



WILD ECOLOGY

Ecological Report

Resource consent application
at

Tuhirangi Road (287)
Lot 3 DP 107469
Makarau

Prepared for
Auckland Shooting Club Incorporated

May 2023

DOCUMENT QUALITY ASSURANCE

Bibliographic reference for citation: *Ecological Report prepared for proposed development of 287 Tuhirangi Road, Makarau (Lot 3 DP 107469)*. Report prepared by Wild Ecology for Auckland Shooting Club Incorporated

Prepared for:	Auckland Shooting Club Incorporated	
Version:	Final	
Date:	16/05/2023	
Author:	Madara Vilde Principal Ecologist Wild Ecology	<i>MVilde</i>
Revision History		
Status:	Final	Issue date: 16/05/2023
	1 st Draft	Issue date: 08/05/2023
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1.0 INTRODUCTION

1.1 Background and project description

Terra Consultants engaged Wild Ecology on behalf of Auckland Shooting Club Incorporated ('the Applicant') to prepare an Ecology Report for a proposed resource consent application at 287 Tuhirangi Road, Makarau (Lot 3 DP 107469) ('the subject site'). The Applicant proposes to lodge an application for a resource consent to establish and operate an outdoor firearms range at the subject site ('the project'). The project footprint consists of an existing access road, 4 existing shooting bays, with the Applicant also seeking to construct 1 additional shooting bay, customer parking and installation of stormwater infrastructure.

A key aspect of the project is the incorporation of comprehensive sensitive design methodologies to avoid and minimise potential ecological effects, based on iterative process of Wild Ecology providing ecological mapping, description of ecological values, and advice on methodologies and philosophies of sensitive design that have been incorporated as part of the project's overall design. The project aims to contain the activity within a development pocket which is to be encompassed by extensive tracts of indigenous vegetation.

The project footprint has been designed to be sited as far as practicable outside 20m riparian yards of intermittent and permanent streams (as identified under AUP (OP)) and outside 10m setback from natural inland wetland (as defined under NPS-FM 2020) areas. It is considered that the site development and operation will result in less than minor ecological effects should industry best practice be applied during construction and operational phases of the development.

The proposal strikes a balance between protecting and enhancing areas of higher existing or potential ecological values, while concentrating the site's development on areas with low existing ecological values or functionality. The proposal seeks to create a confined development footprint and provide separation between the development footprint and the wider ecological setting. Recognising the rural setting the development is to take place in, the Applicant volunteers to minimise any potential residual adverse effects through the establishment of over 4.33 ha of proposed ecological enhancement area. This area is to serve multiple purposes including habitat provisioning services, erosion protection, nutrient and pollutant filtration, provision of habitat for indigenous fauna and associated ecosystem, cultural and recreational services. Over time as the vegetation matures it will deliver benefit in noise reduction through establishment of dense vegetation cover encompassing the shooting ranges. It will also enhance the amenity values for the future users of the shooting facilities and promote enjoyment of the existing ecological values on site.

1.2 Purpose and scope

The purpose of this Report is to provide a baseline assessment of the ecological features contained within the site boundaries and immediate surrounds, and to assess whether the sites

in a manner consistent with the relevant ecological provisions in relation to local, regional and national plans, policy statements and regulations associated with the protection and preservation of indigenous habitats and species.

This report outlines the potential adverse effects of the proposed development on ecological values and the degree to which significant adverse effects can be avoided, remedied, mitigated or offset. Both constraints and opportunities relating to the site's ecological values are identified and discussed.

2.0 METHODOLOGY

2.1 Desktop review

The desktop investigation included a review of scientific literature (published and unpublished), the Auckland Unitary Plan (Operative) and associated ecological site information, and relevant websites. Ecological databases were also accessed. These included:

- Retrolens historic aerial imagery
- DOC Bio-web Herpetofauna database
- DOC Bat database
- iNaturalist New Zealand
- LENZ Threatened Environments Classification
- Land Use Classification
- Baseline Highly Productive Land – Manaaki Whenua
- Potential and current ecosystem extent
- Wilderlab eDNA dababase
- New Zealand Freshwater Fish Database (NZFFD)

2.2 Site investigation

The site and surrounding areas were visited on the 4th October 2022, and 8th of February 2023 and a general walkover was conducted over the entire site with terrestrial and aquatic features identified. The natural features were surveyed and recorded using a GPS unit (Trimble DA2).

Vegetation was recorded and classified in general accordance with Singers *et al.* (2017).

The following fauna surveys were conducted:

- 5MBC surveys were conducted at various parts of the site to record avifauna (bird) present on site;
- eDNA stream survey using a Wilderlab peg-mount passive sampling kit;
- Basic assessment of habitat values for native lizards (skinks and geckos) was undertaken during site visits.
- Basic assessment of habitat values for bats was undertaken during site visits.

2.3. Watercourse classification

Watercourses on site and immediate surrounds were classified in general accordance with criteria outlined in the Auckland Unitary Plan (Operative) (see Appendix 2 for associated definitions). Classification was made in general accordance with the decision tree outlined under Table 1.

Table 1: AUP (OP) criteria for permanent, intermittent rivers and streams, ephemeral streams and artificial watercourses

Criterion	Definition
Permanent river or stream	
1	Evidence of continuous flow.
Intermittently flowing river or stream	
1	Evidence of natural pools
2	Well defined channel. Banks and bed can be distinguished.
3	Surface water present (more than 48hrs after a rain event).
4	Rooted terrestrial vegetation not present across the entire cross-sectional width of channel.
5	It appears as a blue line on topographical maps at 1:50,000 scale.
Ephemeral stream	
1	Stream bed above the water table at all times.
2	Water present only during and shortly after rain fall.
	Does not meet classification of an intermittently flowing river or stream.
Artificial watercourse	
1	A man-made channel constructed in or over land for carrying water and includes an irrigation canal, roadside drains and water tables, water supply race, canal for the supply of water for electricity power generation and farm drainage canals.
2	It does not include a channel constructed in or along the path of any historical or existing river, stream or natural wetland.

Please note that given the high incidence of modified watercourses within the site boundaries, a watercourse was assessed as an 'artificial watercourse' only when it could be successfully traced back to a time of origin based on analysis of historic aerial imagery (1961 onwards). All other modified watercourses within the site boundaries were assessed using a pre-cautionary approach and assumed to be representative of historic or existing river, stream or natural

wetland, even if historically and currently managed under an apparent farming regime (i.e. dredged, straightened, modified) for farming purposes.

The surveys were outside the recommended window for classifying intermittent and ephemeral watercourses (July–October) and therefore a conservative approach was taken in respect to stream classification. There were no rainfall events within 48 hours prior to the February 8th, 2023, survey (Meteorological Service of New Zealand Ltd 2023).

2.4. Wetland delineation

For wetland delineation protocols in the field the NPS-FM refers to the Ministry for the Environment (MfE) Wetland delineation protocols (2022) which are generally based on following the four main steps outlined in Figure 1. The primary step is based on the Vegetation tool for wetland delineation in New Zealand (Clarkson 2013) to determine the status of wetlands. This step relies on the presence or absence of hydrophytic vegetation as being the dominant vegetation type. The list of hydrophytes used in this assessment are as per the most recently revised list (Clarkson *et al.* 2021). The results from the vegetation tool provided conclusive results and therefore dominance – prevalence hydrophytic vegetation test (Step 2) and hydric soils tool (Step 3) and wetland hydrology tools (Step 4) were not utilised for this site.

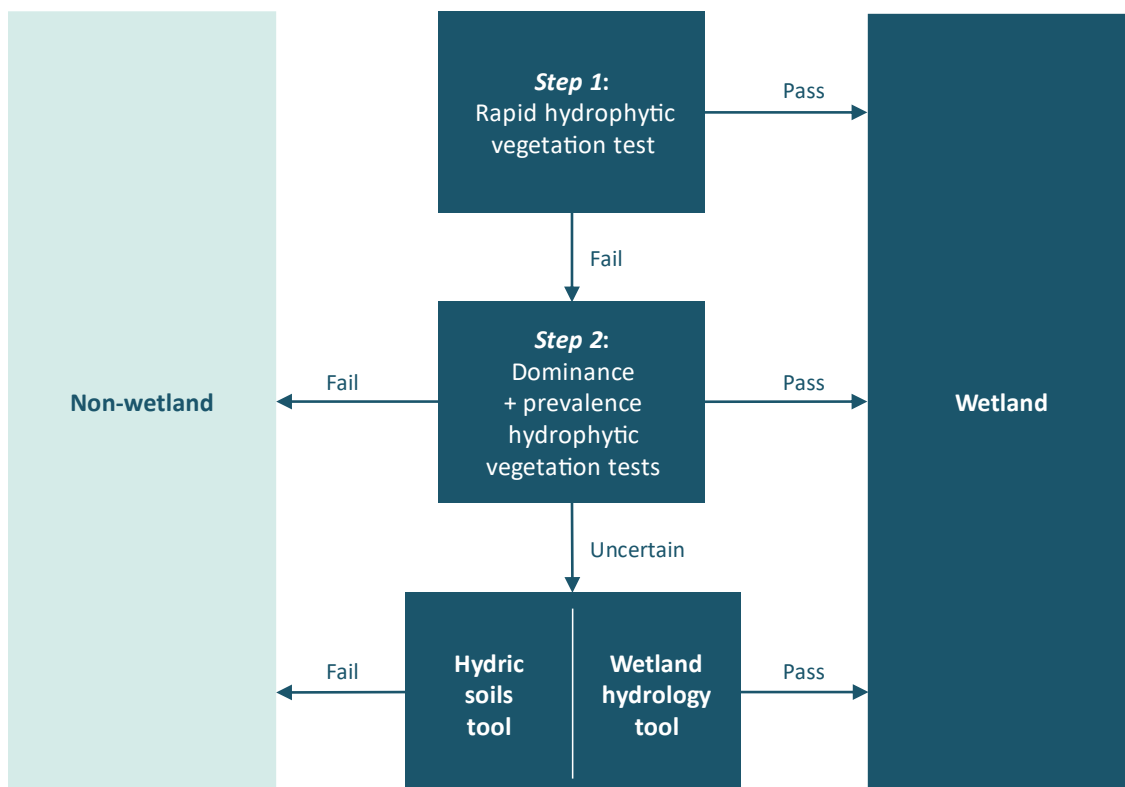


Figure 1: Four steps for delineating wetlands using the hydrophytic vegetation, hydric soils and wetland hydrology tools

In general accordance with MfE (2022) wetland delineation protocols (WDP) the following methodology was applied:

- a) An area of wetland type vegetation (total area <2ha) was delineated using a handheld GPS with +/-0.6m accuracy (Trimble DA2).
- b) A decision of 'normal circumstances' was made based on typical climatic/hydrologic conditions. Recent disturbance (i.e. grazing pressures) were noted and accounted for in the overall assessment. Historic disturbance (creation of motocross tracks) was extremely difficult to account for, and all therefore any potential wetland areas were assessed by applying precautionary principle.
- c) A general description of each area containing wetland type vegetation was noted following wetland delineation with a GPS. Where wetland areas encompassed ephemeral or intermittent waterbodies, the immediate stream channel was included in the assessment where a distinctive open water channel was not present at the time of survey.
- d) In each area containing wetland type vegetation, the species in each stratum (herb, sapling/shrub, tree) were identified and percent cover estimated for each of the strata. It should be noted that only herb layer remained somewhat intact within the wetlands onsite because of historic and current land use and land modification.
- e) In each area containing wetland type vegetation, hydrophytic vegetation was determined as per Clarkson *et al.* (2021). Where species were not included in the revised Clarkson *et al.* (2021) they were classed according to their known habitat preferences. The basic steps included:
 - For each of the plots a Rapid Test was conducted. All dominant species within the plot must be either OBL or FACW vegetation to confirm if the area is a wetland.
- f) Where >50% of the overall vegetation cover consisted of improved pasture species, these were excluded from the definition of a 'natural inland wetland' as per exclusion (e) (ii) under NPS-FM (2020 – Amended December 2022). As per most recent MfE guidance, improved pasture species were assessed as those described under 'Draft National List of Exotic Pasture Species' (Cosgrove *et al.* 2022) which largely update species that were included as 'pasture species' in the current 4th Edition of Pasture and Forage Plants for New Zealand. The revised 5th Edition contains some additional entries (Stewart, pers comm.) and these have been included (see Appendix 3).
- g) Where the wetland type vegetation was present in or around an artificial watercourse (as defined under AUP(OP)), these areas were excluded from the definition of a 'natural inland wetland' as per exclusion (c) under NPS-FM (2020 – Amended December 2022). A watercourse was assessed as being an 'artificial watercourse' when it met the determinants of the definition of an artificial watercourse under AUP (OP).

2.5. Evaluation of Potential Ecological Effects

2.5.1. EIANZ Assessment

As a part of this ecological assessment, potential ecological effects associated with the site development on both terrestrial and aquatic values on site were described and appropriately assessed. The assessment generally followed the process as described within Ecological Impact

Assessment (EcIA) guidelines (EIANZ 2018). The guidelines provide a process for identifying, quantifying and evaluating the potential impacts of defined actions on ecosystems or their components; and providing a scientifically defensible approach to ecosystem management.

2.5.2. Values assessment

Four matters were used to determine the ecological value of the ecological features present on-site, these being 'Representativeness, Rarity/distinctiveness, Diversity and Pattern, and Ecological Context' as prescribed under the EIANZ (2018) criteria. The method involves assigning ecological values under each of these four matters, an explanation on each matter and a series of attributes as outlined within Table 4 of the EIANZ guidelines (2018). A scoring system provided in the EIANZ guidelines requires the combination of these assessment values to provide an overall assignment of ecological value to each feature.

2.5.3. Magnitude of effects assessment

An assessment of the potential magnitude of effects was evaluated in general accordance with Roper-Lindsay et al. 2018) with the consideration of potential effects associated with the project on identified ecological values on site. The method involves assessing the magnitude of effects based on criteria outlined in Table 2 and the overall level of effect using the matrix in Table 3. This assessment framework allows for effects to be ranked on a scale from 'Net gain' to 'Very High' and provided justification for avoidance, mitigation and offsetting requirements as appropriate.

Table 2: Criteria for describing magnitude of effect (Roper-Lindsay et al. 2018)

Magnitude	Description
Very high	Total loss 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 baseline (pre-development) conditions such that post development character/ composition/ 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 baseline conditions such that post development character/composition/attributes of baseline 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/attributes of 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 baseline condition. Change barely distinguishable, approximating to the “no change” situation; AND/OR having negligible effect on the known population or range of the element/feature.

Table 3: Criteria for describing level of effects (Roper-Lindsay et al. 2018)

Magnitude	Level of effects				
	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

3.0 SITE DESCRIPTION

3.1 Site description and location

The site is located at 287 Tuhirangi Road, Makarau. The site is located approximately 3 km west of Kaipara Coast Highway (Figure 2) and is zoned 'Rural Production' under Auckland Unitary Plan (Operative). The total site area is approximately 37.83 ha, and the site is comprised of exotic pastureland, scattered areas of regenerating bush and wetland habitats, and a myriad of ephemeral, intermittent and permanent streams (Figure 3). The site contains an existing access track, 4 existing shooting ranges, and associated facilities.

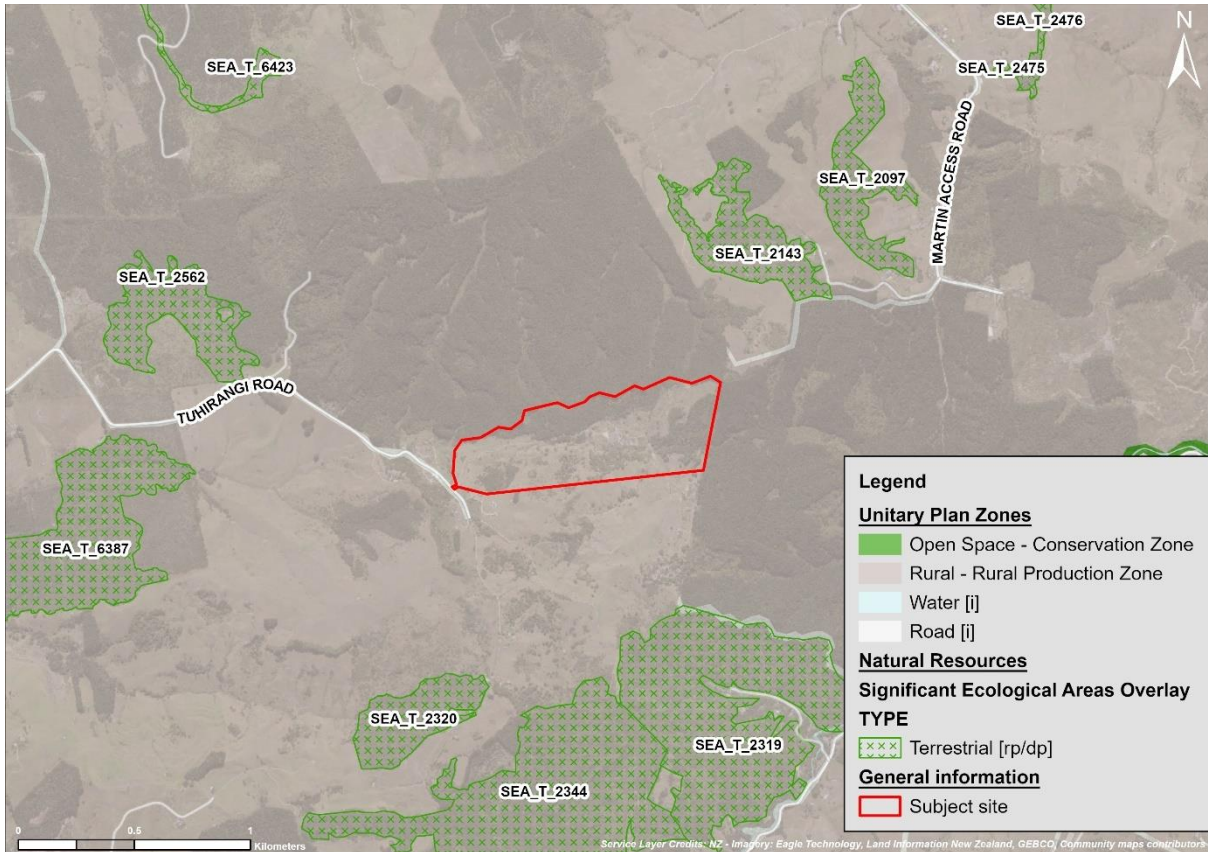


Figure 2: Showing the site's location in relation to Kaipara Coast Highway and associated zoning under AUP (OP)



Figure 3: Showing the general characteristics of the site – comprised in pasture with scattered bush remnants and a permanent stream habitat flowing along the site's central aspect

3.2. Historic land use

Originally the vegetation cover on site and the surrounding area would have been a continuation of the wider Makarau Forest vegetated habitat sequence. While the site at current day contains some isolated pockets of terrestrial and aquatic habitats, historically the vegetation cover in this area likely would have been more representative of Kauri, podocarp, broadleaved forest (WF11) (Singers (2014) (Figure 4). At current day little representative vegetation remains, with the majority of vegetation being reduced to manuka, kanuka scrub forest (VS3) and kanuka scrub/forest (VS2) (as identified by Auckland Council, with a number of habitats on site immediate surrounds being labelled as 'Unclassified' (Figure 5). Please note that Wild Ecology as part of site surveys has further classified and identified all indigenous vegetation on site during a site visit carried out in October 2022 and February 2023 using the latest classification provided by Singers *et al.* (2017). These habitats are further classified and described in Section 5.0 of this report.

