude** of effect (Table 23). This step also includes consideration of the timescale and permanence of the effect, whereby temporary (< 25 years) and long-term (substantial improvement after 25 years) effects are distinguished from permanent (beyond the span of a human generation) effects.

Step 3: Evaluate the overall severity or **level of effect** using a matrix (Table 24) of the ecological value and magnitude of effect.

That analysis then leads to an effects management regime comparable to the level of adverse ecological effect using the management hierarchy to end with an overall outcome for ecological values that demonstrably results in no greater than minor, or preferably, a net improvement (Net Environmental Gain).

Fauna considered in this report include all those that are protected by the Wildlife Act (1953), including lizards, birds and long-tailed bats. Particular consideration was given where species with a conservation status of nationally 'At Risk' or higher have the potential to be present.

Table 19. Factors to be considered in assigning value to species (Roper-Lindsay et al., 2018).

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 (Zone of Interest) either permanently or seasonally	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pests, species having recreational value	Negligible

[11] Environmental Institute of Australia and New Zealand

Table 20. Attributes to be considered when assigning ecological value or importance to a site or area of terrestrial vegetation / habitat / community (as per Table 4 of Roper-Lindsay et al. 2018).

Matters	Attributes to be considered
Representativeness	Criteria for representative vegetation: • Typical structure and composition • Indigenous species dominate • Expected species and tiers are present • Criteria for representative vegetation: • Species assemblages that are typical of the habitat • Indigenous species that occur in most of the guilds expected for the habitat type
Rarity/Distinctiveness	Criteria for rare/distinctive vegetation and habitats: • Naturally uncommon or induced scarcity • Amount of habitat or vegetation remaining • Distinctive ecological features • National Priority for Protection • Criteria for rare/distinctive species of species assemblages: • Habitat supporting nationally threatened or At-Risk species, or locally uncommon species • Regional or national distribution limits of species or communities • Unusual species or assemblages • Endemism
Diversity and pattern	• Level of natural diversity, abundance and distribution • Biodiversity reflecting underlying diversity • Biogeographical considerations- pattern, complexity • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation
Ecological context	• Site history and local environment conditions which have influenced the development of habitats and communities • The essential characteristics that determine an ecosystems integrity, form, functioning and resilience (from 'intrinsic value' as defined in RMA) • Size, shape and buffering • Condition and sensitivity to change • Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material • Species role in ecosystem functioning - high level, key species identification, habitat as proxy

Table 21. Matters that may be considered when assigning ecological value to a freshwater site or area (as per Table 7 of Roper-Lindsay et al. 2018).

Matters	Attributes to be considered
Representativeness	• Extent to which site/catchment is typical or characteristic • Stream order • Permanent, intermittent or ephemeral waterway • Catchment size • Standing water characteristics
Rarity/ Distinctiveness	• Supporting nationally or locally Threatened, At Risk or uncommon species • National distribution limits • Endemism • Distinctive ecological features • Type of lake/pond/wetland/spring
Diversity and pattern	• Level of natural diversity • Diversity metrics • Complexity of community • Biogeographical considerations - pattern, complexity, size, shape
Ecological context	• Stream order • Instream habitat • Riparian habitat • Local environmental conditions and influences, site history and development • Intactness, health and resilience of populations and communities • Contribution to ecological networks, linkages, pathways • Role in ecosystem functioning – high level, proxies

Table 22. Assigning ecological value (Roper-Lindsay et al. 2018).

Magnitude	Description
Very High	Area rates High for 3 or all of the four assessment matters listed in Table 20 or Table 21. Likely to be nationally important and recognised as such.
High	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder, or Area rates High for 1 of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

Table 23. Criteria matrix for describing magnitude of effects (Roper-Lindsay et al. 2018).

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

Table 24. Criteria matrix for describing level of effects (Roper-Lindsay et al. 2018).