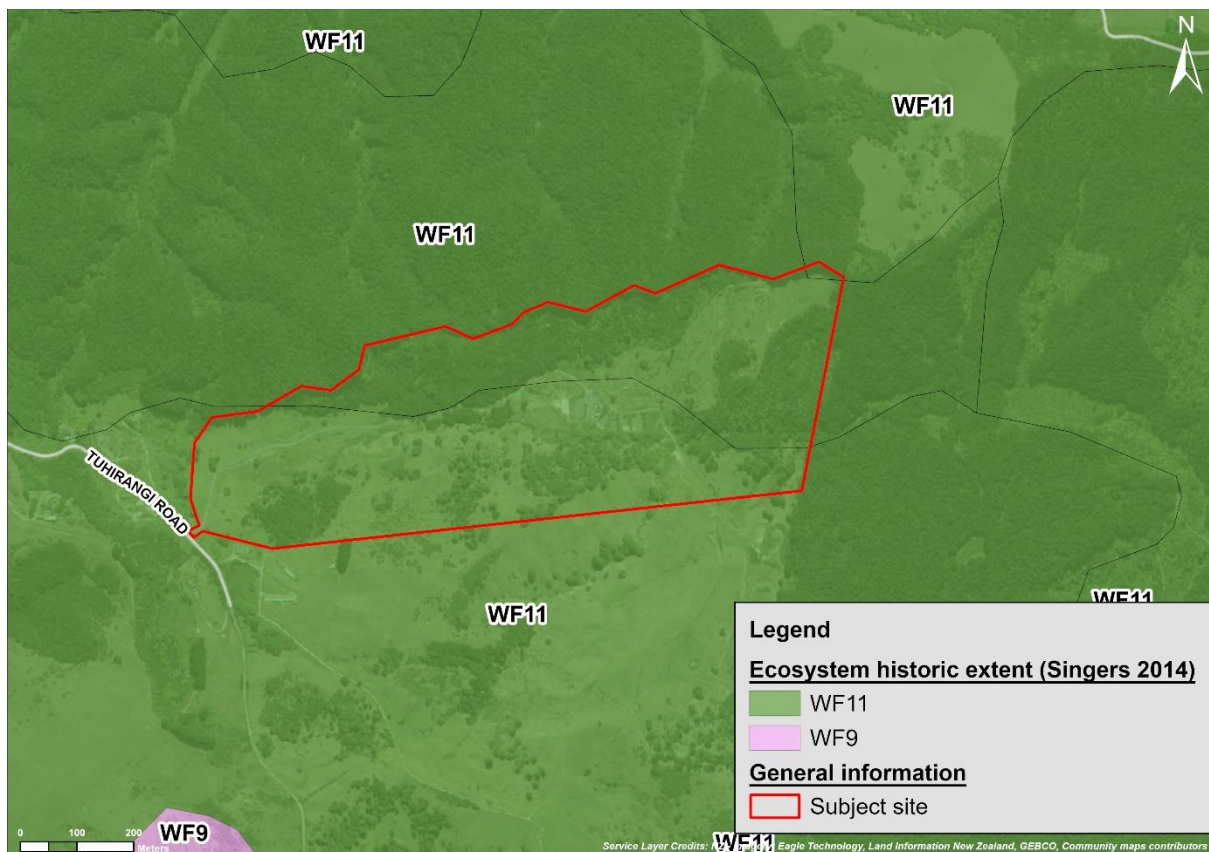


Figure 4: Auckland potential ecosystem classification (Singers 2014)

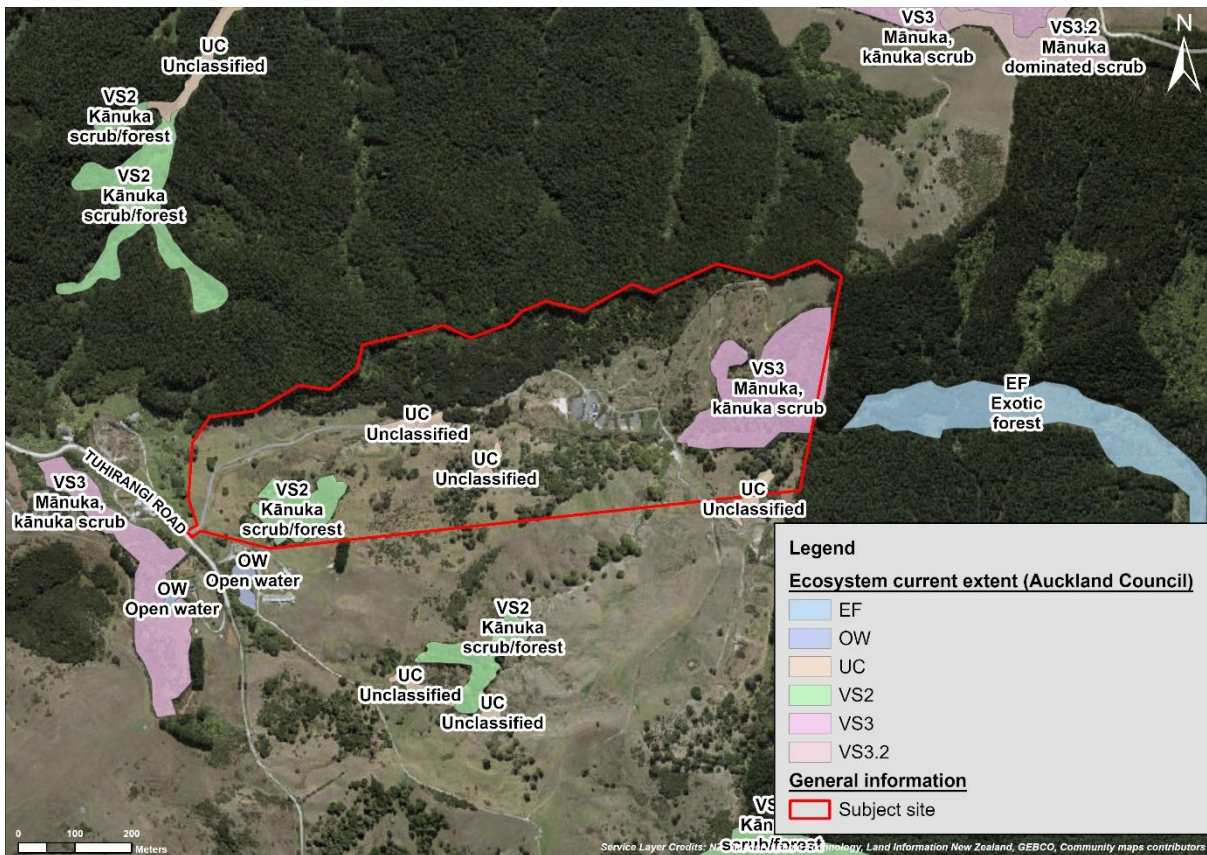


Figure 5: Showing the ecosystem types present on the subject site and surrounds as classified by Auckland Council (2023)

Historic land use activities have largely modified and reduced the extent and structure of the original ecosystem types that would have once extended over the area, primarily through vegetation clearance and conversion into agricultural land. By analysing the earliest historic aerial imagery from Retrolens aerial imagery from 1966 (Figure 6), the majority of the indigenous vegetation on site had already been cleared for farming activity, albeit more extensive tracts of vegetation cover can be observed extending along the sites northern and eastern aspects.

Between 1966 and 1988, land clearance activities on site and immediate surrounds intensify, with indigenous bush areas largely reduced in extent with only a number of scattered areas of vegetation remaining (Figure 7). The surrounding land encompassing the subject site has been planted in exotic forestry. The indigenous vegetation cover on site between 1986 and 2010 appear relatively unchanged, albeit natural regeneration is likely taking place within areas that are less accessible to stock and less suited for farming activity.

Sometime between 1986 and 2010, a number of farm tracks have been established on site, and a large stream crossing can be observed to have been established crossing the permanent stream channel roughly at the sites south-eastern boundary. The sites north-eastern aspect (Figure 8) has been significantly modified through establishment of an amateur motocross area with associated tracks, large mounds, deep and extensive excavations and ramps. It is likely that the establishment of these tracks have significantly modified the natural drainage patterns of the land.

Between 2010 and 2020, the site has remained largely unchanged, albeit it is noted that the motocross track has become disused, and the area has since been used for grazing (Figure 9). Blocks of plantation forestry Radiata pine (*Pinus radiata*) encompass the site to the north and east – some of these were observed to have been recently cleared during the February 2023 site visit (Figure 10).



Figure 6: Showing the site and surrounds in 1966 (Source: Retrolens)



Figure 7: Showing the site and surrounds in 1988 (Source: Retrolens)

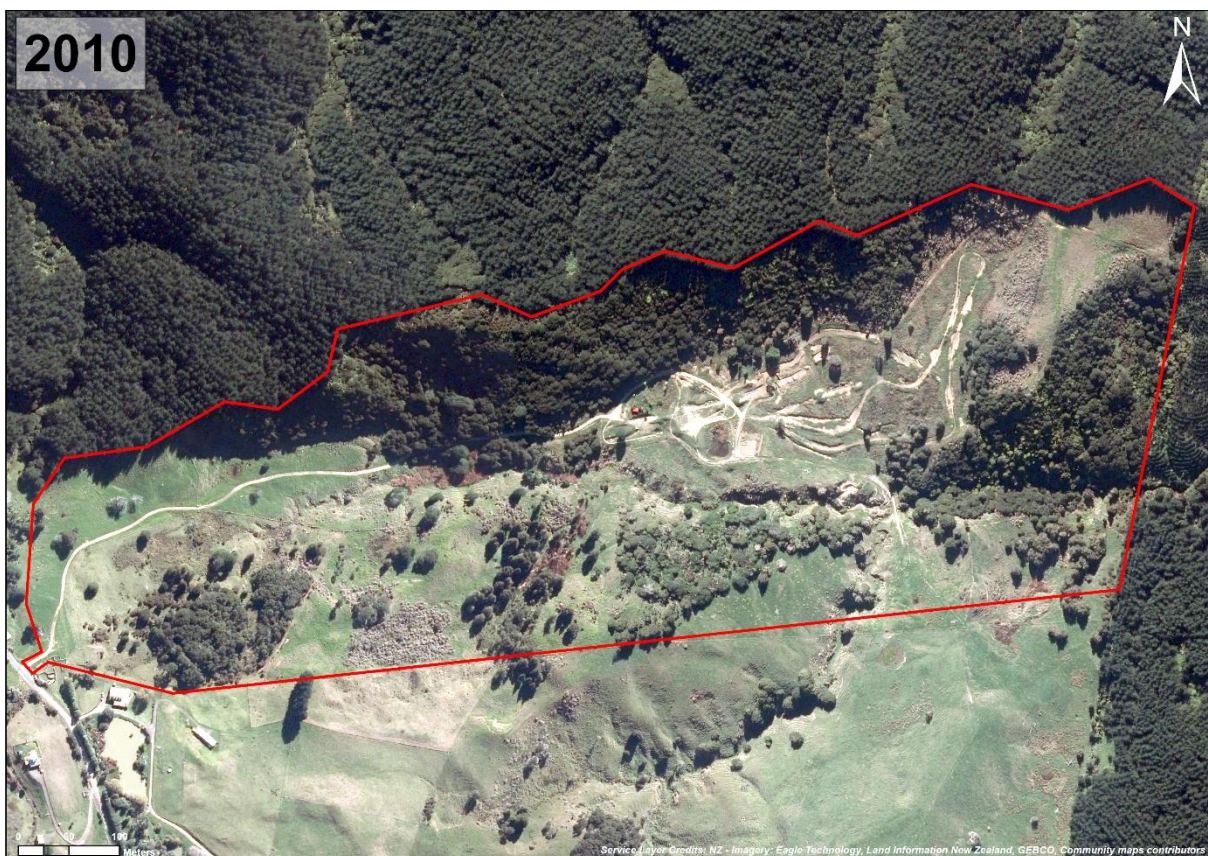


Figure 8: Showing the site and surrounds in aerial imagery of 2010 (Source: LINZ)

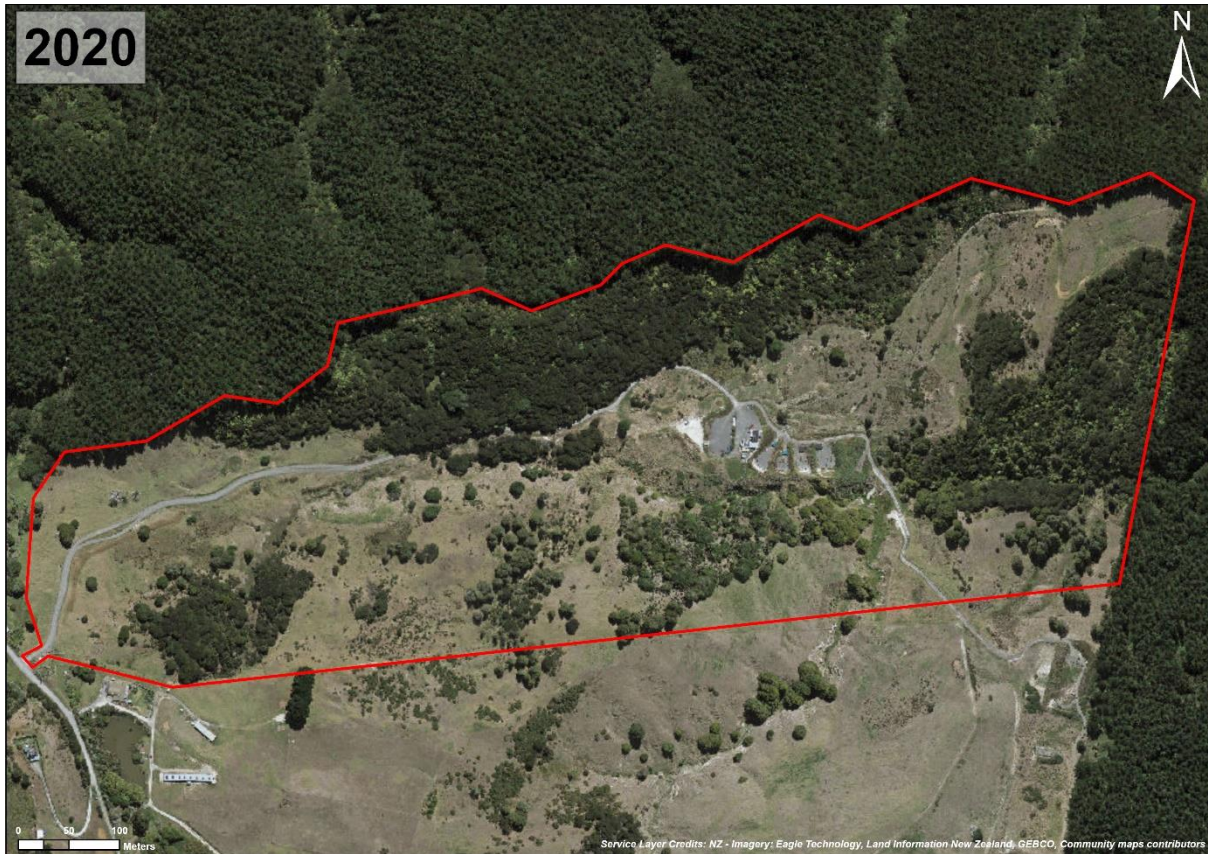


Figure 9: Showing the site and surrounds in the most recent aerial imagery (Source: LINZ)



Figure 10: Showing a recently cleared exotic plantation forestry block to the north of the site

3.3. Site characteristics

The site has a rolling to steeply sloping topography and generally slopes north and south towards the Kotipu Stream flowing through the central aspect of the site (Figure 11). The existing shooting bays are located in a 'bowl' in topography, having been formed within a flat area that is encompassed by sloping land to all sides.



Figure 11: The site has a rolling to steeply sloping topography sloping towards the existing shooting bays

The geology of the site is characterised by Zealandia Megasequence mainly marine sedimentary rocks of Waitemata Group lithology, consisting of interbedded, graded sandstone and siltstone or mudstone, massive mudstone and sandstone; local intercalated volcanic grit, breccia and conglomerate, and minor bioclastic limestone (GNS 2022). Yellow ultic (UY) soils extend over the subject site (Figure 12). These soils are strongly affected by waterlogging and have been chemically reduced. Waterlogging occurs in winter and spring, and some soils remain wet all year. These soils have high groundwater-tables, shallow potential rooting depth, and relatively high bulk density. Trafficability is limited when soils are wet, and drainage is necessary for most agricultural land use (Landcare Research 2023).

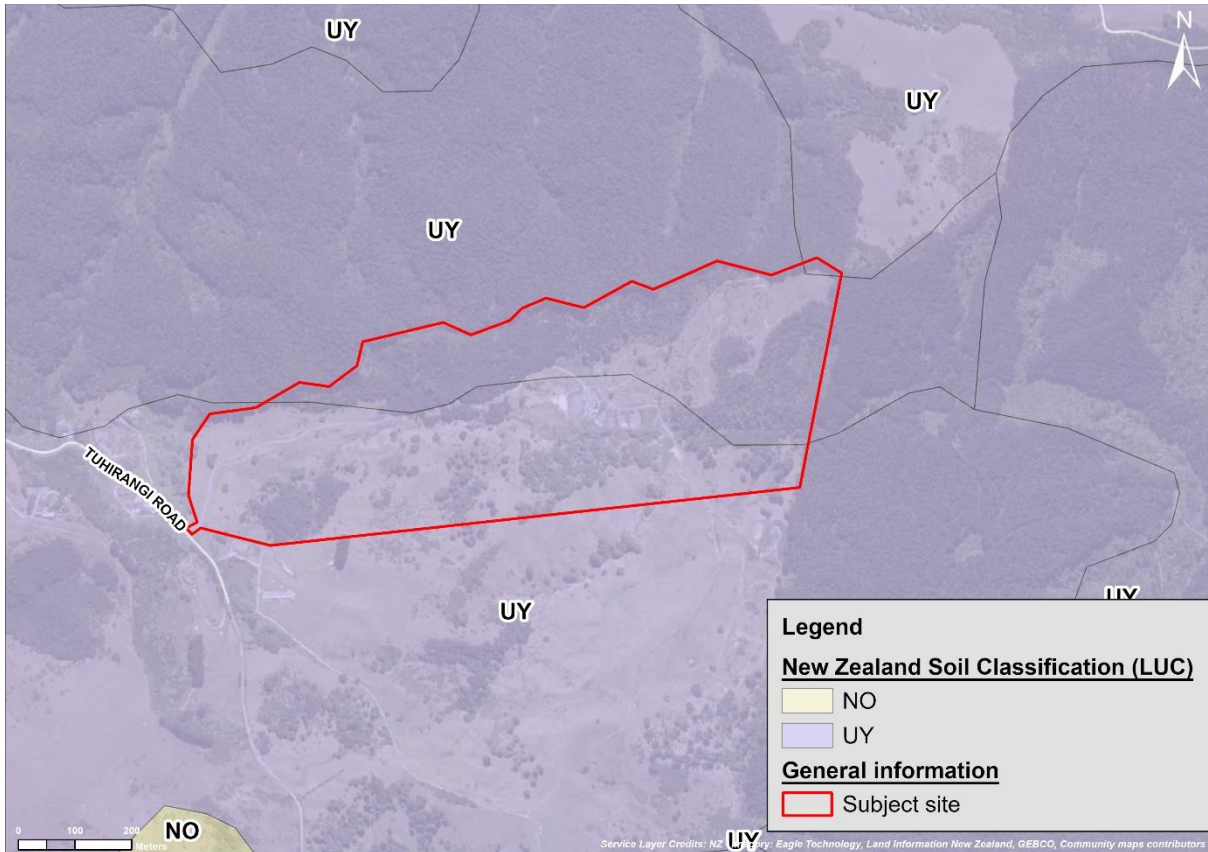


Figure 12: The site consists of yellow ultic soils which are typically prone to waterlogging

To assess the site’s agricultural production potential, Land Use Capability (LUC) inventory was analysed to assess whether any areas on site could be classified as of highly productive land (as defined within the National Policy Statement for Highly Productive Land 2022 (NPS-HPL)). LUC inventory classifies land into eight classes according to its long-term capability to sustain one or more productive uses. Highly Productive Land is represented as Land Use Capability classes 1, 2 and 3, as mapped in the New Zealand Land Resource Inventory. The priority for LUC Classes 1-3 is to maintain the potential for these high-quality soils to be used for agricultural purposes, rather than activities that are not dependent on soil quality. From analysing LUC inventory, it can be seen that the site and immediate surrounds are classified as LUC Class 6 land (Figure 13). Class 6 land is not suitable for arable use and has some low pastoral grazing and production forestry suitability (Landcare Research 2010). No soils on the site have been identified as highly productive land as defined under NPS-HPL (2022).

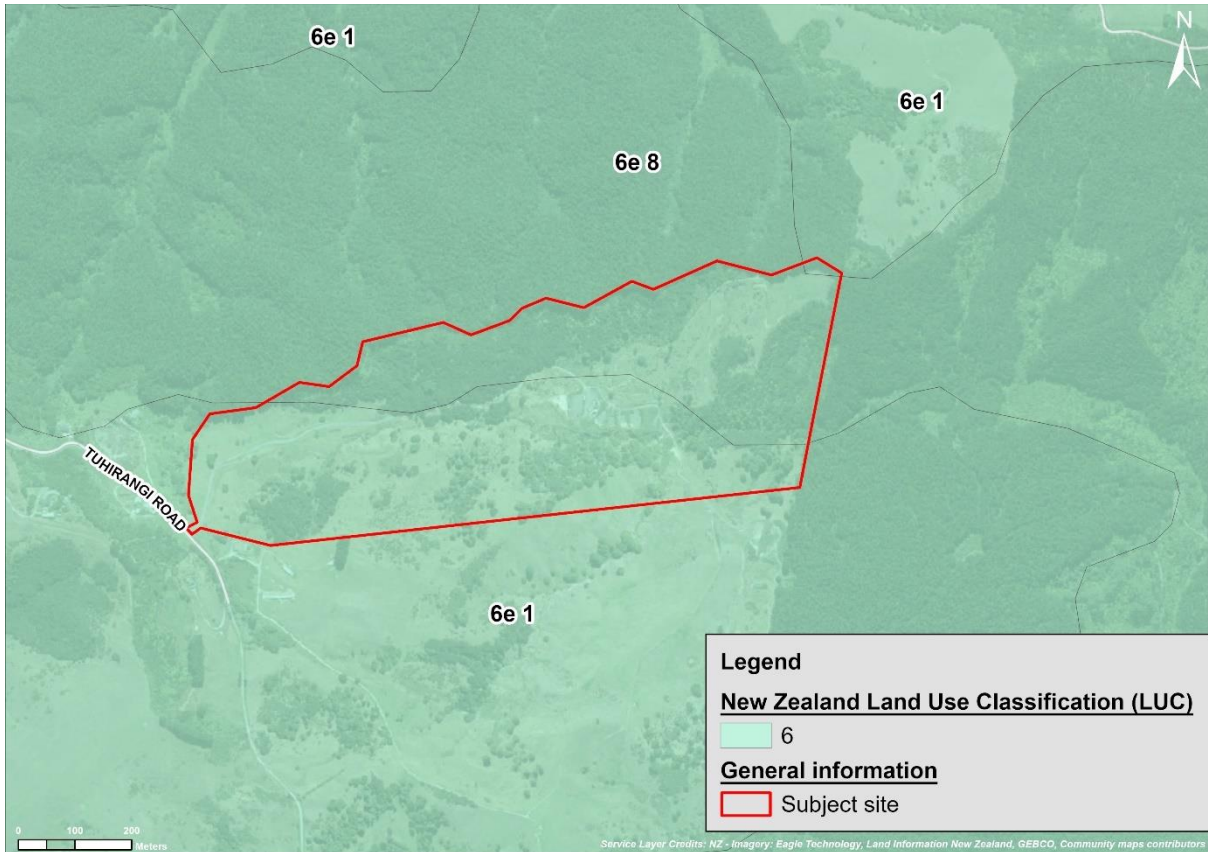


Figure 13: Showing the LUC classification for the site

The site forms an upper catchment area the Kaipara Harbour. Kotipu Stream originates within the site boundaries and flows in an easterly direction towards the Rauhori Stream, which eventually flows into Makarau River discharging into the Kaipara Harbour. The Kotipu Stream while flowing through the site boundaries is likely subject to periodic flooding as indicated by streambank erosion and flood debris observed along the riparian margins. The entirety of the Kotipu Stream margins while flowing through the subject site have been identified as a floodplain, while two small, isolated areas within the more elevated flat land to the north of the Kotipu Stream have been identified as flood prone areas under Auckland Council Open Data (Figure 14).

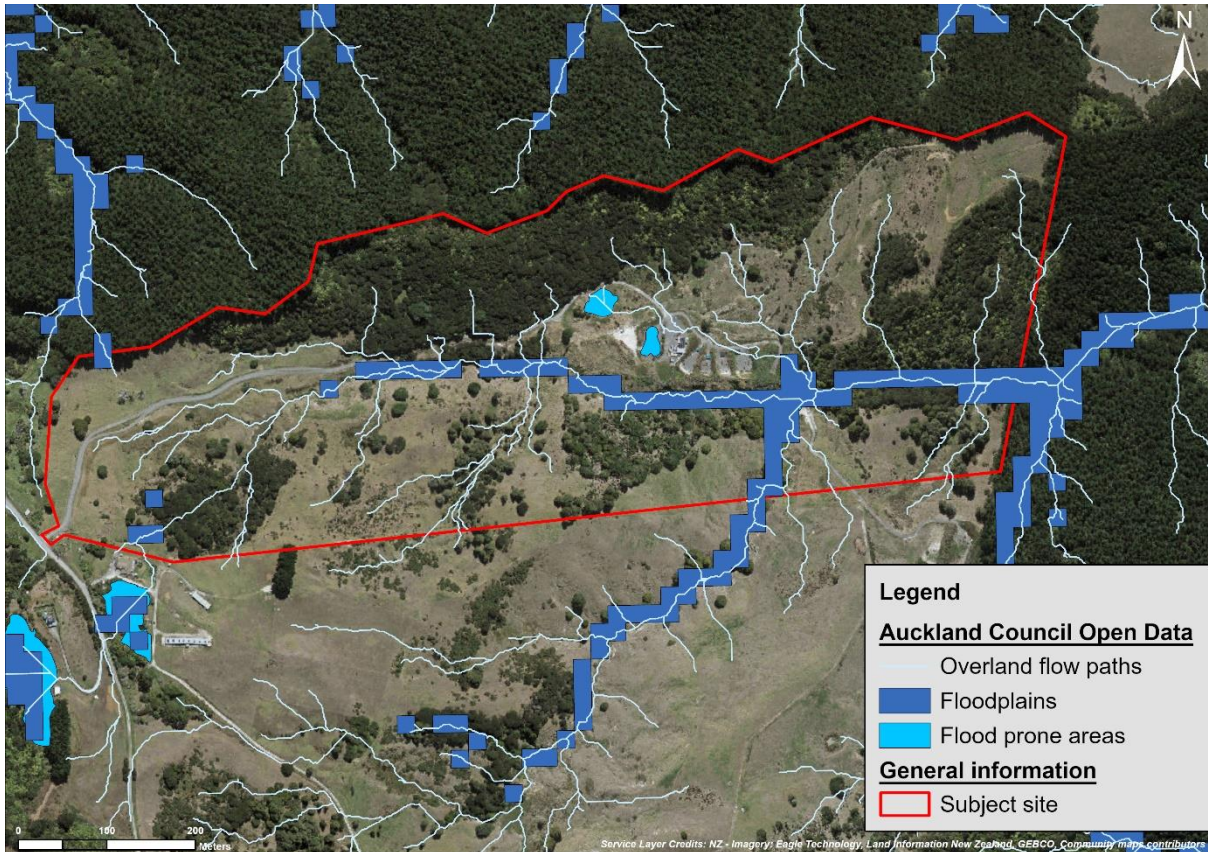


Figure 14: Overland flow path, floodplain and flood prone area overlays as per Auckland Council Open Data (Catchment & Hydrology) within the site boundaries and surrounds

The majority of the site is comprised of grazed exotic pasture (Figure 15) dominated by kikuyu (*Cenchrus clandestinus*), Dallas grass (*Paspalum dilatatum*), Yorkshire fog (*Holcus lanatus*), perennial ryegrass (*Lolium perenne*), and white clover (*Trifolium repens*) among other common exotic pastoral grasses and forbs. It is understood that the site is maintained under an active agricultural grazing regime. Scattered areas of terrestrial indigenous vegetation on site are contained along the sites less accessible and steeper northern and southern aspects. Generally, the on-site vegetation comprises of areas of regenerating kanuka scrub/forest (VS2), and small areas of remnant kauri, podocarp broadleaved forest (WF11) and areas of scattered exotic (EW) and indigenous wetland (WL19) areas. The vegetation characteristics and habitat types are further described in section 4.1.1 below.



Figure 15: The site is generally in grazed pasture with scattered areas of indigenous bush

From the analysis conducted above, the site and surrounds have been largely modified from its original ecosystem type by anthropogenic land use practices, with large tracts of indigenous vegetation cleared for agricultural production. Continued unrestricted grazing pressures within the margins of watercourses and waterbodies on site has further resulted in aquatic habitat degradation. Land modification circa early 2000s associated with the establishment of an amateur motocross area with associated tracks, large mounds, deep and extensive excavations and ramps have significantly modified the natural drainage patterns of the land.

4.0 ECOLOGICAL SURVEY RESULTS

4.1. Terrestrial

4.1.1. Vegetation communities

Field surveys were undertaken during October 2022 and February 2023. Vegetation was recorded during site visits and has been described below in general accordance with Atkinson (1985). Habitats identified on site have been mapped under Figure 16, with their general characteristics described under the following sections. The site contains approximately 12.7 ha of kanuka scrub/forest (VS5), 2.95 ha of modified Kauri, podocarp, broadleaved forest (WF11), with pockets of exotic wetland (EW) collectively covering 1.66 ha of land and raupo reedland (WL19) variations collectively covering 0.82 ha of land scattered throughout the site (Singers

(2018). Ecological value to each respective habitat type was assigned based on EclA EIANZ guidelines utilising Table 4 criteria and scoring combining values as per Table 6 of the guidelines.

A full flora inventory of species observed during site visits on site and in the immediate surrounds is summarised under Appendix 2.

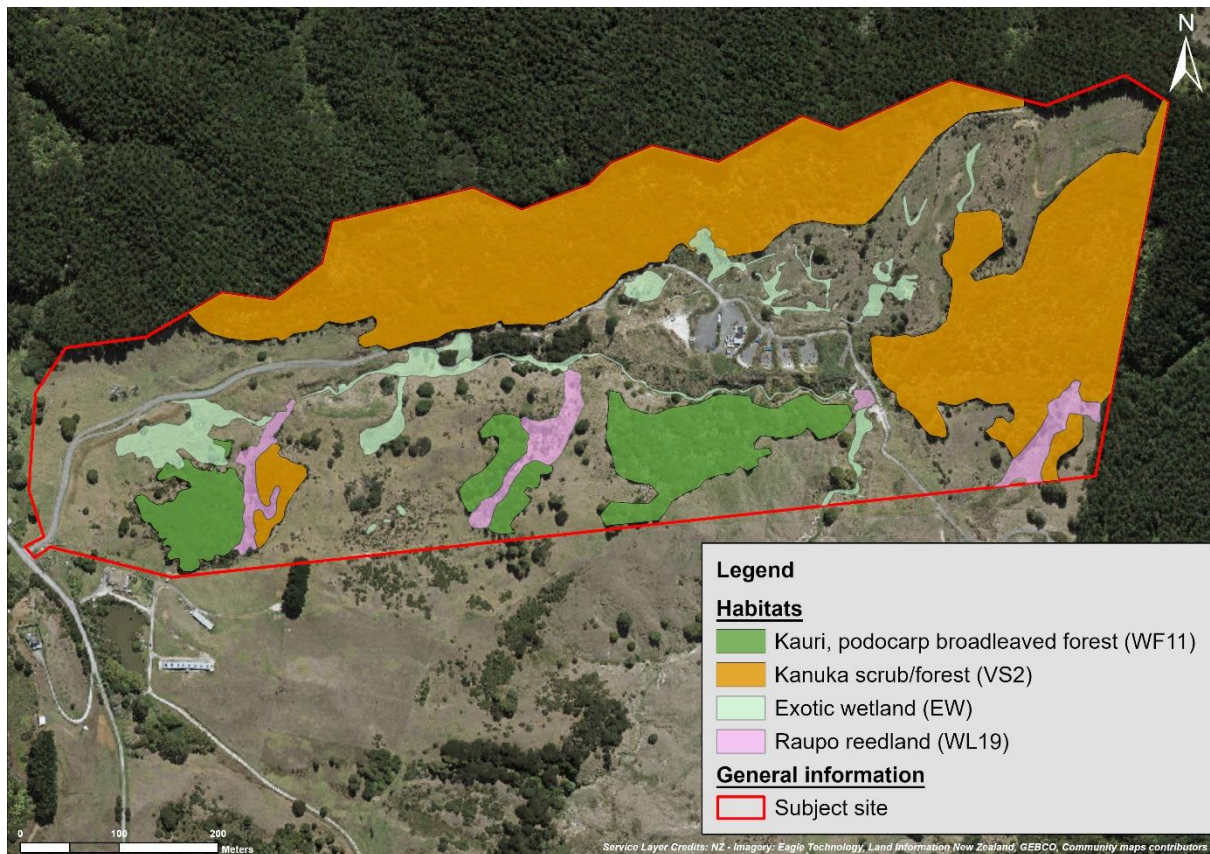


Figure 16: Showing general habitat types noted during field surveys

Table 4: Ecosystems identified in accordance with Singers et al. (2017); with Regional IUCN Threat Status and ecological value based on EIANZ criteria based on O’Connor et al. (1990)

Habitat type	Total land area covered within site boundaries	Regional IUCN threat status	Ecological value (EIANZ criteria based on O’Connor et al. (1990))
Kanuka scrub forest (VS2)	12.7 ha	Least concern	Moderate
Kauri, podocarp broadleaf forest (WF11)	2.95 ha	Endangered	High
Exotic wetland (EW)	1.66 ha	No status	Low
Raupo reedland	9,815 m ²	Endangered	High

4.1.1.1. *Kanuka scrub/forest (VS2)*

The majority of the terrestrial vegetation on site is dominated by regenerating kanuka scrub/forest (VS2). Kanuka (*Kunzea ericoides*) is dominant, with scattered emergent totara (*Podocarpus totara*) and kahikatea (*Dacrycarpus dacrydioides*) interspersed with regenerating ponga (*Cyathea dealbata*), mamaku (*Cyathea medullaris*), wheki (*Dicksonia squarrosa*), mahoe (*Meliccytus ramiflorus*), mapou (*Myrsine australis*), hangenage (*Geniostoma ligustrifolium* var. *ligustrifolium*), putaputaweta (*Carpodetus serratus*), mingimingi (*Coprosma propinqua*), mamangi (*Coprosma arborea*) and twiggy coprosma (*Coprosma rhamnoides*). Along the edges of the bush areas gorse (*Ulex europaeus*) and pampas (*Cortaderia selloana*) were persisting. The ground tier was dominated by regenerating samplings and seedlings of higher tier species from the surrounding areas.

Species found in the ground tier encompassing stream edges included forest sedge (*Carex dissita*), parataniwha (*Elatostema rugosum*), basket grass (*Oplismenus hirtellus*) as well as small native herbs *Hydrocotyle moschata*, and *Nertera dichondrifolia*. Ferns observed included threadfern (*Blechnum filiforme*), *Deparia petersenii* subsp. *congrua*, kiokio (*Blechnum novae-zelandiae*) and gully fern (*Pakau pennigera*).



Figure 17: Showing general species composition of kanuka scrub/forest (VS2) within the site boundaries

4.1.1.2. *Kauri, podocarp broadleaved species forest (WF11)*

Two small pockets of highly modified kauri, podocarp broadleaved species forest (WF11) are generally located along the ridgelines located along the southern aspect of the site. While no

kauri (*Agathis australis*) were noted within these remnants, having likely been logged historically, a number of representative broadleaved species maintain the dominant canopy layer. The upper ridgelines of the site are dominated by large emergent forest trees including emergent totara (*Podocarpus totara*), kahikatea (*Dacrycarpus dacrydioides*), matai (*Prumnopitys taxifolia*) with sparse taraire (*Beilschmiedia tarairi*), tawa (*Beilschmiedia tawa*), karaka (*Corynocarpus laevigatus*), rimu (*Dacrydium cupressinum*), kohekohe (*Dysoxylum spectabile*), hinau (*Elaeocarpus dentatus* var. *dentatus*), puriri (*Vitex lucens*), white maire (*Nestegis lanceolata*) and nikau (*Rhopalostylis sapida*) observed growing within these areas (Figure 18).

Many of the nikau, canopy trees and boulders were covered in epiphytes and climbers such as tank lily (*Astelia hastata*), perching lily (*Astelia solandri*), kiekie (*Freycinetia banksii*), thread fern (*Icarus filiformis*), hounds' tongue (*Zealandia pustulata* subsp. *pustulata*).

While some of the areas were observed to have some temporary fencing (typically 1 to 2 wire electric) the shrub tier and understory of these areas is almost absent and is generally in pasture with some less palatable species such as twiggy coprosma. It is deemed that prolonged grazing pressures have reduced the species diversity associated with the respective ecosystem type and hindered natural regeneration processes.



Figure 18: Showing the general species composition of the kauri/podocarp species forest (WF11)

4.1.1.3. Raupo reedland (WL19)

Pockets of modified raupo reedland (WL19) wetland habitats are dotted throughout the site – primarily associated with areas that have been less accessible to grazing stock. Raupo reedland

is classified as 'Endangered' in the Auckland Region. The pockets of raupo wetland scattered through the site are largely dominated by swamp millet (*Isachne globosa*) and raupo (*Typha oreintalis*) among kuta (*Schoenoplectus tabernaemontani*), orange nut sedge (*Machaerina rubignosa*), rautahi (*Carex geminata*), purei (*Carex secta*) and pukio (*Carex virgata*). Manuka (*Leptospermum scoparium*) is common throughout. Small stands of cabbage tree (*Cordyline australis*), wheki (*Dicksonia squarrosa*) were observed on the wetland edges.



Figure 19: Showing general species composition of the raupo reedland (WL19) areas on site

4.1.1.4. Exotic wetland (EW)

The site contains a number of scattered exotic wetland (EW) areas primarily encompassing the site's permanent, intermittent and ephemeral stream margins and drainage patterns. The key vegetation type across the majority of wetland areas was relatively uniform and was dominated by novel mercer grass (*Paspalum distichum*) grassland and *Juncus* sp. rushland ecosystems. The wetland areas contained species such as 'facultative wetland' mercer grass (*Paspalum distichum*), creeping bent (*Agrostis stolonifera*), umbrella sedge (*Cyperus eragrostis*), water pepper (*Persicaria hydropiper*), jointed rush (*Juncus articulatus*) and 'obligate' fools' watercress (*Apium nodiflorum*) interspersed with 'facultative wetland' soft rush (*Juncus effusus*), with clumps of fan-flowered rush (*Juncus sarophorus*) and pastoral species such as and 'facultative' tall fescue (*Lolium arundinaceum*), Yorkshire fog (*Holcus lanatus*), Lotus (*Lotus pedunculatus*), and buttercup (*Ranunculus repens*) interspersed throughout. Some 'upland' species were also noted within the wetland areas being kikuyu (*Cenchrus clandestinus*), and ryegrass (*Lolium perenne*) which is reflective of the exotic pasture the wetland areas are encompassed by, albeit these species were not dominant (<50%) within the mapped wetland areas.