Ecological value → Magnitude ↓	Very high	High	Moderate	Low	Negligible
Very High	Very High	Very High	High	Moderate	Low
High	Very High	Very High	Moderate	Low	Very Low
Moderate	High	High	Moderate	Low	Very Low
Low	Moderate	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

Appendix C. Supplementary stream photos

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

(I)

(j)

(k)

(L)

(m) 	(n) 	(o) 	(p) 
(q) 	(r) 	(s) 	(t) 
(u) 	(v) 	(w) 	(x) 

(y)

(z)

(aa)

(ab)

(ac)

(ad)

(ae)

(af)

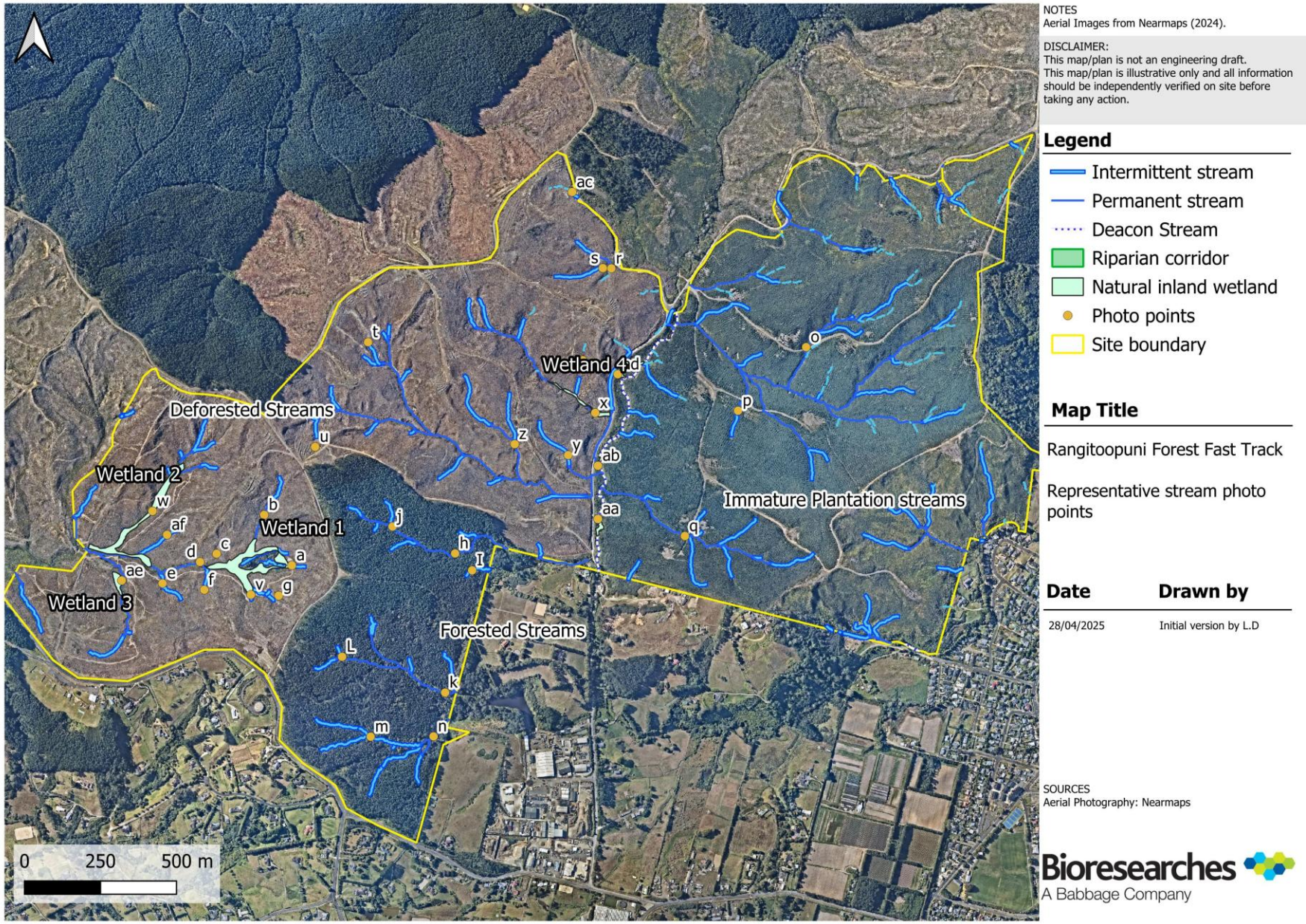
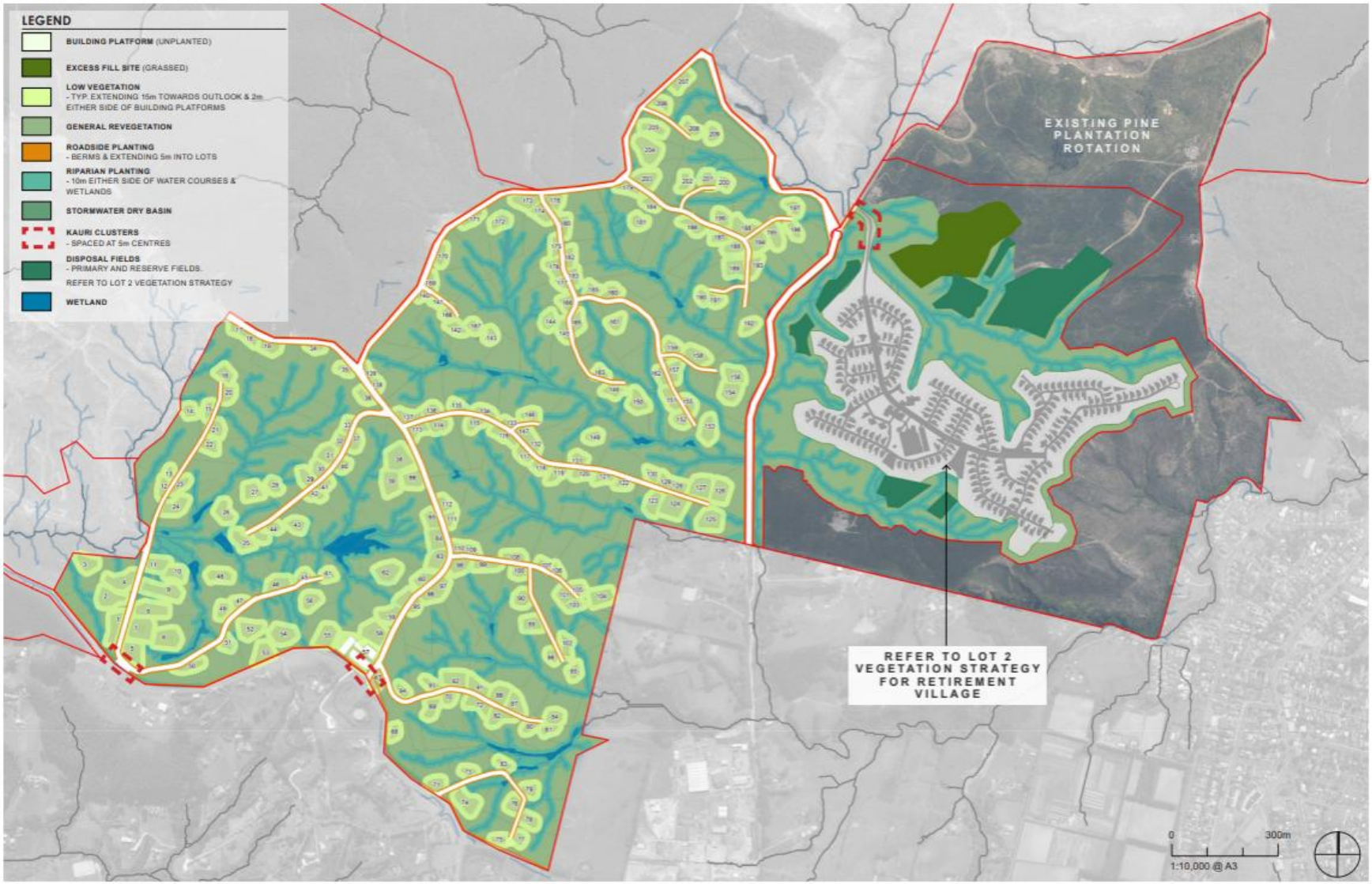