The majority of these wetland ecosystems (especially within the sites north-eastern aspect) are likely induced due to human modification of drainage patterns and due to continuous stock grazing pressures. All of the exotic wetland areas are located on clay soils with typical hydric soil characteristics, which combined with continued unrestricted grazing pressures and pugging has influenced the hydrophytic species persistence in these areas. These areas are unlikely to have historically formed a representative wetland ecosystem, but would have rather formed part of the wider forested indigenous forest complex prior to initial land clearance,



Figure 20: Showing a representative example of exotic wetland habitat on site – primarily dominated by Mercer grass with common hydrophytic forbs and rushes

4.1.1.5. Exotic weeds and pest plants

Exotic weedy species and pest plants noted within the site boundaries were generally limited to common weeds associated with the wider pastoral landscape and included species such as kikuyu (*Cenchrus clandestinus*), gorse (*Ulex europaeus*), pampas (*Cortaderia selloana*), and Woolley nightshade (*Solanum mauritianum*). Patches of blackberry (*Rubus fruticosus* agg.) and inkweed (*Phytolacca octandra*) were present throughout.



Figure 21: Showing pampas and scattered gorse growing along the elevated slopes encompassing the Kotipu Stream flowing through the subject site

4.2. Aquatic

4.2.1. Streams

The site forms an upper catchment area the Kaipara Harbour. Kotipu Stream originates within the site boundaries and flows in an easterly direction towards the Rauhori Stream eventually flowing into Makarau River which discharges into the Kaipara Harbour.

Watercourses were assessed and classified on site during the site visit in October 2022, with their status determined in accordance with AUP (OP) watercourse classification criteria.

Given that none of the stream habitats are proposed to be impacted by the site development, a standard Stream Ecological Value (SEV) assessment was not deemed as necessary. Ecological condition and value was semi-quantitatively assessed during site visits in October 2022 and February 2023 factoring in the basic principles considering SEV criteria assessment and relevant EIANZ criteria.

There are 21 streams within the subject site, including two permanent streams (P) and nineteen intermittent streams (I). These are shown under Table 5 and Figure 25. The primary catchment within the subject site is the Kotipu Stream (P1) which runs along the central aspect of the site flowing in an easterly direction. P2 is a Kotipu Stream tributary stream which discharges into Kotipu Stream roughly at the sites south-eastern aspect. Both of the permanent stream habitats were observed to be flowing through steep incised valleys consisting of a sluggish, soft-

bottomed stream with predominantly low shallow flows which had been smothered by sediment and debris associated with the heavy rainfall conditions during February 2023 (Figure 22). During the site survey in February 2023 the average wetted width in these reaches was approximately 2–3 m wide with a central channel depth of varying from roughly 0.3 m to 1.5 m (in deeper isolated pools).



Figure 22: Showing permanent stream channel of P1 where it flows through the south–western aspect of the site

The intermittent stream habitats within the site boundaries are generally highly modified and degraded from the surrounding rural land use, with distinct commonalities between all reaches including poor riparian cover, stream beds and margins being open to stock, degraded stream beds with high sediment loading. Many of the intermittent streams have been channelised, piped and modified. In particular the intermittent stream habitats (Figure 23) contained within the disused motocross area were difficult to characterise given the significantly modified natural drainage patterns associated with the underlying earthworks carried out in this area in the past. However, applying the pre-cautionary principle these watercourses were assessed as intermittent streams as at the time of the survey visits they met at least three of the criteria of an intermittent stream (as defined under AUP(OP)). It is considered that the majority of the intermittent streams are of low ecological value and offer a limited range of suitable habitat for freshwater fauna.



Figure 23: Showing a representative example of intermittent stream I11 habitat contained within the sites north-eastern aspect

In contrast, intermittent and permanent streams (Figure 24) within vegetated gullies that are less accessible to grazing stock are well shaded, hard bottomed and, overall exhibit good ecological condition. These stream reaches are limited to the site's south-eastern aspect where the Kotipu Stream and its tributaries flow through a predominantly indigenous forest cover.



Figure 24: Showing a section of P1 while flowing through the bush area contained along the sites south-eastern aspect

Of the 21 streams surveyed, five were assessed as having good condition, seven were assessed of having moderate condition, and nine were assessed as having either poor or very poor ecological condition. Intermittent streams within the less modified south-western catchment were generally of moderate-good ecological condition, while the intermittent stream catchment contained within the north-eastern aspect of the site was generally heavily modified and contained little to no natural (unmodified) portions of stream bed and generally had low habitat quality and suitability for indigenous fauna.

Generally, the condition and ecological value of the streams contained within the site boundaries is that of typical rural landscapes within the Auckland Region, where more accessible watercourses have been degraded through unsustainable land use practices, while the less accessible streams are generally less impacted by land use due to physical or topographical constraints for access.

Table 5: Stream identification and assessment of condition and value

Stream identifier	Length within site boundaries	Ecological condition	Ecological value (EIANZ criteria based on O'Connor et al. (1990))
P1	907m	Good	High
P2	151m	Good	High
I1	107m	Moderate	Moderate
I2	170m	Moderate	Moderate
I3	43m	Moderate	Moderate
I4	128m	Moderate	Moderate
I5	98m	Moderate	Moderate
I6	203m	Moderate	Moderate
I7	32m	Poor	Low
I8	43m	Poor	Low
I9	47m	Very poor	Low
I10	70m	Very poor	Low
I11	226m	Very poor	Low
I12	48m	Very poor	Low
I13	42m	Very poor	Low
I14	92m	Very poor	Low
I15	27m	Very poor	Low
I16	55m	Very poor	Low
I17	260m	Moderate	Moderate
I18	143m	Good	Moderate
I19	240m	Good	Moderate
I20	106m	Good	Moderate
I21	37m	Moderate	Moderate

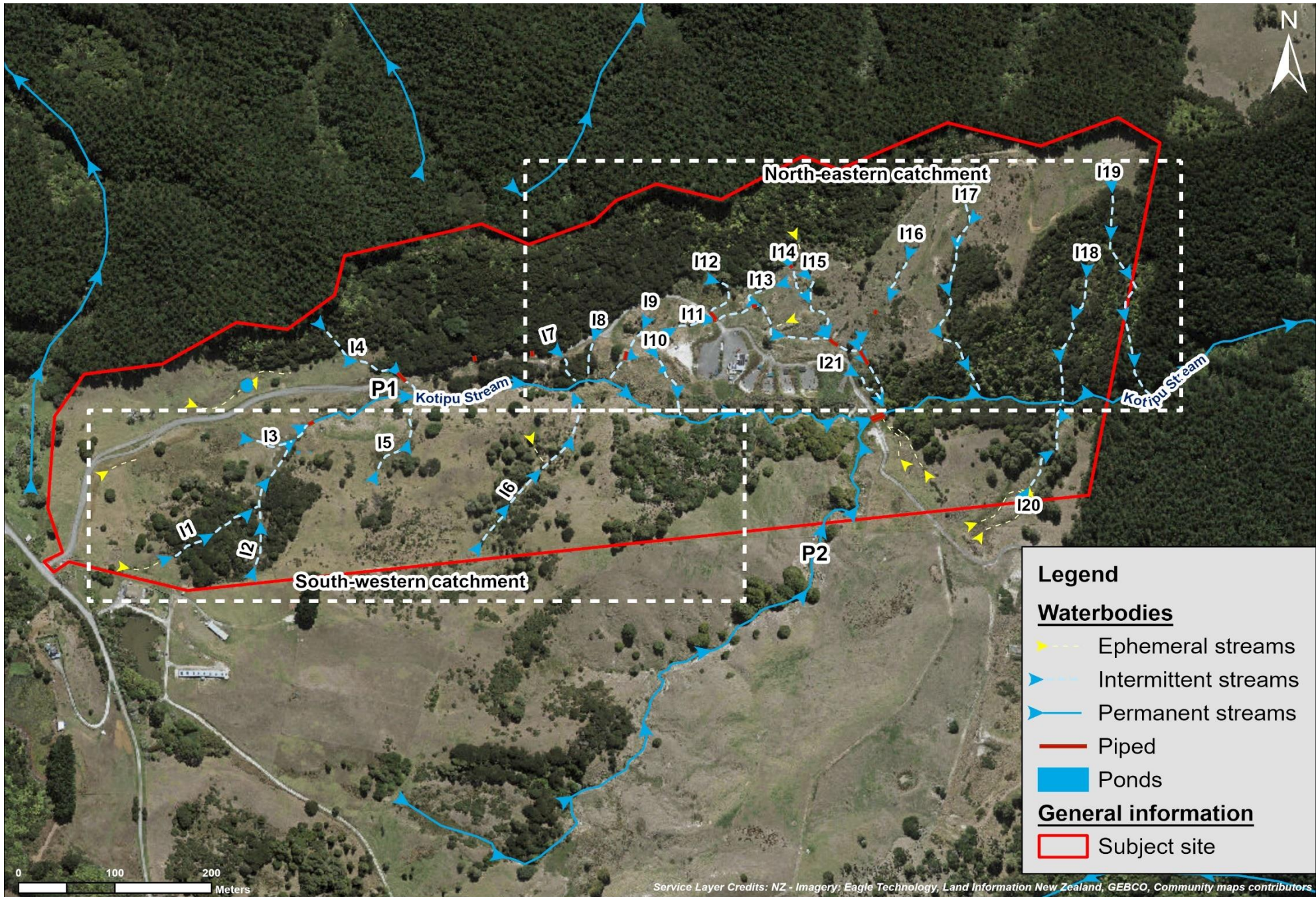


Figure 25: Showing the stream classification within the subject site boundaries

4.2.2. Wetlands

4.2.2.1. NPS-FM 'natural inland wetland' definition and exclusions

The National Policy Statement for Freshwater (NPS-FM) 2020 provides local authorities with updated direction on how they should manage freshwater under the Resource Management Act 1991. The National Environmental Standard for Freshwater (NES-FW) sets out national rules for works and discharges in the vicinity of natural wetlands.

The RMA (1991) definition of a wetland "*includes permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions*".

MfE released an amended version of the NPS-FM and NES-FW on 08/12/22. The revised NPS-FM definition of a 'natural inland wetland' is set out below:

Natural inland wetland means a wetland (as defined in the 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**

For the purpose of this assessment to assess whether a wetland area comprises more than 50% exotic pasture species cover, the general species composition was assessed against pasture or forage species that have been described under 'Draft National List of Exotic Pasture Species' (Cosgrove *et al.* 2022) which largely update species that were included as 'pasture species' in the current 4th Edition of Pasture and Forage Plants for New Zealand.

Any artificial waterbodies (i.e. artificial watercourses and artificial stock ponds) and their immediate margins were excluded from the definition of a 'natural inland wetland' as per exclusion (c).

4.2.2.2. NPS-FM 'natural inland wetland' delineation assessment

Based on a brief desktop assessment and site walkover visit conducted on 4th October 2022, and 8th of February 2023 it was deemed that the site contains or directly abounds areas of 'wetland' habitats as defined under the RMA. During a site walkover it was noted that these areas

were dominated by a mixture of exotic and indigenous species that are commonly recorded growing within seasonally saturated land, and therefore a high level NPS-FM wetland delineation assessment based on passing rapid wetland delineation test was carried in general accordance with MfE (2022) Wetland delineation methodology. The boundary of putative wetland areas was established by utilising a 100m tape between the interface of wetland and non-wetland (pasture vegetation). The boundary of a wetland area was recorded as the interface between wetland and non-wetland (i.e. pasture vegetation) by establishing a random 2m x 2m plot, and recording the species assemblages. All pasture interface plots contained >50% of exotic pasture species (dominated by a mixture of kikuyu, dallas grass (*Paspalum dilatatum*) and clover (*Trifolium repens*) as described under Cosgrove *et al.* 2022.

The results of this assessment are presented under Table 6, Figure 26 and Appendix 3. Wetland areas that met the definition of a 'natural inland wetland' as defined under NPS-FM (2020 – amended 2022) have been identified to ensure that appropriate consideration can be given to relevant NES-FW (2022 – amended 2022) regulations. Brief consideration has also been given to the overall ecological condition based on parameters included in Handbook for Monitoring Wetland Condition (Landcare Research 2004), and ecological value as per parameters outlined under Table 4 of EIANZ criteria based on O'Connor *et al.* (1990).

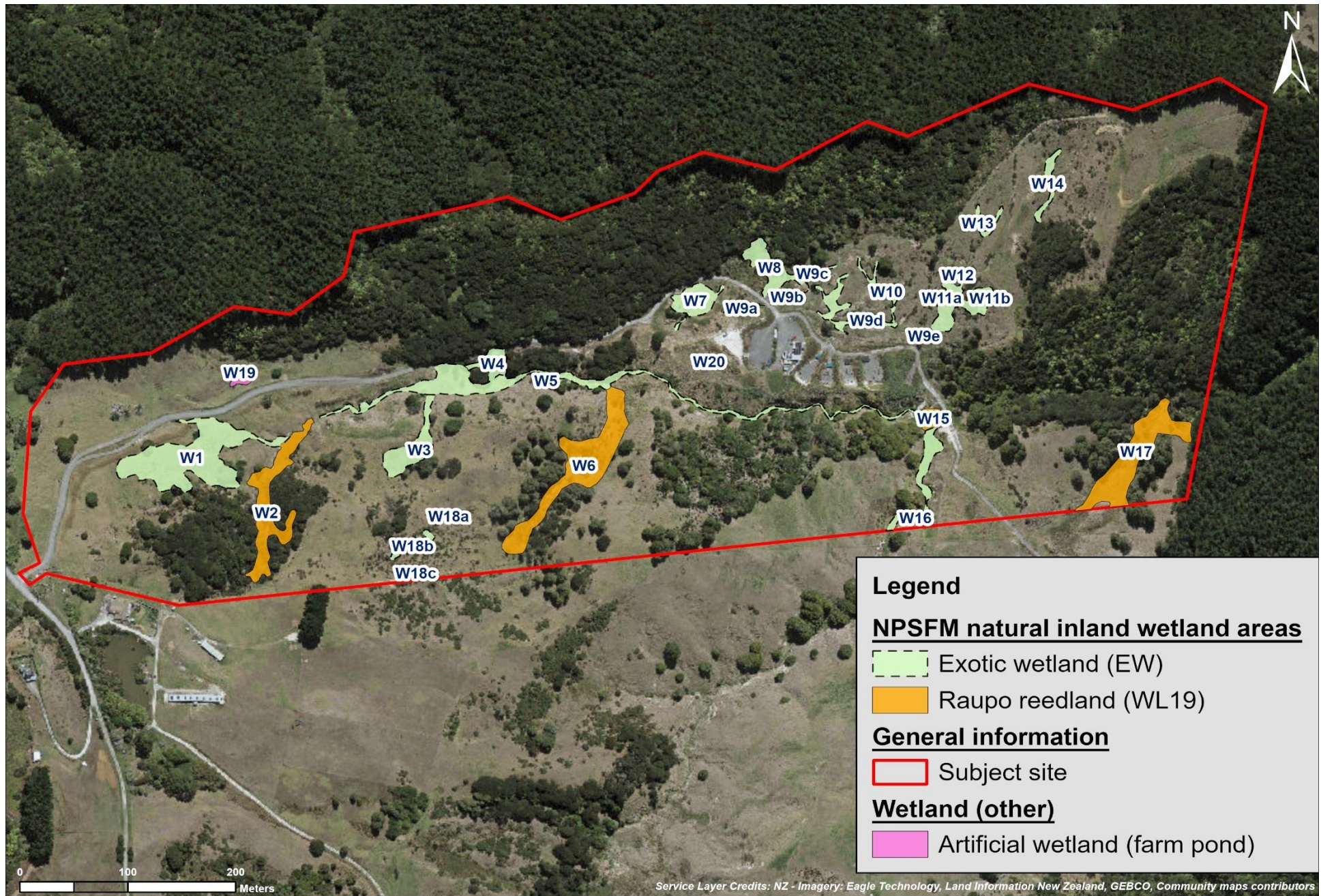


Figure 26: Showing other wetland and 'natural inland wetland' (NPSFM) area extent on site – note W19 is an artificial wetland established over in a farm stock pond

The wetland areas on site can be separated into wetland areas dominated by indigenous species (being W2, W6 and W17) comprising of species such as 'obligate' swamp millet (*Isachne globosa*) and raupo (*Typha orientalis*) among kuta (*Schoenoplectus tabernaemontani*), orange nut sedge (*Machaerina rubignosa*), rautahi (*Carex geminata*), purei (*Carex secta*) and pukio (*Carex virgata*). These areas at the time of survey visits were generally considered to be of good ecological condition and moderate-high ecological value albeit their condition is likely continuously adversely affected by surrounding agricultural land use practices.

The remainder of the wetland areas on site were dominated by exotic hydrophytic species including mercer grass (*Paspalum distichum*) grassland and *Juncus* sp. rushland ecosystems including species such as 'facultative wetland' mercer grass (*Paspalum distichum*), creeping bent (*Agrostis stolonifera*), umbrella sedge (*Cyperus eragrostis*), water pepper (*Persicaria hydropiper*), jointed rush (*Juncus articulatus*) and 'obligate' fools' watercress (*Apium nodiflorum*) interspersed with 'facultative wetland' soft rush (*Juncus effusus*), with clumps of fan-flowered rush (*Juncus sarophorus*) and pastoral species such as and 'facultative' tall fescue (*Lolium arundinaceum*), Yorkshire fog (*Holcus lanatus*), Lotus (*Lotus pedunculatus*), and buttercup (*Ranunculus repens*) interspersed throughout. Some 'upland' species were also noted within the wetland areas being kikuyu (*Cenchrus clandestinus*), and ryegrass (*Lolium perenne*) which is reflective of the exotic pasture the wetland areas are encompassed by, albeit these species were not dominant (<50%) within the wetland areas.

The majority of wetland areas on site are generally of poor ecological condition and value as a direct result of past modification, with the exception of wetland areas that are less accessible to both stock and human modification. This is associated with initial modification through land clearance, and more recent modification as a result of the creation of motocross tracks, as well ongoing unrestricted grazing pressures. In particular the small wetland areas scattered along the north-eastern aspect of the site (W7-W14 & W20) are likely not of 'natural origin' and have established as a result of the land use activities carried out in the past (i.e. earthworks and earth moving associated with the motocross tracks). While these wetlands are generally of poor ecological condition and have been influenced by human activity, induced wetlands are formed through natural processes and are not deliberately "constructed". They therefore fall within the definition of natural inland wetland and are regulated by the NES-FW.

An overgrown stock pond area has been identified as W19, as at the time of survey visits it was observed to have overgrown with common hydrophytic species. It is understood that the pond is utilised for stock water purposes and is routinely maintained (i.e. dredged and cleared of vegetation) for such purposes. This is standard agricultural practice and there is no evidence that the stock pond has been established in a historic wetland area and is therefore considered fully artificial. Nevertheless, the stock pond is located outside the immediate project footprint, will not be impacted on by the development and is to be utilised for ongoing farming purposes.

Table 6: Wetland description on site

Wetland identifier	Area	Wetland under RMA	Natural inland wetland as defined under NPS-FM	Size	Ecological condition (based on parameters included in Handbook for Monitoring Wetland Condition (Landcare 2004).	Ecological value (EIANZ criteria based on O'Connor et al. (1990)
W1	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	4,779 m ²	Poor	Low
W2	T. orientalis – I. globosa wetland	Yes	Yes	2,509 m ²	Good	High
W3	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	1,273 m ²	Poor	Low
W4	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	563 m ²	Poor	Low
W5	P. distichum – A.stolonifera – J. effusus – C. eragrostis – wetland with patches of T. orientalis – I. globosa	Yes	Yes	3,326 m ²	Moderate	Moderate
W6	T. orientalis – I. globosa wetland	Yes	Yes	3,882 m ²	Good	High
W7	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	1,001 m ²	Poor	Low
W8	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	1,129 m ²	Poor	Low
W9	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	1,092 m ²	Poor	Low

W10	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	315 m ²	Poor	Low
W11	P. distichum – P. hdyropiper– C. eragrostis wetland	Yes	Yes	1,072 m ²	Poor	Low
W12	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	294 m ²	Poor	Low
W13	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	244 m ²	Poor	Low
W14	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	415 m ²	Poor	Low
W15	T. orientalis – I. globosa wetland	Yes	Yes	345 m ²	Good	High
W16	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	929 m ²	Poor	Low
W17	T. orientalis – I. globosa – S. tabernaemontani wetland	Yes	Yes	3,077 m ²	Good	High
W18	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	167 m ²	Poor	Low
W19*	P. distichum – A.stolonifera – J. effusus – C. eragrostis vegetation established in an old farm pond	Yes	No*	102 m ²	Very poor	Low
W20	P. distichum – A.stolonifera – J. effusus – C. eragrostis wetland	Yes	Yes	21 m ²	Poor	Low

*W19 has developed within an artificially created farm pond which is utilised for the farming activity on site and requires to be maintained for stock drinking water. There is no evidence of historic wetland presence in this location and therefore is considered fully artificial. And excluded from NPSFM natural inland definition as per exclusion (c)

4.2.3. Aquatic diversity

A water sample within the easternmost section of Kotipu Stream flowing through site was taken using a Wilderlab eDNA test kit for multi-species analysis by DNA metabarcoding (WilderLab 2022) during the site visit on 8th of February 2023. The full eDNA sampling and analysis methodology can be found at wilderlab.co.nz. Full survey results can be found in Appendix 5. The eDNA sample location is shown Appendix 6.

A further quantitative search of the New Zealand Freshwater Fish Database (NZFFD, accessed February 2023, revealed records of six fish and three native invertebrate species as being present within the wider Makarau River catchment (Table 7).

Table 7: Summary of aquatic species recorded within Makarau River catchment and eDNA survey in February 2023 (Conservation status as per Dunn et al. 2017 and Grainger et al. 2018)

Scientific name	Common name	Conservation status	Recorded via
<i>Anguilla australis</i>	Shortfin eel	Endemic and Not Threatened	NZFFD & eDNA
<i>Anguilla dieffenbachii</i>	Longfin eel	Native & Declining (At risk)	NZFFD & eDNA
<i>Galaxias fasciatus</i>	Banded kokopu	Endemic and Not Threatened	NZFFD & eDNA
<i>Galaxias maculatus</i>	Inanga	Native & Declining (At risk)	NZFFD
<i>Gobiomorphus basalis</i>	Cran's bully	Native and Not Threatened	NZFFD
<i>Gobiomorphus cotidianus</i>	Common bully	Native and Not Threatened	NZFFD & eDNA
<i>Paranephrops</i> spp.	Koura	Native & Declining (At risk)	NZFFD & eDNA

Of note, the eDNA sample detected the presence of 'At Risk-Declining' long-fin eel (*Anguilla dieffenbachii*), 'At Risk-Declining' koura (*Paranephrops* spp.) as being present within the section of the Kotipu Stream flowing through the subject site. Both of these species are known to be comparatively tolerant of silty substrates, which can result from the human induced (earthworks, plantation forestry slash) and natural processes (i.e. flooding and erosion). However,

sedimentation may reduce the availability of food to tuna by clogging up instream substrates where organisms such as invertebrates and kōura live.



Figure 27: Longfin eel presence was detected within the eDNA sample taken within the Kotipū Stream

4.3. Avifauna

Avifauna species were observed on the site via two 5MBCs and opportunistic observations during site visit on February 8th 2023, with a comprehensive bird species list outlined in Table 8. The full survey results can be found under Appendix 4, with bird survey locations shown under Appendix 6.

The birds observed on site are representative of the modified riparian areas with some common introduced and native bird species such as spur winged plover (*Vanellus miles*) and welcome swallow (*Carduelis carduelis*) observed within the pastoral areas. Several New Zealand fantails (*Rhipidura fuliginosa*) were seen during site walkover. Sacred kingfishers (*Todiramphus sanctus*) were observed flying along the riparian corridor. One kereru (*Hemiphaga novaeseelandiae*) was observed roosting within the on-site bush (WF11) area. Mallard (*Anas platyrhynchos*), pukeko (*Porphyrio melanotus*), paradise shelduck (*Tadorna variegata*) were observed within the Kotipū Stream riparian corridor and utilising the wider riparian habitats on site.

Overall, the diversity of birds observed was low/moderate, with 9 native/endemic and 4 introduced species.

Table 8: Bird species recorded on the site during site visit in February 2023

Scientific name	Common name	Conservation status
<i>Acridotheres tristis</i>	Myna	Introduced & Naturalised
<i>Anas platyrhynchos</i>	Mallard	Introduced & Naturalised
<i>Carduelis carduelis</i>	European goldfinch	Introduced & Naturalised
<i>Circus approximans</i>	Swamp harrier	Native & Not Threatened
<i>Gerygone igata</i>	Grey warbler	Endemic & Not Threatened
<i>Hemiphaga novaeseelandiae</i>	Kereru	Native & Not Threatened
<i>Hirundo neoxena</i>	Welcome swallow	Native & Not Threatened
<i>Passer domesticus</i>	House sparrow	Introduced & Naturalised
<i>Platycercus eximius</i>	Eastern rosella	Introduced & Naturalised
<i>Porphyrio melanotus</i>	Pukeko	Native & Not threatened
<i>Prothemadera novaeseelandiae</i>	Tui	Endemic & Not Threatened
<i>Rhipidura fuliginosa</i>	New Zealand fantail	Endemic & Not Threatened
<i>Tadorna variegata</i>	Paradise shelduck	Endemic & Not Threatened
<i>Todiramphus sanctus</i>	Sacred kingfisher	Native & Not Threatened
<i>Vanellus miles</i>	Spur-winged plover	Native & Not Threatened
<i>Zosterops lateralis</i>	Silvereye	Native & Not Threatened



Figure 28: Kereru were recorded roosting within the bush area on site

4.4. Herpetofauna

A diurnal habitat search inspecting areas likely to be utilized by native lizards for sheltering or foraging (e.g., beneath logs, boulders, and manmade objects) was conducted during site visits in February 2023.

The habitat quality for lizards throughout the site is generally good due given that a large part of the subject site contains tracts of indigenous bush. Multiple green and golden bell frogs (*Ranoidea aurea*), and rainbow skink (*Lampropholis delicata*) were observed at various locations throughout the site. Rainbow skinks arrived in New Zealand in the late 1960s, but only became classified as an 'Unwanted Organism' in recent years and removed from the Wildlife Act in 2010 (DoC 2015).

A further hand search along the edges of the less disturbed kanuka scrubland extending along the northern aspect of the site also found a single copper skink (*Oligosoma aeneum*) (Figure 29). Copper skinks inhabit areas with good ground cover in open and shaded areas of forest. Copper skink has only recently been assessed as 'At Risk – Declining' under the latest Conservation status of NZ reptiles (Hitchmough *et al.* 2021). These changes result from observations of noticeable decline and/or habitat loss at sites which have been visited over long periods, and for some species from inferences based on observed declines and knowledge of the impacts of invasive predator irruptions on the ecosystem in general (Hitchmough *et al.* 2021).



Figure 29: A single copper skink was recorded within the existing covenant area on site

Figure 30 and Table 9 below outlines the species likely to occur within the wider area and their corresponding conservation status. It is also likely that species such as forest gecko (*Mokopirirakau granulators*) are present within the site boundaries given that the site contains optimal habitat for this species.

No indigenous vegetation clearance is proposed to be carried out as part of the site development works and therefore the likelihood of the development resulting in any adverse effects of herpetofauna is low. Some exotic weedy species (primarily pampas) are proposed to be removed as part of the riparian enhancement planting. To avoid and minimise actual and potential adverse effects to native lizards, lizard-sensitive clearance protocols will be adopted and all vegetation to be cleared will be inspected by a suitably qualified ecologist and all indigenous herpetofauna shall be salvaged and relocated to a nearby suitable habitat.

Table 9: Herpetofauna likely to be present with the surrounding area, including latest Threat Status (Hitchmough et al. 2021)

Common name	Latin name	Threat status	Suitable habitat on site or adjacent ?
Rainbow/plague skink	<i>Lampropholis delicata</i>	Unwanted organism	Present on site and surrounds
Green and golden bell frog	<i>Ranoidea aurea</i>	Exotic species	Present on site and surrounds
Forest gecko	<i>Mokopirirakau granulators</i>	At Risk - Declining	Previously recorded 3km east of the subject site - optimal habitat on site
Copper skink	<i>Oligosoma aeneum</i>	At Risk - Declining	Recorded on site - optimal habitat on site
Stripe skink	<i>Oligosoma striatum</i>	At Risk - Declining	Previously recorded 3km north-west of the site - minimal optimal habitat on site

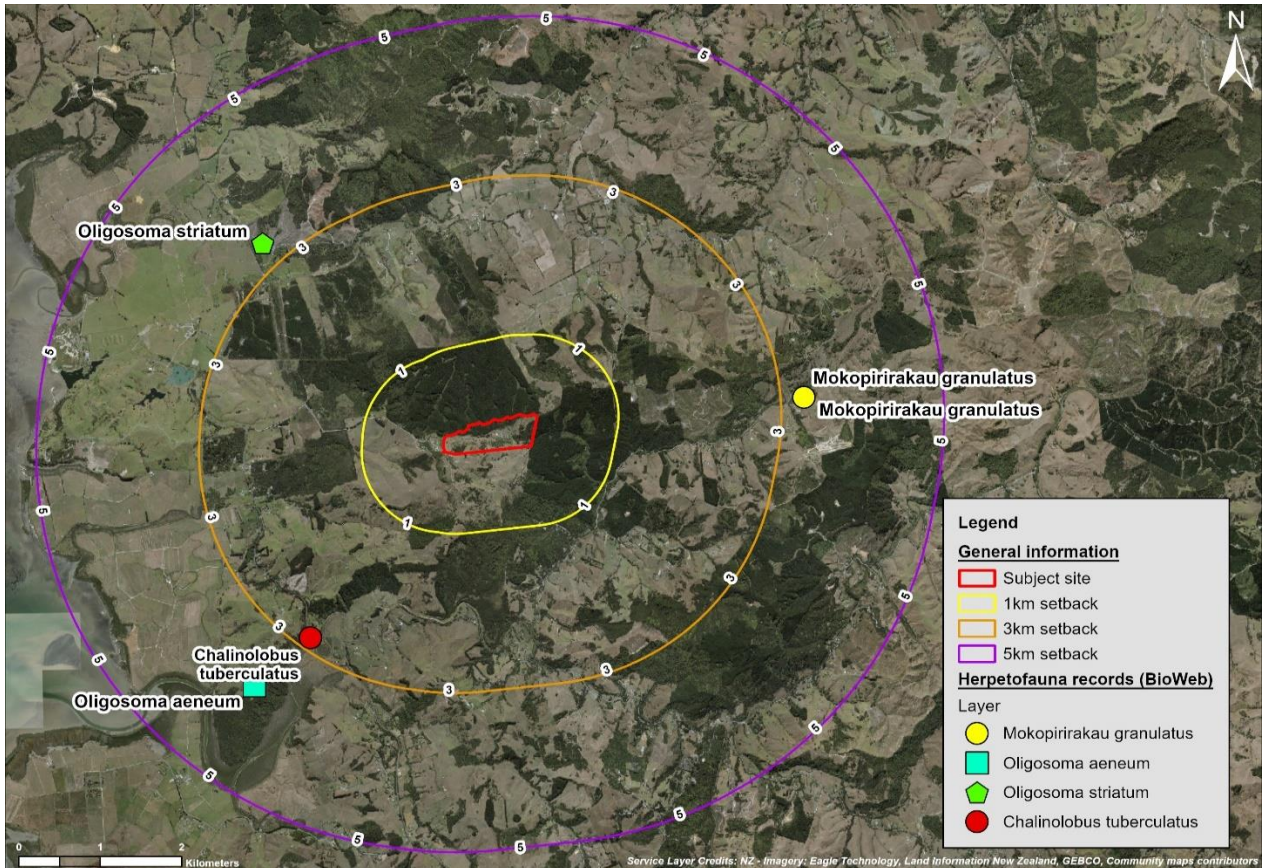


Figure 30: Showing DoC database records for herpetofauna within a 5 km radius from the site

4.4.1. Bats

New Zealand has two native bat species, being the long-tailed bat (*Chalinolobus tuberculatus*) and the lesser short-tailed bat (*Mystacina tuberculata*). Native bats are 'absolutely protected' under the Wildlife Act (1953). The subject site is located approximately 3 km north-west of confirmed recent records (2014) of long-tailed bats in the Makarau Bridge Reserve (Figure 30).

During the site visit in February 2023, a visual assessment for potential roost sites was undertaken. Trees on site were assessed for their potential to support bat roosts which comprised of a ground based visual inspection using binoculars to identify any features potentially suitable for roosting bats. Such features may include holes, frost cracks, deadwood, knot holes and limb wounds.

The majority of the site is comprised of regenerating kanuka scrub and thus bat roosting potential is low, however some isolated large puriri trees contained within the bush areas identified as WF11 contained mature trees with suitable roost features (knot holes) that may offer some suitable roosting habitat.

eDNA analysis carried out on site did not record any traces of long-tail bat DNA, and it is likely that the presence of exotic mammalian predators (such as rats and mustelids) and the overall highly modified habitat of the site likely inhibits long tail bat use of the site. Given the long linear

riparian features on site, it is not discounted that long-tailed bats may periodically utilise the site for foraging.

No indigenous vegetation clearance is proposed to be carried out as part of the project, so bat roost potential on site will not be affected. The nature of the operation of the shooting ranges is unlikely to have any effect on any potential bat populations utilising the area given that bats typically forage after dusk and before dawn, while the operational hours of the proposed shooting ranges will be limited to daylight hours. It is deemed that bat foraging habitat will in fact be enhanced through the protection, enhancement and restoration of the Kotipu Stream which will promote emergent aquatic insect prey for foraging and provide a protected linear landscape corridor for movement and navigation to the wider area.

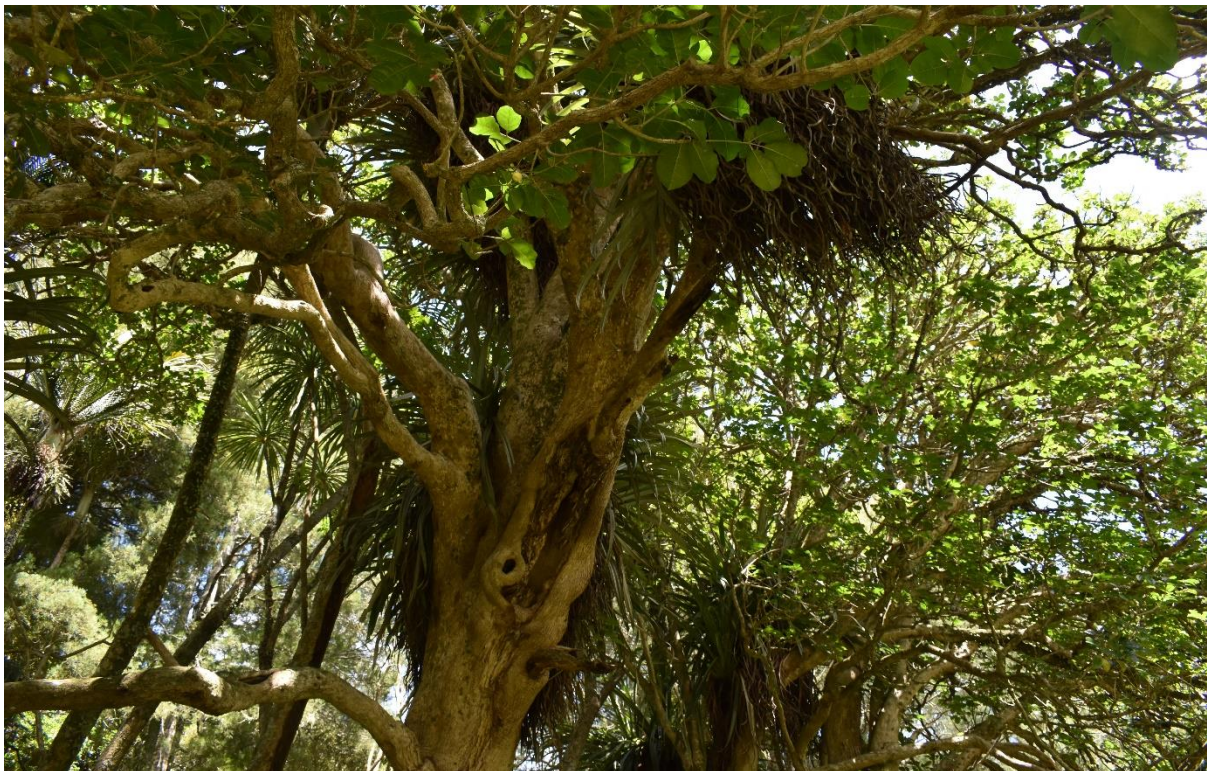


Figure 31: The site contains some older growth trees that may have potential for roosting bats however their presence on site is likely to be inhibited by a high number of pest animals noted on site

5.0 ASSESSMENT OF ECOLOGICAL EFFECTS

5.1. Potential ecological effects

The following sections describe potential ecological effects based on the general layout and location plan and associated services as shown within the proposed Engineering Drawings prepared by Terra Consultants dated May 2023. The layout of the development has been comprehensively designed in consultation with Wild Ecology to ensure that the development avoids potential adverse effects on the indigenous habitats and species present within the site boundaries and allows for ecological enhancement to be achieved as part of the project.

The majority of the development footprint has been designed to be sited fully outside of a 10m NPS-FM 'natural inland wetland' setback, and 20m riparian yard of permanent and intermittent stream habitats in site. The existing access track is to be partly upgraded in some sections to widen the road or establish a passing bay, and earthworks will have some minor encroachment into the riparian yard areas. However, it is deemed that these works will not adversely affect the stream environments and while partly encroaching into individual riparian yards, the works have been located as far as practicable from the immediate stream areas.

The potential adverse effects associated with the any development on terrestrial and aquatic biodiversity values can generally be divided into the following, noting that some of these effects will not be caused by the proposed on-site development:

- Potential loss of indigenous vegetation;
- Potential loss of habitat for indigenous fauna;
- Potential effects associated with increased noise;
- Potential effects associated with potential contaminant run-off;
- Potential change in aquatic habitat connection;
- Potential change in aquatic habitat availability and condition;
- Change in flow regime due to increased site imperviousness; and
- Potential introduction of pathogens.