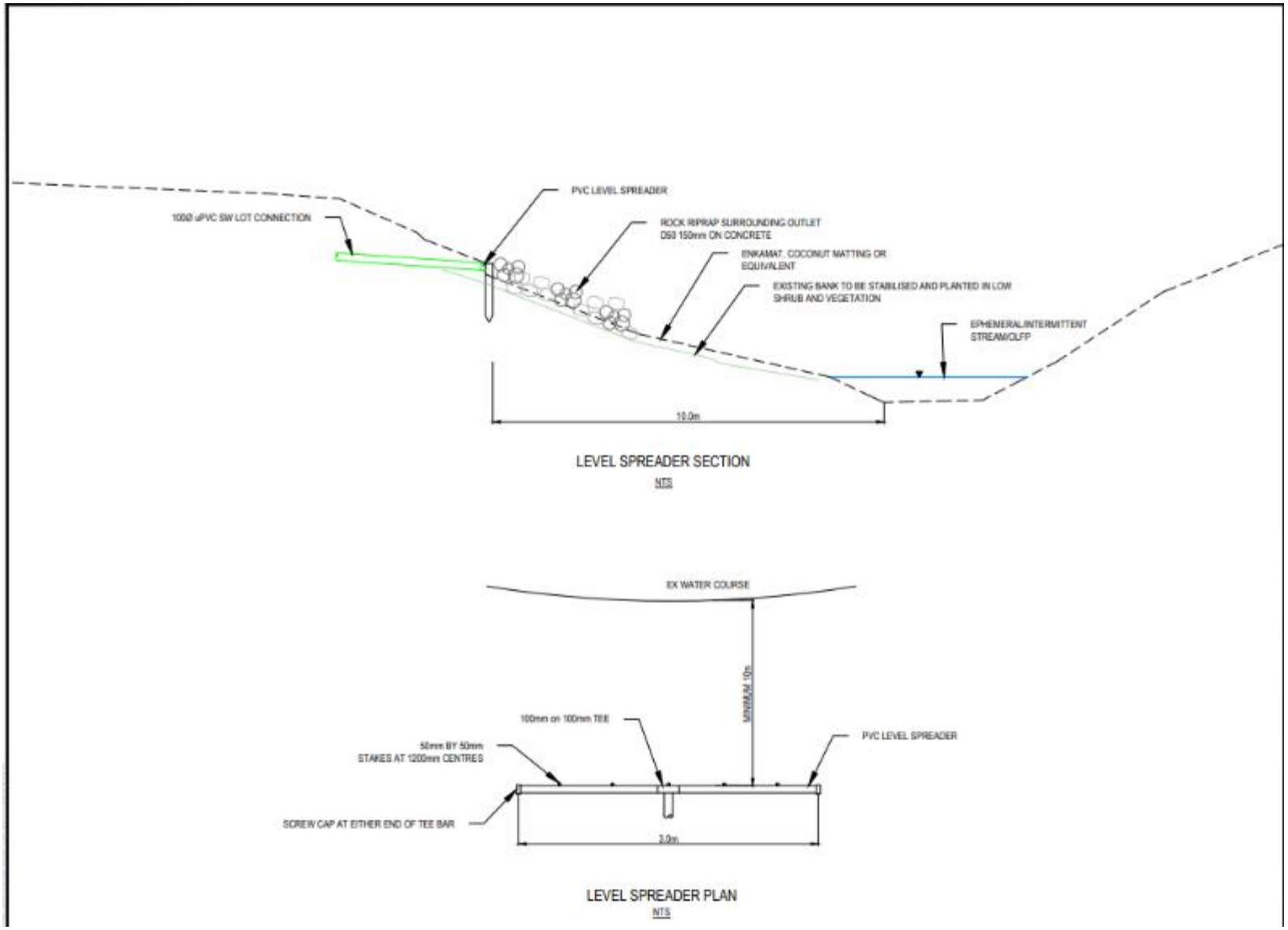
Figure 14. Corresponding photo points of the supplementary stream photos

Appendix D. Revegetation strategy and planting zones throughout the Project Area. Prepared by Boffa Miskell

VEGETATION STRATEGY



Appendix E Typical Lot 1 stormwater outfall discharge options. Prepared by Maven.



Appendix F Revegetation planting palette for general vegetation and riparian corridors prepared by Boffa Miskell (2025).

Table 25. General revegetation planting palette. Highlighted species correspond with recognised roost tree species for long-tailed bats (Borkin & Martin, 2018)

	EXAMPLE/SAMPLE		BOTANICAL NAME	COMMON NAME	SIZE (L)	SPACING (M)	%	FORM	HEIGHT AT PLANTING	HEIGHT AT MATURITY	VALLEY FLOOR	LOWER SLOPE	MID SLOPE	UPPER SLOPE	RIDGELINE	ASPECT NORTH/ SOUTH
TAONGA SPECIES			*Agathis australis*	Kauri	1	5.0	3	Pyramidal	0.5m	30m	•		•	•	•	N
			Dacrycarpus dacrydioides	Kahikatea	1	5.0	3	Columnar	0.5m	50m	•	•	•			S
			*Podocarpus totara*	Tōtara	1	5.0	3	Pyramidal	0.5m	15m			•	•	•	N
			Vitex lucens	Pūriri	1	5.0	3	Round	0.5m	15m	•	•	•	•	•	N
			*Rhopalostylis sapida*	Nīkau	1	5.0	3	Palm	0.5m	10m		•	•	•		S
			Dacrydium cupressinum	Rimu	1	5.0	3	Weeping	0.5m	25m		•	•	•	•	S
CANOPY SPECIES			*Cordyline australis*	TI Kouka	1	1.5	3	Fountain	0.5m	10m	•	•	•			N
			Beilschmiedia tarairi	Taraire	1	5.0	3	Round	0.5m	20m		•	•			N
			*Didymocheton spectabilis*	Kohekohe	1	5.0	3	Round	0.5m	10m		•	•			S
			Laurelia novae-zelandiae	Pukatea	1	5.0	3	Pyramidal	0.5m	25m	•	•	•			S
			*Prumnopitys taxifolia*	Matai	1	5.0	3	Pyramidal	0.5m	20m	•	•	•			S
			Pseudopanax crassifolius	Horoeka	1	5.0	3	Columnar	0.5m	12m		•	•	•	•	S
SUB-CANOPY SPECIES			*Kunzea robusta*	Kānuka	1	1.5	35	Tall shrub/ tree	0.5m	10m	•	•	•	•	•	N / S
			Leptospermum scoparium	Mānuka	1	1.5	35	Tall shrub/ tree	0.5m	5.0m	•	•	•			N / S

Species based on 'Te Haumanu Taiao : Restoring the Natural Environment in Tāmaki Makaurau' - 4.2.8 WF11: Kauri, podocarp, broadleaved forest and 4.4.3 VS3: Mānuka, kānuka scrub

Table 26. Riparian corridor planting palette. Highlighted species correspond with recognised roost tree species for long-tailed bats (Borkin & Martin, 2018)