Any site development should consider the above potential effects and ensure that measures are put in place to avoid, remedy, mitigate, offset or compensate actions that are to be taken to ensure that the site development does not result in adverse ecological effects or a net loss of ecological value. Where possible measures are to be put in place to result in positive ecological outcomes.

Table 10 below summarises potential ecological effects and assesses level of effect in relation to the ecological value and magnitude of effect (with no mitigation) in a way of matrix approach as described within EIANZ. This is followed by recommended avoidance or mitigation measures and re-assessment of overall level of effect with mitigation measures adopted.

Table 10: Potential effects associated with the site development and proposed mitigation options (as per EclA EIANZ criteria)

Factor	Potential habitat impacted	Ecological value ¹	Magnitude of effect ²	Comment	Comment/recommended mitigation measures	Level of effect (with mitigation) ³
Earthworks and sedimentation, smothering bed	Terrestrial and aquatic	Moderate	Moderate	<p>Minimal earthworks will be required and primarily associated with the creation of the additional shooting bay and some minor earthworks associated with upgrade to the existing access track.</p> <p>Earthworks associated with the active development of the site has potential to result in sediment runoff into the on-site waterways that eventually discharge in the Kotipu Stream.</p>	<p>Earthworks are likely to be minimal and will take place outside fully outside a 10m wetland setback and 20m riparian yard (where possible). It is noted that some encroachment into the 20m riparian yard of permanent intermittent streams is inevitable given that there are 21 streams on site, however these works will not take place within the bed or within a 10m setback of the streams, and the effect is likely to be negligible.</p> <p>To minimise the risk of sediment entering the onsite streams during site development works, and contaminating the downstream catchment, erosion and sediment control plans should be prepared and implemented in accordance with Auckland Council Guideline Documents 2016/005: Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region.</p> <p>Earthworks on site to be conducted during appropriate periods of dry weather to avoid any potential accidental discharges of sediment laden surface or stormwater from site development works.</p>	Low

¹ EIANZ matrix tables 5 and 6

² EIANZ matrix table 8

³ EIANZ matrix table 10

Factor	Potential habitat impacted	Ecological value ¹	Magnitude of effect ²	Comment	Comment/recommended mitigation measures	Level of effect (with mitigation) ³
Vegetation clearance	Terrestrial and aquatic	Moderate	Negligible	<p>No indigenous vegetation clearance is proposed as part of site development.</p> <p>Exotic pest weeds are to be controlled on site as per recommendations made within the body of this report and associated EMP to be prepared post-consent.</p>	No mitigation required. Habitat is to be improved as part of revegetation planting, weed and pest animal control and permanent stock exclusion.	Positive
Stormwater infrastructure and management	Stream habitats	Moderate	Moderate	<p>The development of pasture into structures with low permeability can result in alteration to natural drainage patterns and increased catchment imperviousness that can alter hydrology and water quality in the downstream environment.</p> <p>All stormwater management are to follow expert reporting and recommendations prepared for the proposed development.</p>	<p>From reviewing Terra Consultants Engineering Plans, it is considered that all stormwater infrastructure has been designed to maintain natural drainage and landform, where possible, to reduce a reduction in overland flows.</p> <p>It is understood stormwater treatment on site designed based on the principles of 'sustainable stormwater treatment train' to allow for high level of stormwater treatment before discharging into the intermittent stream habitat identified as I21.</p> <p>To address the potential effects associated with the establishment and ongoing maintenance of stormwater infrastructure and associated discharges, stormwater infrastructure has been designed by a suitably qualified engineer.</p>	Low

Factor	Potential habitat impacted	Ecological value ¹	Magnitude of effect ²	Comment	Comment/recommended mitigation measures	Level of effect (with mitigation) ³
					This alteration in catchment size is unlikely to result in a measurable ecological effect to the localised stream and wetland hydrology on site given the small overall development footprint of the proposal.	
Earthworks near wetland or stream habitats	Aquatic habitats	Moderate	Negligible	<p>No wetlands or watercourses will be directly impacted on as part of project.</p> <p>No earthworks to be carried out within a 10m setback of a natural inland wetland.</p> <p>Very minor encroachment into riparian yard setback (20m from intermittent and permanent streams), as part of minor upgrades to the existing access road.</p>	<p>No specific mitigation required. All site earthworks are to take place outside a 10m setback from any identified 'natural inland wetland' areas.</p> <p>Earthworks have been guided to take place outside a 20m riparian yard of intermittent and permanent streams where possible, noting that some minor encroachment will take place as part of minor upgrades to the existing access track, noting that the setback distance between any potential earthworks and immediate stream centreline is >10m.</p> <p>Riparian and wetland habitats are to be enhanced as part of revegetation planting, weed and pest animal control and permanent stock exclusion.</p>	Low
Introduction of pathogens and pest plants and organisms	Terrestrial and aquatic habitats	Moderate	Moderate	Potential risk associated with primarily development stage of works using dirty earthmoving machinery introducing potential risk of spreading spores and plant material.	<p>All machinery entering the site will have to be appropriately disinfected and cleaned regularly (if taken offsite).</p> <p>A hygiene protocol should be drawn up to address regular disinfection of tools brought to site.</p>	Low

Factor	Potential habitat impacted	Ecological value ¹	Magnitude of effect ²	Comment	Comment/recommended mitigation measures	Level of effect (with mitigation) ³
		Moderate	Moderate	Potential introduction of pathogens (i.e. PTA, kauri dieback) and pest organisms (Argentine ants) on site through revegetation planting.	All plants to be utilised within revegetation planting are to be eco-sourced and inspected for disease, pest organism presence and pest weeds prior to planting. Plants to be sourced from a Plant Pass registered nursery.	Low
Avifauna	Terrestrial habitat	Low-moderate	Low	Common and mobile avifauna noted on site. No 'At Risk' of 'Threatened' avifauna noted on site, however, works should be minimized to reduce disturbance.	No adverse effect on avifauna anticipated. Habitat is to be improved as part of revegetation planting, weed and pest animal control and permanent stock exclusion.	Positive
Herpetofauna	Terrestrial habitat	Moderate-high	Minor	The site contains optimal habitat for indigenous herpetofauna in the onsite bush areas. No indigenous vegetation clearance proposed as part of the site development, and as such, any associated site development works are unlikely to have a direct impact on indigenous herpetofauna.	No adverse effect on herpetofauna anticipated. Habitat is to be improved as part of revegetation planting, weed and pest animal control and permanent stock exclusion. It is noted that weedy species clearance will occur within the proposed enhancement areas – it is recommended that a suitably qualified professional oversees the weed control works to ensure that should any indigenous lizard species be encountered these can be relocated to other suitable habitat on site.	Low
Fish	Aquatic habitat	High	Negligible	Site contains suitable habitat for indigenous fish. Kotipu Stream is considered a migratory stream between	Comprehensive sediment and erosion controls should be implemented as part of active site development works. No in-stream structures proposed to be installed as part of the site development works.	Low

Factor	Potential habitat impacted	Ecological value ¹	Magnitude of effect ²	Comment	Comment/recommended mitigation measures	Level of effect (with mitigation) ³
				marine and freshwater environments. Species present within the site boundaries include longfin eel and koura.	Habitat is to be improved as part of revegetation planting, weed and pest animal control and permanent stock exclusion.	
Bats	Bats - Terrestrial habitat	High	Negligible	Closest long tail bat record approx. 3km south-west of the site. No bat presence recorded on site, however suitable foraging and potentially roosting habitat is present.	No adverse effect on bats anticipated. No vegetation clearance proposed as part of the project. Habitat is to be improved and extended as part of revegetation planting, weed and pest animal control and permanent stock exclusion.	Low
Light	Terrestrial habitat	Moderate	Minor	The potential adverse effects from artificial light on the surrounding habitats and species using these areas pose some low-level minor risk to the fauna species moving through the site. Many New Zealand avifauna, herpetofauna and insects are fully or partially nocturnal. Introduction of unrestricted light levels within the area are likely to disrupt species movements, therefore these need to be managed through appropriate controls.	The potential impacts of the effects of artificial lighting can be significantly minimised through the following: <ul style="list-style-type: none"> • Exterior lights should be cowled (shielded) and or low-level downward directional, to reduce light spill and direct lighting only where required. • Exterior lights are to be on a short (1min) timer, set to automatically switch off when not in use. • No flood lights facing forest vegetation. • Any external lighting should be LED, narrow spectrum, with minimum Ultraviolet spectrum. Should be warm spectrum avoiding white and blue light spectrum. 	Low

Factor	Potential habitat impacted	Ecological value ¹	Magnitude of effect ²	Comment	Comment/recommended mitigation measures	Level of effect (with mitigation) ³
Noise	Terrestrial habitat	Moderate	Moderate	Increases of anthropogenic noise have the potential to negatively affect bird fitness as it may interfere with communication and may decrease predator detection or breeding activity.	<p>It is thought that anthropogenic noise will be mitigated through the small development footprint and the abundance and diversity of vegetation cover throughout the site. Habitat for birds to freely move within the landscape with low noise effects is plentiful along the riparian margins of the Kotipu Stream. Kotipu Stream margins will also be protected, revegetated and enhanced as part of the project, and will result in overall extension of suitable habitat for commuting and foraging.</p> <p>Consideration relating to overall modelled noise levels associated with the project are comprehensively described under reporting and associated memos prepared by Marshall Day Acoustics. Their reporting also outlines management measures (including operational hours and special events) to ensure that adverse effects associated with increased noise levels can be minimised.</p>	
By-products/contaminants	Aquatic habitat	Moderate	Moderate	The operational stages of the proposed development pose a risk of discharging trace amounts of contaminants (including lead) from stray bullets entering the earth embankments and potentially leaching into freshwater environments on	<p>There are a range of measures that can be employed to reduce the likelihood that potential contaminants could enter the onsite freshwater bodies. No direct stormwater discharges to any of the identified natural inland wetland areas are proposed.</p> <p>The potential for lead to be discharged into the wider environment has been described under ENGEL Reporting which outlines a wide range of measures on potential contaminant management and treatment.</p>	Low

Factor	Potential habitat impacted	Ecological value ¹	Magnitude of effect ²	Comment	Comment/recommended mitigation measures	Level of effect (with mitigation) ³
				<p>site either via surface water runoff or through indirect leaching into soil.</p> <p>Considerations to potential contaminant management via run-off or through soil leaching are appropriately described within the reporting prepared by ENGEO.</p>	<p>It is considered that the project has developed comprehensive sediment controls and stormwater management program to ensure that any potential traces of lead do not enter the freshwater ecosystems on site either through stormwater runoff or soil leaching.</p> <p>Reporting prepared by ENGEO describe Site-Specific Environmental Management that will be employed as part of the operational aspects of the project, this includes bullet containment, controlling run-off via engineered solutions and planting vegetation, removing and recycling spent bullets and documentation and record keeping activities.</p> <p>It is recommended that stormwater and stream monitoring programme is put in place to ensure that any potential soil and groundwater contamination is not realised. Ongoing management and monitoring is described in ENGEO Reporting.</p> <p>A high level of ecological restoration through appropriate revegetation planting is proposed to take place – this will at least reduce the likelihood of contaminants enter waterbodies via surface water runoff. Vegetation acts as a sponge and slows down the rate of flow and reduce the likelihood of potential contaminants entering the soil via rainwater.</p>	

5.2. Summary of effects

Overall, the actual or potential adverse effects on ecological values that may result from construction and ongoing operational activities will be generally low provided works are carried out in a manner that gives effect to the expert reporting and recommendations prepared for the project. During the construction phase this primarily includes applying appropriate erosion and sediment controls during active site earthworks. The primary potential adverse effect during the operational phase, is likely to be associated with potential contaminant run-off into the on-site stream systems. However, a number of comprehensive management methods have been proposed for the operational phase to ensure that any potential contaminants have been captured and treated prior to their discharge into the stream environments. It is understood that ongoing monitoring will take place to ensure that applicable limits to potential contaminant discharges are not exceeded as described in ENGEO Reporting prepared for the project.

Taking into the account the analysis conducted above in conjunction to the expert reporting prepared for the project, it is considered that the overall level of adverse ecological effect is to be less than minor. It is therefore deemed that the development can be carried out in a manner that will not adversely affect the ecological values on site. No specific response through a biodiversity offset or ecological compensation is therefore considered to be necessary.

Recognising the rural setting the development is to take place in, the Applicant volunteers to minimise any potential residual adverse effects on stream and wetland areas within proximity to the proposed development footprint through ecological restoration and enhancements. These measures are volunteered by the Applicant to provide a vegetated buffer between the proposed development on site and the wider ecological setting and improve biodiversity corridors, linkages, buffering and creation of habitat for indigenous fauna.

6.0 NES-FW CONSENTING OBLIGATIONS

The proposed development (please refer to Terra Consultants Engineering Drawings Package) has been designed with the input of the results of the watercourse and wetland classification and delineation, with the proposed built development (upgrade to the main access road, new shooting bay and associated infrastructure) to be placed as far as practicable from the sensitive receiving environments. However, given the scattered nature of the stream and wetland areas on site, it is inevitable that at least some minor earthworks and stormwater discharges will occur within a 100m setback from the identified wetland areas, noting that no earthworks or vegetation clearance will take place within a 10m setback of a natural inland wetland area.

Only some minor works will occur within a 100m setback from a natural inland wetland, and these will not result, or are not likely to result, in the complete or partial drainage of all or part of a natural inland wetland. A basic assessment in relation to consenting obligations under NES-FW (2020) is briefly discussed under Table 2 below. Based on this assessment it is concluded that the development will not adversely affect wetland features on site and will not result or is unlikely to result in the complete or partial drainage of the wetland habitats noted on site, no earthworks

or vegetation clearance within a 10m setback is proposed, therefore it is considered that the proposal does not require a consent under NES-FW (2020).

Table 11: Assessment of NES-FW consenting obligations

NES-FW (2020) Regulation	Comment/assessment
<p>Drainage of natural wetlands</p> <p>52 Non-complying activities</p> <p>(1) Earthworks outside, but within a 100 m setback from, a natural inland wetland is a non-complying activity if it—</p> <p>(a) results, or is likely to result, in the complete or partial drainage of all or part of a natural inland wetland; and</p> <p>(b) does not have another status under any of regulations 38 to 51.</p>	<p>Consent under Regulation 52(1) is not required/applicable as earthworks associated with the site development required to take place within a 100m setback of the identified natural inland wetland areas will not result or is not likely to result in complete or partial drainage of the natural inland wetland features identified on site and immediate boundaries should appropriate erosion and sediment control measures are constructed and maintained in accordance with the principles outlined in relevant expert reporting prepared for the proposal and best practice.</p>
<p>52(2) The taking, use, damming, diversion, or discharge of water outside, but within a 100 m setback from, a natural wetland is a non-complying activity if it—</p> <p>(a) results, or is likely to result, in the complete or partial drainage of all or part of a natural wetland; and</p> <p>(b) does not have another status under any of regulations 38 to 51.</p>	<p>Consent under Regulation 52(2) is not required/applicable. The diversion of water and discharge of water outside but within a 100m setback from natural inland wetlands associated with stormwater discharges and diversions as part of site development will not result or are not likely to result in complete or partial drainage of the natural inland wetland features identified. The incremental increase in impervious surfaces as a result of development of the site and establishment of the stormwater dispersal devices is anticipated to involve some minor earthworks and will result in some additional hydraulic inputs, that will be diverted towards existing watercourses and wetland areas. Due to the incremental increase in impervious surface associated with the site's development, the overall volume of water entering the aquatic features is not expected to increase to any quantifiable level. These discharges are not likely to change the water level range or hydrological function of the wetland areas.</p>
<p>Other activities</p> <p>Regulation 54 amended (Non-complying activities)</p>	<p>Consent under Regulation 54(a) is not required as no disturbance or vegetation clearance within a 10m setback of any identified natural inland wetland area is proposed.</p>

54(a) vegetation clearance within, or within a 10 m setback from, a natural inland wetland:	
54(b) earthworks within, or within a 10 m setback from, a natural inland wetland	Consent under Regulation 54(b) is not required as the proposal will not result in earthworks being carried out within a 10m setback from any identified natural inland wetland areas. All sediment and erosion controls for the wider site development are to be installed as per GDO5 and associated technical reporting prepared for the site development.
54(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.	Consent under Reg 54(c) is not required, as while the stormwater diversions associated with the site development will occur within a 100m setback from the identified wetland areas, and may have a hydrological connection with these areas, they will not change or are unlikely to change the water level range or hydrological function of the wetland.
54(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	Consent under Reg 54(d) is not required as s as while stormwater is proposed to be discharged (after treatment) into intermittent stream I21. I21 does not have any hydrological connection with any of the identified natural inland wetland areas on site as it is a tributary of P1, and drains into a permanent stream habitat that is forested and does not form part of any wetland features. Stormwater discharges will not enter any of the wetland areas on site, and therefore stormwater discharges will not charge or are not likely to change the water level range or hydrological function of the wetland areas.

7.0 ECOLOGICAL ENHANCEMENT PROPOSAL

7.1. Ecological enhancement

The project aims to contain the activity within a development pocket which is to be encompassed by indigenous vegetation. The overall layout of the development footprint has been designed to integrate with the wider ecological values and serve multiple purposes, including provision of a vegetated buffer area between the development and the wider

ecological setting, which as it establishes will aid potential absorption of the noise generated from gunshots.

The Applicant as a part of the site's development proposes to enhance and protect an area of approximately 4.33 ha of stream, wetland and existing bush areas encompassing the immediate development footprint boundaries. The ecological enhancement area design follows the natural confines of the site and is aimed at establishing boundaries that can be fenced with practical ease. The following sections provide brief description regarding proposed ecological enhancement to be carried out as part of the project. It is proposed that an Ecological Management Plan (EMP) which will cover a full suite of integral management components including full revegetation planting detail, eco-sourcing, stock exclusion, pest animal and plant control, biosecurity and disease management, fencing, ongoing maintenance and monitoring is prepared as a condition of consent.

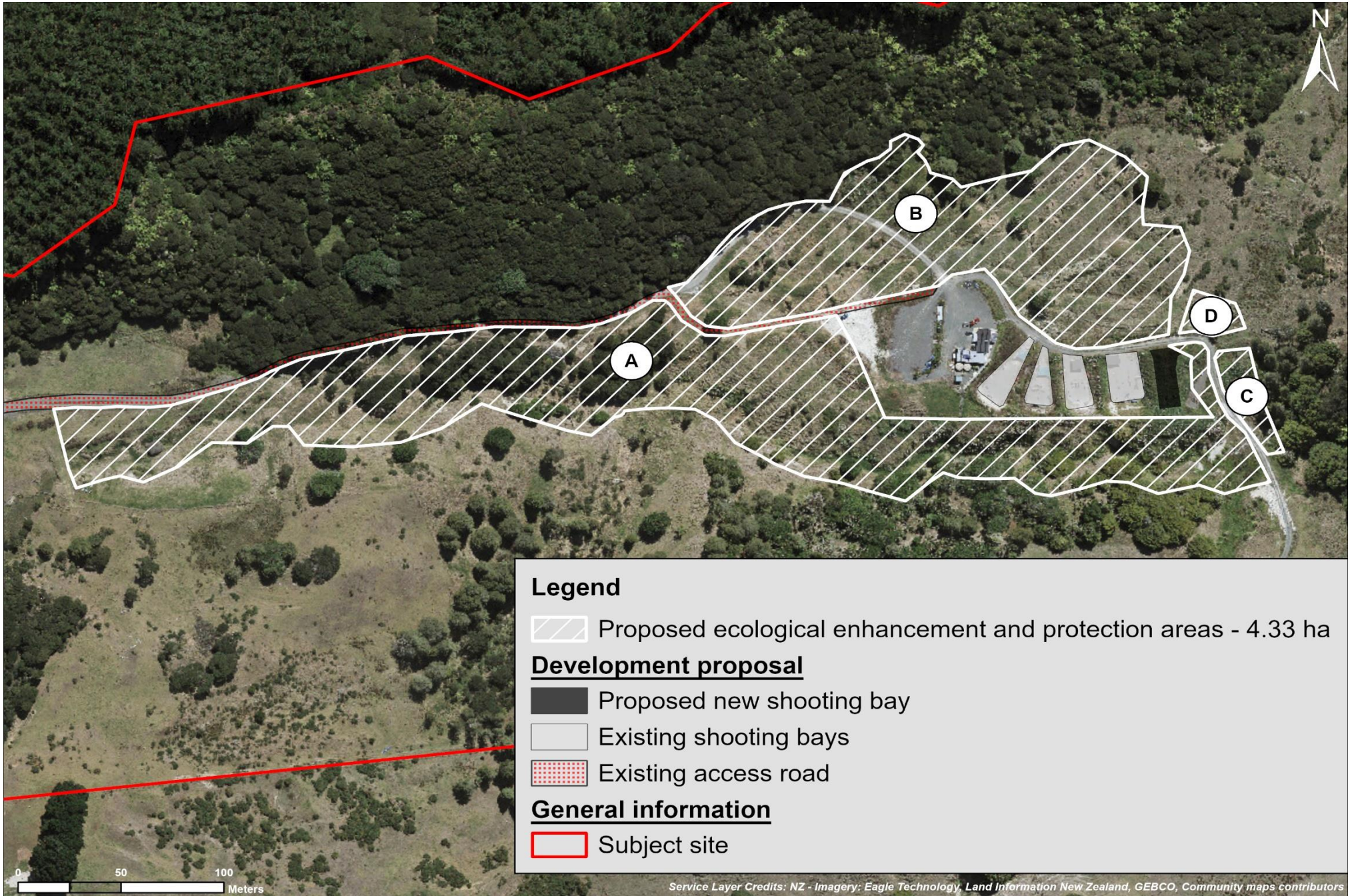


Figure 32: Showing the proposed ecological enhancement areas

7.2. Benefits of revegetation planting

The proposed revegetation planting will provide ecosystem regulating services through revegetation planting such as carbon capture and storage, erosion controls, nutrient cycling, climate regulation, and improvements of water quality within the stream catchment, among others. Of note is the multipurpose benefit from utilising revegetation planting which can also aid minimisation of potential noise impacts and reducing the risk of residual contaminant inputs into freshwater environments.

Of note, the proposal aims to create a vegetated buffer between the proposed development footprint and the wider ecological features noted on site. Providing a vegetated buffer area between the immediate development footprint and the wider adjacent Kotipu Stream riparian environment will reduce any potential secondary effects associated with the operational phase of the proposed development (i.e., increased human presence) on any potential species that may utilise this area. Enhancing the riparian corridor of the Kotipu Stream and protecting and managing the riparian zones will ensure ongoing environmental benefit by providing shading, buffering and inputs of essential components for stream function (i.e. inputs of leaf litter, and woody debris).

Overseas research (United States Environmental Protection Agency 2005; Kajander and Parri 2014) suggests that retaining or establishing vegetation cover in the vicinity of the shooting range is important, particularly if the vegetation is dense and high between the shooting range and the area subjected to noise. Particularly, the zone closest to the range is important. Therefore, the revegetation planting proposal has been designed to create a development pocket which will be encompassed by densely planted indigenous vegetation which will blend into the existing bush vegetation on site.

In addition the vegetation will act as a green sponge that binds any residual pollutants from the proposed activity. Using vegetation for water treatment facilities have been used for quite some time with good results in the treatment of surface runoff from road areas, but it appears that they have not been tested at shooting ranges as of yet. However, it is deemed to have a lot of potential, as plants (in particular wetland plants) and their root systems are able to bind pollutants in dissolved or particle form, or bonded with organic matter and thus reduce the likelihood that any residual contaminants may enter the freshwater bodies on site.

The proposed enhancement areas will be revegetated with a mix of appropriate native species suited to the site based on the ecosystem types noted in the immediate vicinity. In the short term (1–3 years following revegetation), the revegetation plantings will assist in sediment filtering of overland run-off, act as a natural erosion control agent, and extend habitat for some more common mobile avifauna species. In the medium term (3–5 years), the enhancement areas will provide/extend physical habitat for a wider range terrestrial and aquatic fauna, and also provide water quality benefits through shading and by filtering overland run-off. In the longer term (>5 years), this enhancement will result in a net gain in ecological function for the existing terrestrial and aquatic habitats noted on site and surrounds and will allow for natural self-sustaining processes to begin including natural regeneration, shading out of any weedy species and increasing habitat complexity.

It is recommended that the ecological enhancement areas are protected in perpetuity by covenant or similar. The external boundaries of the ecological enhancement area (where feasible and practicable to avoid stock entry) should be fenced to an appropriate stock-proof standard.

7.3. Proposed planting detail

The proposed ecological enhancement planting areas are shown under Figure 33 and Appendix 1. Generally planting areas are to be separated in 2 zones depending on their immediate planting/management needs:

- Terrestrial buffer planting – 3.19 ha
- Wetland infill planting – 0.77 ha

The main goal of the proposed ecological enhancement planting is to buffer the immediate development footprint and connect and expand the existing riparian, wetland and bush areas on site. The proposed revegetation plant lists incorporate an appropriate mix of pioneer plant species mix suited to the underlying clay soils underlying the planting area. The proposed species list will ensure that suitable ground coverage is achieved through dense planting, which will aid weedy species suppression, and will help manage soil erosion by providing some surface stability through vegetation cover and soil binding roots and thus aid erosion control and enhance the natural character and ecological values of the site.

The proposed revegetation planting will provide a wide variety of ecosystem services including habitat provisioning services, erosion protection, nutrient filtration, provision of habitat for indigenous fauna and associated ecosystem, cultural and recreational services. It will also enhance the amenity values for the future users of the shooting facilities and promote enjoyment of the existing ecological values on site.

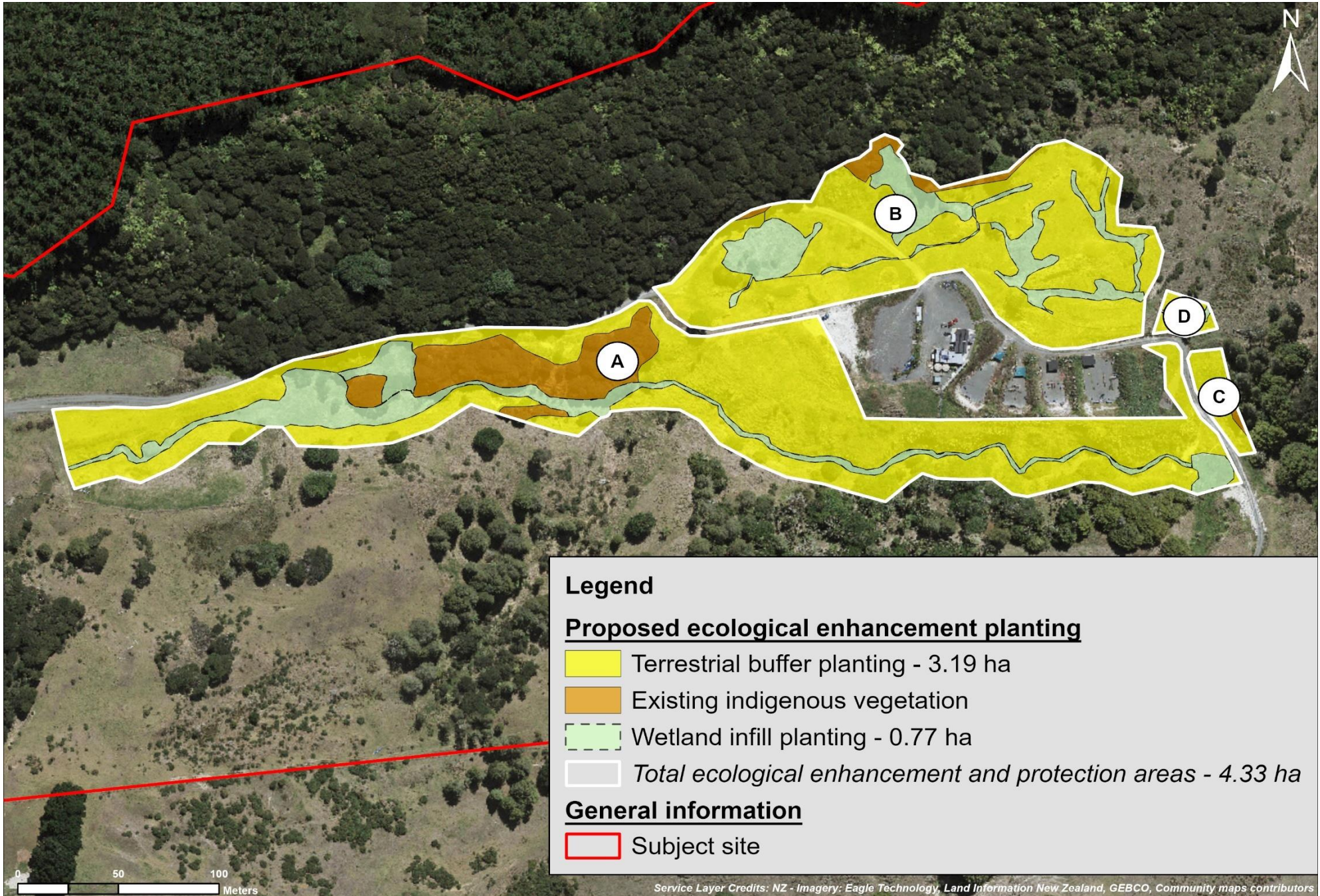


Figure 33: Showing the proposed ecological enhancement planting and protection areas plan

Table 12: Proposed enhancement planting species detail

		Wetland infill planting (0.77 ha)			Terrestrial buffer planting (3.19)		
Scientific name	Common name	% mix	Grade	Spacing (m)	% mix	Grade	Spacing (m)
<i>Carex lessoniana</i>	Rautahi	10%	0.5L	0.75m			
<i>Carex virgata</i>	Pukio	10%	0.5L	0.75m			
<i>Carex secta</i>	Purei	10%	0.5L	0.75m			
<i>Coprosma robusta</i>	Karamu				6%	0.5L	1.4m
<i>Cordyline australis</i>	Ti kouka	10%	0.5L	1.4m	6%	0.5L	1.4m
<i>Corynocarpus laevigatus</i>	Karaka				2%	1L	2m
<i>Cyperus ustulatus</i>	Giant umbrella sedge	10%	0.5L	0.75m			
<i>Dacrycarpus dacrydioides</i>	Kahikatea				2%	1L	2m
<i>Dodonaea viscosa</i>	Akeake				5%	0.5L	1.4m
<i>Kunzea robusta</i>	Kanuka				25%	0.5L	1.4m
<i>Leptospermum scoparium</i>	Manuka				20%	0.5L	1.4m
<i>Machaerina articulata</i>	Jointed twig rush	10%	0.5L	0.75m			
<i>Machaerina rubiginosa</i>	Orange nut sedge	10%	0.5L	0.75m			
<i>Melicytus ramiflorus</i>	Mahoe				5%	0.5L	1.4m
<i>Myrsine australis</i>	Mapou				5%	0.5L	1.4m
<i>Phormium tenax</i>	Harakeke	10%	0.5L	0.75m	10%	0.5L	1.4m
<i>Podocarpus totara</i>	Totara				5%	1L	2m
<i>Schoenoplectus tabernaemontani</i>	Kuta	10%	0.5L	0.75m			
<i>Sophora chatamica</i>	Kowhai				2%	1L	2m
<i>Typha orientalis</i>	Raupo	10%	0.5L	0.75m			
<i>Veronica stricta var. stricta</i>	Hebe				5%	0.5L	1.4m
<i>Vitex lucens</i>	Puriri				2%	1L	2m

8.0 CONCLUSION

The Applicant proposes to lodge an application for a resource consent to establish and operate an outdoor firearms range at the subject site. A key aspect of the project has been the incorporation of comprehensive sensitive design methodologies to avoid and minimise potential ecological effects, based on iterative process of Wild Ecology providing ecological mapping, description of ecological values, and advice on methodologies and philosophies of sensitive design that have been incorporated as part of the project's overall design.

The project aims to contain the activity within a 'development pocket' which is to be encompassed by indigenous vegetation. A range of design controls have been developed as part of the application to ensure that any actual and potential adverse effects on the environment can be appropriately addressed. From an ecological perspective these controls include avoiding earthworks within a 10m setback of natural inland wetlands, ensuring that works required to be carried out within a riparian yard (20m setback) of intermittent and permanent streams can be avoided where possible, and establishing a large, vegetated buffer area encompassing the proposed development.

The project strikes a balance between protecting and enhancing areas of higher existing or potential ecological values, while concentrating the site's development on areas with low existing ecological values or functionality. The project seeks to create a confined development footprint and provide separation between the development footprint and the wider ecological setting through the establishment of over 4.33 ha of proposed ecological enhancement area. This area is to serve multiple purposes including habitat provisioning services, erosion protection, nutrient and pollutant filtration, provision of habitat for indigenous fauna and associated ecosystem, cultural and recreational services. Over time as the vegetation matures it will likely deliver benefit in noise reduction through establishment of dense vegetation cover encompassing the shooting ranges. It will also enhance the amenity values for the future users of the shooting facilities and promote enjoyment of the existing ecological values on site.

It is considered that the site is able to accommodate the proposed development, and any potential adverse ecological effects associated with the project can be avoided, minimised or mitigated through applying comprehensive design principles and development controls. Provided that they are implemented successfully during construction and operational phases of the development, adverse effects on the environment would be less than minor, and the project would allow for the enhancement of functional and structural connectivity and functioning of the ecological values identified on site and immediate surrounds.

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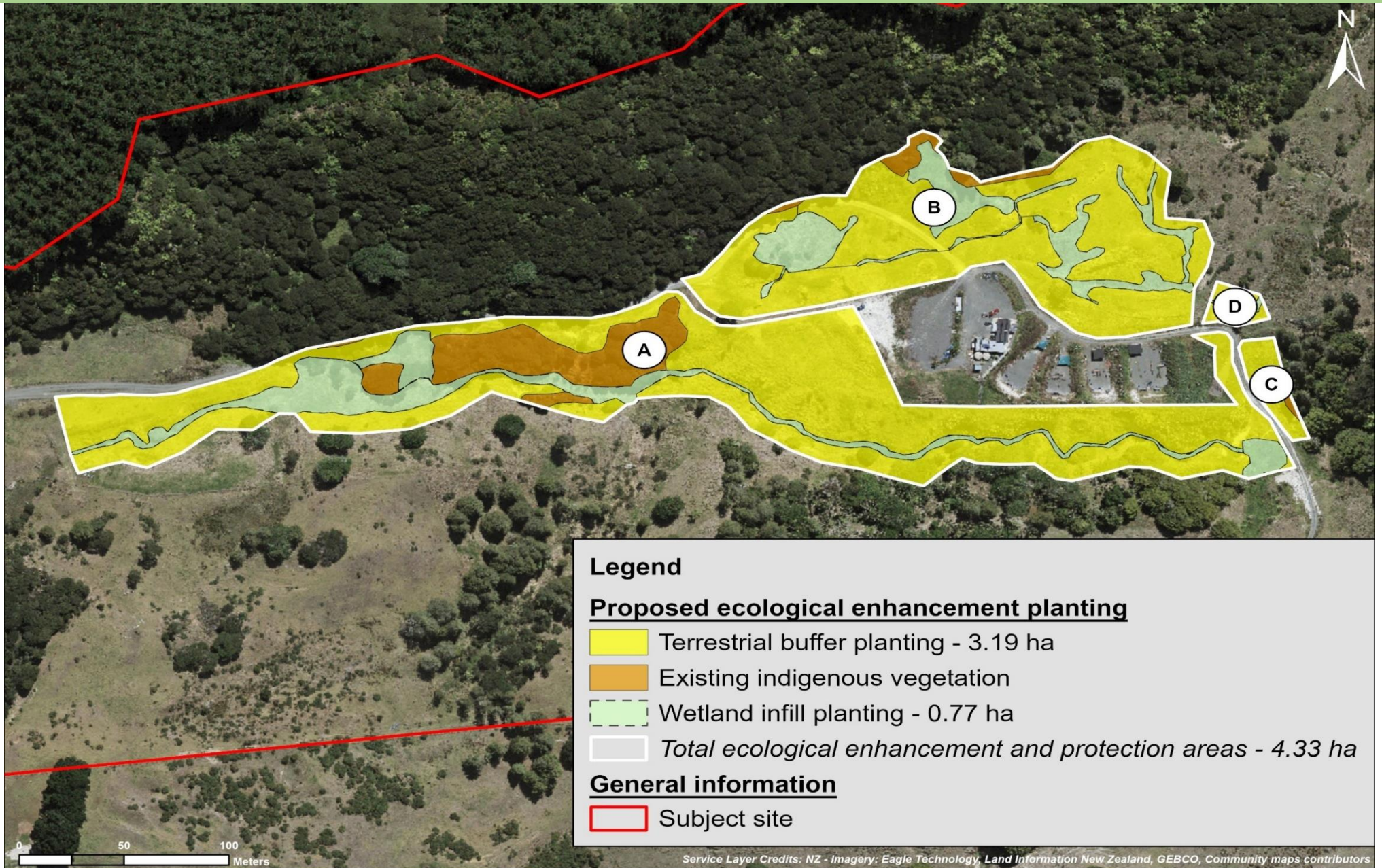
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APPENDIX 1 – ECOLOGICAL ENHANCEMENT AREAS



APPENDIX 2 – FLORA LIST (NATIVE & EXOTIC)

FERNS	
<i>Adiantum cunninghamii</i> common maidenhair	<i>Dicksonia squarrosa</i> wheki
<i>Adiantum hispidulum</i> rosy maidenhair fern	<i>Diplazium australe</i>
<i>Asplenium bulbiferum</i> hen and chicken fern	<i>Doodia australis (Blechnum parrisiae)</i> rasp fern
<i>Asplenium flaccidum</i> hanging spleenwort	<i>Hymenophyllum flexuosum</i> filmy fern
<i>Asplenium oblongifolium</i> shining spleenwort	<i>Hymenophyllum nephrophyllum</i> kidney fern
<i>Blechnum chambersii (Austroblechnum lanceolatum)</i> nini	<i>Paesia scaberula</i> sweet fern
<i>Blechnum membranaceum (Austroblechnum membranaceum)</i>	<i>Pakau pennigera</i> gully fern
<i>Blechnum filiforme (Icarus filiformis)</i> threadfern	<i>Parapolystichum glabellum</i> smooth shield fern
<i>Blechnum novae-zelandiae (Parablechnum novae-zelandiae)</i> kiokio	<i>Pteridium esculentum</i> bracken
<i>Cyathea dealbata</i> ponga	<i>Pteris macilenta</i> sweet fern
<i>Cyathea medullaris</i> mamaku	<i>Pteris tremula</i> shaking break
<i>Dendroconche scandens</i> fragrant fern	<i>Pyrrosia elaeagnifolia</i>
<i>Deparia petersenii</i> subsp. <i>congrua</i>	<i>Zelandia pustulata</i> subsp. <i>pustulata</i> hound's tongue
CONIFERS	
<i>Dacrydium cupressinum</i> rimu	
<i>Dacrycarpus dacrydioides</i> kahikatea	
<i>Pectinopitys ferruginea</i> miro	
<i>Phyllocladus trichomanoides</i> tanekaha	
<i>Podocarpus totara</i> var. <i>totara totara</i>	
<i>Prumnopitys taxifolia</i> matai	
DICOT TREES SHRUBS & CLIMBERS	
<i>Alseuosmia quercifolia</i> toropapa	<i>Kunzea robusta</i> kanuka
<i>Beilschmiedia tarairi</i> taraire	<i>Laurelia novae-zelandiae</i> pukatea
<i>Beilschmiedia tawa tawa</i>	<i>Leucopogon fasciculatus</i> mingimingi
<i>Carpodetus serratus</i> putaputaweta	<i>Melicytus macrophyllus</i> large-leaved mahoe
<i>Coprosma aerolata</i> thin leaved coprosma	<i>Melicytus ramiflorus</i> mahoe
<i>Coprosma arborea</i> mamangi	<i>Myrsine australis</i> mapou
<i>Coprosma robusta</i> karamu	<i>Nestegis lanceolata</i> white maire
<i>Coprosma rhamnoides</i> twiggy coprosma	<i>Piper excelsum</i> kawakawa
<i>Corynocarpus laevigatus</i> karaka	<i>Pseudopanax crassifolius</i> lancewood
<i>Dysoxylum spectabile</i> kohekohe	<i>Rhabdothamnus solandri</i> taurepo