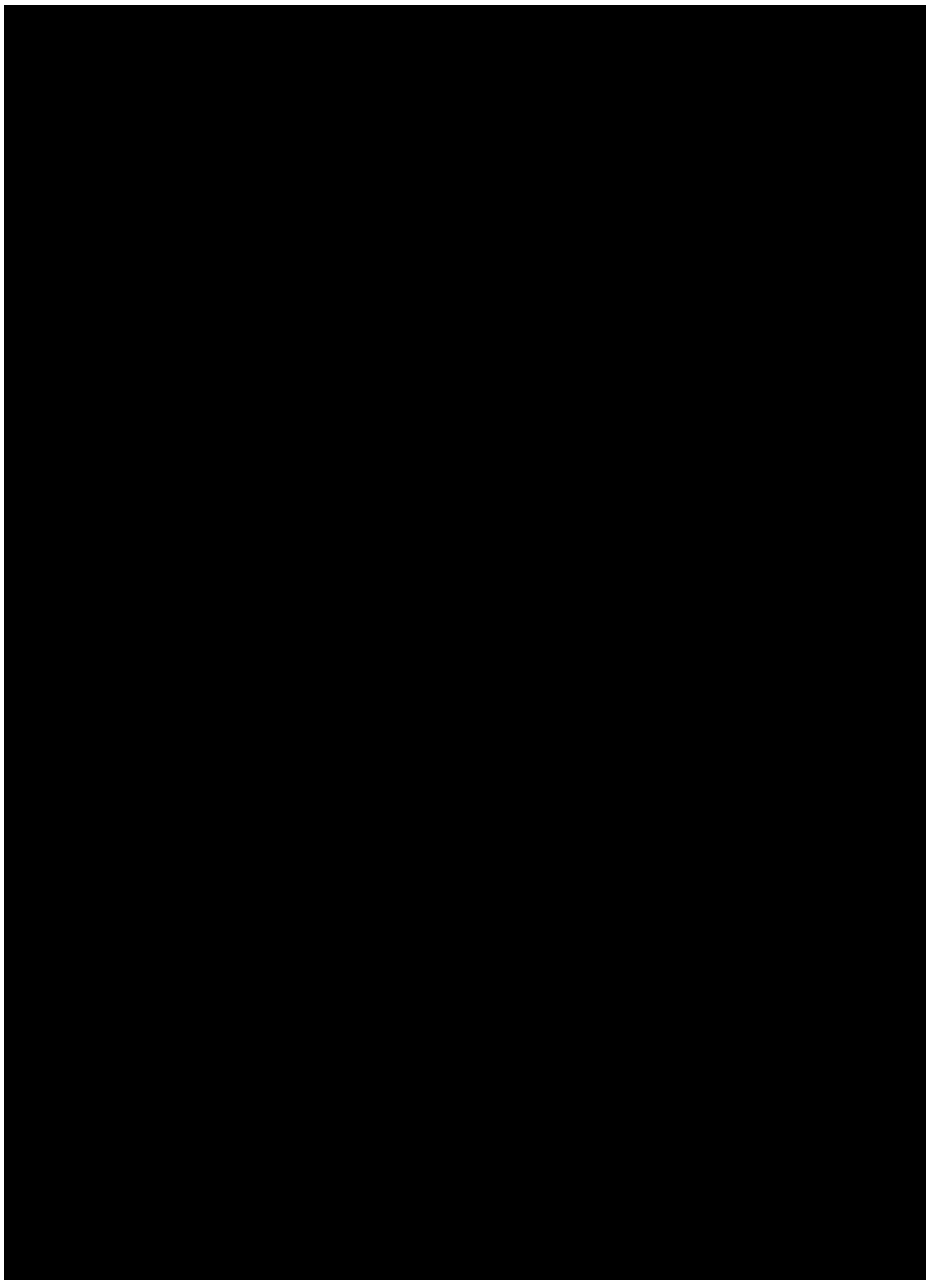
	EXAMPLE/SAMPLE		BOTANICAL NAME	COMMON NAME	SIZE (L)	SPACING (M)	%	FORM	HEIGHT AT PLANTING	HEIGHT AT MATURITY
STREAM EDGE, FLOOD AND DRY SLOPE			*Austroderia fulvida*	Toetoe	1	1.5	8	Grass	0.25m	1.5m
			Blechnum novae-zelandiae	Kiokio	1	1	8	Fern	0.25m	1.0m
			*Carex dissita*	Forest sedge	1	1	8	Sedge	0.25m	0.5m
			Carex lessoniana	Rautahi	1	1	8	Sedge	0.25m	1.0m
			*Carex virgata*	Pūkio	1	1	12	Sedge	0.25m	1.0m
			Carpodetus serratus	Putaputawētā	1	1.5	3	Tall shrub	0.25m	6.0m
			*Cordyline australis*	Tī kōuka	1	1.5	3	Tall shrub/ tree	0.5m	8.0m+
			Veronica stricta var. stricta	Koromiko	1	1.5	7	Shrub	0.5m	2.0m
			*Cyperus ustulatus*	Giant umbrella sedge	1	1	8	Sedge	0.5m	1.5m
			Leptospermum scoparium	Mānuka	1	1.5	11	Tall shrub/ tree	0.5m	5.0m
DRY SLOPE ONLY			*Melicytus ramiflorus*	Māhoe	1	1.5	3	Tall shrub/ tree	0.5m	6.0m
			Phormium tenax	Harakeke	1	1.5	3	Herb	0.5m	3.0m
			*Hedycarya arborea*	Porokaiwhiri	1	1.5	3	Tall shrub/ tree	0.5m	8.0m
			Hoheria populnea	Houhere	1	1.5	3	Tall shrub/ tree	0.5m	8.0m
			*Kunzea robusta*	Kānuka	1	1.5	3	Tall shrub/ tree	0.5m	10m
			Myrsine australis	Māpou	1	1.5	3	Tall shrub/ tree	0.5m	6.0m
			*Pittosporum tenuifolium*	Kōhūhū	1	1.5	3	Tall shrub/ tree	0.5m	6.0m
			Schefflera digitata	Patē	1	1.5	3	Tall shrub/ tree	0.5m	8.0m