<p><i>Geniostoma ligustrifolium</i> hangehange <i>Hedycarya arborea</i> pigeonwood <i>Hoheria populnea</i> houhere <i>Knightia excelsus</i> rewarewa</p>	<p><i>Rubus cissoides</i> bush lawyer <i>Schefflera digitata</i> pate <i>Ulex europaeus</i>** gorse <i>Vitex lucens</i> puriri</p>
DICOT HERBS	
<p><i>Ageratina adenophora</i>** Mexican devil <i>Anagallis arvensis</i>* <i>Callitriche stagnalis</i>* <i>Centella uniflora</i> centella <i>Cirsium vulgare</i>* thistle <i>Crepis capillaris</i>* smooth hawksbeard <i>Daucus carota</i>* wild carrot <i>Elatostema rugosum</i> parataniwha <i>Galium aparine</i>* cleavers <i>Geranium homeanum</i> northern cranesbill <i>Jacobaea vulgaris</i>* ragwort <i>Lotus pedunculatus</i>* trefoil</p>	<p><i>Persicaria decipiens</i> slender knotweed <i>Persicaria hydropiper</i>* water pepper <i>Phytolacca octandra</i> * inkweed <i>Prunella vulgaris</i>* <i>Ranunculus repens</i>* creeping buttercup <i>Rubus fruticosus</i> agg. ** blackberry <i>Rumex crispus</i>* curled dock <i>Rumex sagittatus</i>* climbing dock <i>Senecio esleri</i> <i>Senecio jacobaea</i>* ragwort <i>Solanum americanum</i></p>
MONOCOTS	
<p><i>Agrostis stolonifera</i> creeping bent <i>Carex dissita</i> <i>Carex flagellifera</i> trip me up sedge <i>Carex geminata</i> rautahi <i>Carex lessoniana</i> rautahi <i>Carex secta</i> purei <i>Carex solandri</i> <i>Carex virgata</i> pukio <i>Cenchrus clandestinum</i> ** kikuyu <i>Cordyline australis</i> ti kouka <i>Cortaderia selloana</i>** pampas <i>Cyperus brevifolius</i>*</p>	<p><i>Cyperus ustulatus</i> giant umbrella sedge <i>Freycinetia banksia</i> kiekie <i>Juncus effusus</i>* soft rush <i>Juncus sarophorus</i> fan-flowered rush <i>Juncus articulatus</i>* jointed rush <i>Oplismenus hirtellus</i> <i>Paspalum dilatatum</i>* dallis grass <i>Paspalum distichum</i>* mercer grass <i>Prunella vulgaris</i>* <i>Rhopalostylis sapida</i> nikau <i>Ripogonum scandens</i> supplejack <i>Typha orientalis</i> raupo</p>

APPENDIX 3 – WETLAND DELINEATION ASSESSMENT RESULTS

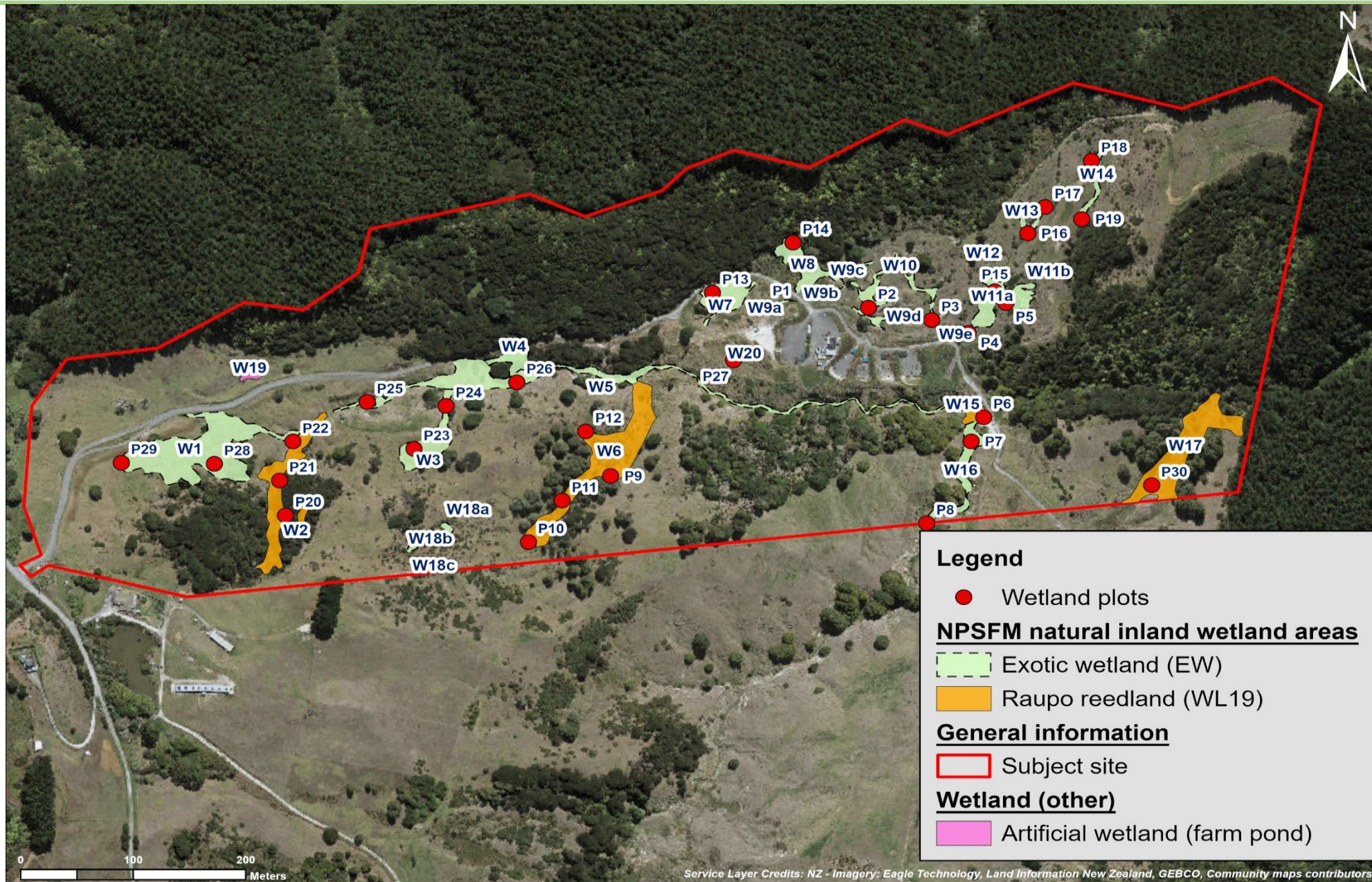


Figure 34: Wetland delineation plots and resulting assessment

Site	287 Tuhirangi Road, Makarau																														
Date	4 th October 2022, and 8 th of February 2023																														
	Vegetation plots																														
Species	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	
<i>Agrostis stolonifera</i>	10%																														
<i>Apium nodiflorum</i>	5%	50%	10%	40%		10%			20%		45%													50%	20%	60%					
<i>Blechnum novae-zelandiae</i>											20%																				
<i>Cenchrus clandestinus</i>	15%	5%	8%		7%	3%						15%																	8%		
<i>Centella uniflora</i>																					2%										
<i>Cyperus brevifolius</i>											5%			5%						10%											
<i>Cyperus eragrostis</i>	3%			5%	10%			60%			15%			15%		10%							15%		5%	10%		5%	15%		
<i>Dacrycarpus dacrydioides</i>										10%																					
<i>Holcus lanatus</i>	2%	15%	20%	5%	15%	5%		15%		20%	5%	10%	10%	20%	20%	10%	20%	7%	30%			3%	30%	5%	10%		10%	15%			
<i>Isachne globosa</i>								10%	5%	15%		10%									15%	25%	75%								
<i>Isolepis cernua</i>																		5%													
<i>Isolepis prolifera</i>								60%					10%																		
<i>Juncus articulatus</i>	3%	2%															5%							5%							
<i>Juncus effusus</i>	10%	8%	10%		2%	2%			10%	10%	5%				20%		10%	5%	5%					10%	10%				5%		
<i>Juncus sarophorus</i>										10%		50%	10%			50%	15%	15%		75%	70%		35%	15%		10%	5%	60%	5%		
<i>Leptospermum scoparium</i>																					2%										
<i>Lotus pedunculatus</i>		10%			3%			5%	10%	10%			10%	10%							5%	3%	3%		5%			10%	5%		
<i>Machaerina articulata</i>									15%																					5%	
<i>Machaerina rubiginosa</i>									5%												3%										
<i>Myosotis laxa</i>	4%			2%							5%															10%			5%	2%	
<i>Paspalum dilatatum</i>	5%	3%	2%	3%								5%																	2%		
<i>Paspalum distichum</i>	40%	10%	50%	50%	50%		20%	10%	5%	40%		10%	50%	20%	50%	30%	50%	70%	50%			15%		15%	60%	10%	80%		50%	5%	
<i>Persicaria hydropiper</i>					%								5%																		
<i>Ranunculus repens</i>	3%				10%		10%	5%					5%	30%	10%				5%		2%		10%					2%	5%		
<i>Rumex obtusifolius</i>								1%					1%		2%														5%	3%	
<i>Schoenoplectus tabernaemontani</i>									20%																					35%	
<i>Trifolium repens</i>																							10%					5%	2%		
<i>Typha orientalis</i>						80%																3%	5%							40%	
Total cover	100%	103%	100%	105%	97%	100%	100%	101%	100%	100%	100%	100%	101%	100%	102%	100%	100%	102%	100%	102%	103%	101%	100%	105%	105%	100%	102%	100%	100%	87%	
% pasture species (Cosgrove et al. 2022)	22%	33%	30%	8%	25%	8%	0%	20%	10%	30%	5%	30%	20%	30%	20%	10%	20%	7%	30%	5%	3%	6%	40%	10%	10%	0%	10%	30%	17%	0%	
Excluded from NPSFM – artificial or improved pasture species >50%?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
Rapid test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Dominance test	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	No		
PI	2.36	1.91	2.30	1.70	2.43	1.21	1.40	2.21	1.35	2.40	1.75	2.40	2.16	2.60	2.31	2.10	2.20	2.02	2.35	1.89	1.78	1.27	2.60	1.62	1.90	1.30	2.17	2.40	2.27	1.06	
NPSFM wetland (Yes or No)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Representative plot photos

P1



P2



P3



P4



P5



P6



P7



P8



P9



P10



P11



P12



P13



P14



P15



P16



P17



P18



P19



P20



P21



P22



P23



P24



P25



P26



P27



P28



P29



P30



APPENDIX 4 – BIRD SURVEY RESULTS

Observer	MV	Date	08/02/2023	Site location	Tuhirangi Road (287), Makarau		5MBC location	5MBC-1 – overlooking riparian and existing bush area 5MBC-2 – overlooking wetland and bush	
Station number				5MBC-1	5MBC-2				
Start time (24 hour)				08:00	09:30				
Temperature (1-6)				3	3				
Wind (0-3)				0	1				
Other noise (0-2)				0	2				
Sun (minutes)				5	3				
Precipitation type (N, M, R, H, S)				N	M				
Precipitation value (0-5)				0	1				
Scientific name	Common name	New Zealand Status	Seen	Heard	Seen	Heard			
<i>Acridotheres tristis</i>	Myna	Introduced & Naturalised	1		2	1			
<i>Anas platyrhynchos</i>	Mallard	Introduced & Naturalised			1				
<i>Carduelis carduelis</i>	European goldfinch	Introduced & Naturalised			1				
<i>Circus approximans</i>	Swamp harrier	Native & Not Threatened			2				
<i>Gerygone igata</i>	Grey warbler	Endemic & Not Threatened		1					
<i>Hemiphaga novaeseelandiae</i>	Kereru	Native & Not Threatened	1						
<i>Hirundo neoxena</i>	Welcome swallow	Native & Not Threatened			1				
<i>Passer domesticus</i>	House sparrow	Introduced & Naturalised	3						
<i>Platycercus eximius</i>	Eastern rosella	Introduced & Naturalised	5						
<i>Porphyrio melanotus</i>	Pukeko	Native & Not threatened	1	1	2	1			
<i>Prosthemadera novaeseelandiae</i>	Tui	Endemic & Not Threatened	2						
<i>Rhipidura fuliginosa</i>	New Zealand fantail	Endemic & Not Threatened	2		3				
<i>Tadorna variegata</i>	Paradise shelduck	Endemic & Not Threatened	1		2				
<i>Todiramphus sanctus</i>	Sacred kingfisher	Native & Not Threatened	2		1				
<i>Vanellus miles</i>	Spur-winged plover	Native & Not Threatened	2		2				
<i>Zosterops lateralis</i>	Silvereye	Native & Not Threatened	1			1			
Sun (0-5) Record approximate duration, in minutes, of bright sun on the canopy immediately overhead					Seen and Heard Birds that are first heard should be entered under H (even if they are later seen), birds that are first seen should be entered under S. Adding H and S should give the total number of birds observed				
Time 24-hour clock, at the beginning of each count					Unbounded Counts are unbounded				
Temperature 1 freezing < 0°C 2 cold 0-5 °C 3 cool 6-10 °C 4 mild 11-15 °C 5 warm 16-22 °C 6 hot > 22 °C	Wind The average for each five-minute count on a modified Beaufort scale: 0 Leaves still or move without noise (Beaufort 0 and 1) 1 Leaves rustle (Beaufort 2) 2 Leaves and branches in constant motion (Beaufort 3 and 4) 3 Branches or trees sway (Beaufort 5, 6 and 7)	Other Noise i.e. Other than wind the average for the five minutes 0 not important 1 moderate 2 loud	Precipitation type Average for each count N None M Mist R Rain H Hail S Snow	Precipitation value 0 None 1 Dripping foliage 2 Drizzle 3 Light 4 Moderate 5 Heavy					

APPENDIX 5 – EDNA SURVEY RESULTS

Scientific name	Common name	Group	Rank	Sequence count
<i>Galaxias fasciatus</i>	Kokōpu,Banded kokopu	Fish	Species	3009
<i>Gobiomorphus huttoni</i>	Redfin bully	Fish	Species	1899
<i>Anguilla australis</i>	Tuna; hao; aopori; hikumutu,Shortfin eel	Fish	Species	480
<i>Trichosurus vulpecula</i>	Paihamu; paihama,Common brushtail possum	Mammals	Species	388
<i>Triplectides obsoletus</i>	NZ caddisfly	Insects	Species	385
<i>Hydra vulgaris</i>	Hydra	Cnidarians	Species	287
<i>Anguilla dieffenbachii</i>	Tuna; kūwharuwharu; reherehe; kirirua,Longfin eel	Fish	Species	164
<i>Aulodrilus plurisetia</i>	Aquatic oligochaete worm	Worms	Species	119
<i>Sus scrofa</i>	Pig	Mammals	Species	113
<i>Chaetogaster diastrophus</i>	Oligochaete worm	Worms	Species	103
<i>Ichthybotus hudsoni</i>	Mayfly	Insects	Species	92
<i>Zephlebia borealis</i>	NZ mayfly	Insects	Species	77
<i>Archichauliodes diversus</i>	NZ dobsonfly	Insects	Species	38
<i>Limnodrilus hoffmeisteri</i>	Redworm	Worms	Species	35
<i>Hypogastrura purpureascens</i>	Springtail	Springtails	Species	27
<i>Orthonychiurus folsomi</i>	Springtail	Springtails	Species	25
<i>Canis lupus familiaris</i>	Pero,Dog	Mammals	Subspecies	21
<i>Nocturama antipodites</i>	Freshwater red alga	Red algae	Species	20
<i>Triplectides dolichos</i>	NZ caddisfly	Insects	Species	20
<i>Amphipsalta zelandica</i>	Cicada	Insects	Species	20
<i>Rattus rattus</i>	Hinamoki; inamoki; kiore,Black Rat	Mammals	Species	15
<i>Rhododrilus n. sp. 7 TRB-2010</i>	Worm	Worms	Species	14
<i>Planotortrix notophaea</i>	Blacklegged leafroller moth	Insects	Species	13
<i>Nais communis</i>	Sludgeworm	Worms	Species	11
<i>Psilochorema mimicum</i>	NZ caddisfly	Insects	Species	10
<i>Hydrobiosis styracine</i>	Caddisfly	Insects	Species	9
<i>Ameletopsis perscitus</i>	Yellow mayfly	Insects	Species	8
<i>Prostoma graecense</i>	Freshwater nemertean	Other	Species	6
<i>Ninox novaeseelandiae</i>	Ruru,Morepork	Birds	Species	5
<i>Paracyclops fimbriatus</i>	Copepod	Crustaceans	Species	4

<i>Anguilla</i>	Eels	Fish	Genus	1955
<i>Gobiomorphus</i>	Bullies	Fish	Genus	202
<i>Potamopyrgus</i>	Mud snails	Molluscs	Genus	93
<i>Hydrobiosella</i>	Caddisfly	Insects	Genus	77
<i>Gobiomorphus cotidianus/basalis/dinae</i>	Titikura,Common/Cran/Dinahs bully	Fish	Genus	64
<i>Nais</i>	Sludgeworm	Worms	Genus	58
<i>Zephlebia</i>	NZ mayfly	Insects	Genus	19
<i>Prostoma</i>		Other	Genus	17
<i>Pristina</i>	Worm	Worms	Genus	16
<i>Hudsonema</i>	Cased caddisfly	Insects	Genus	8
<i>Waematau</i>		Crustaceans	Genus	8
<i>Hydrobiosis</i>	NZ Caddisfly	Insects	Genus	7
<i>Chaetonotus</i>	Gastrotrich	Other	Genus	4
<i>Pycnocentroides</i>	Stony cased caddisfly	Insects	Genus	4
<i>Galaxiiformes</i>	Galaxiids	Fish	Order	197
<i>Batrachospermales</i>	Red alga	Red algae	Order	45
<i>Actinopteri</i>		Other	Class	1864
<i>Insecta</i>	Insects	Other	Class	457
<i>Eurotatoria</i>		Rotifers	Class	5
<i>Arthropoda</i>	Arthropods	Other	Phylum	630
<i>Rhodophyta</i>	Red algae	Other	Phylum	33
<i>Chordata</i>	Chordates	Other	Phylum	5
<i>Metazoa</i>	Metazoans	Other	Kingdom	837
<i>cellular organisms</i>	Cellular organisms	Other	No rank	848

APPENDIX 6 – SURVEY LOCATIONS