Species based on 'Te Haumanu Taiao : Restoring the natural environment in Tāmaki Makaurau' - Table 9.2: Revegetation Schedule for Riparian Zones in Tāmaki Makaurau / Auckland

NOTE
Heights are approximate and subject to supply and environmental influences

Table 27. Low lying vegetation and wastewater disposal field planting palette.

EXAMPLE/SAMPLE		BOTANICAL NAME	COMMON NAME	SIZE (L)	SPACING (M)	%	FORM	HEIGHT AT PLANTING	HEIGHT AT MATURITY
		*Adiantum cunninghamii*	Common maidenhair	1	0.5		Fern	0.2m	0.3m
		Apodasmia similis	Oioi	1	1		Rush	0.5m	1m
		*Asplenium bulbiferum*	Pikopiko	1	1		Fern	0.5m	0.8m
		Astelia chathamica	Kakaha	1	1		Herb	0.25m	1.5m
		*Carex germinata*	Rautahi	1	1		Sedge	0.25m	1m
		Carex lessoniana	Rautahi	1	1		Sedge	0.25m	1m
		*Carex secta*	Purei	1	1		Sedge	0.25m	1.5m
		Carex virgata	Purei	1	1		Sedge	0.25m	1.5m
		*Chionochloa flavicans*	Haumata	1	1		Grass	0.25m	1m
		Coprosma kirkii	Taupata	1	1.5		Shrub	0.25m	0.5m
		*Dianella nigra*	Turutu	1	1		Herb	0.25m	0.5m
		Fuchsia procumbens	Creeping fuchsia	1	2		Liana	0.1m	0.2m
		*Hebe stricta*	Koromiko	1	1.5		Shrub	0.25m	2m
		Libertia grandiflora	Mikoikoi	1	0.5		Herb	0.25m	1m
		*Lobelia angulata*	Panakenake	1	0.5		Liana	0.1m	0.2m
		Lomaria discolor	Petipeti	1	0.5		Fern	0.25m	1m



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