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Mangawhai Hills Plan Change: Ecological Impact Assessment March 2023

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Cover Illustration: Subject site at Tara Road, Mangawhai (photo taken in July 2022).

CONTENTS

1. INTRODUCTION

Bioresearches was engaged by Mangawhai Hills Limited to undertake an ecological impact assessment (EcIA) for a Private Plan Change (PPC) application that will include Mangawhai Hills Development Area provisions under the operative Kaipara District Plan (KDP). The PPC area is located at Tara Road, Cove Road, Moir Road and Old Waipu Road, Mangawhai ('the site'; Figure 1). This assessment has been prepared to support a PPC application that seeks to rezone approximately 218.3 ha of Rural zoned land to Residential, as well as including parks and roading, and more than 85 ha of protected ecological area (Appendix 1).

This report details the ecological assessment that was undertaken by Bioresearches to determine the ecological features within the site and the significance of those features. Within this assessment, Bioresearches considers the ecological value of existing terrestrial and freshwater features on site and evaluates how the proposed PPC may impact the value of these features. As necessary, recommendations are provided to aid in the avoidance, minimisation, or remediation of adverse effects that could arise as a result of the rezoning.

The terrestrial ecological assessment on site resulted in the identification of a high value native bush in the western block, which likely provides habitats for various types of fauna, in addition to some mixed exotic and native vegetation present on the property. Freshwater ecological values were linked to the permanent streams and seepage wetlands present on site. It was concluded from the EcIA that the proposed zone change to a Residential Zone will ensure adequate maintenance and enhancement of ecosystem services, indigenous biodiversity and areas of contiguous indigenous vegetation cover, while accommodating for the appropriate subdivision, use and development of urban land.

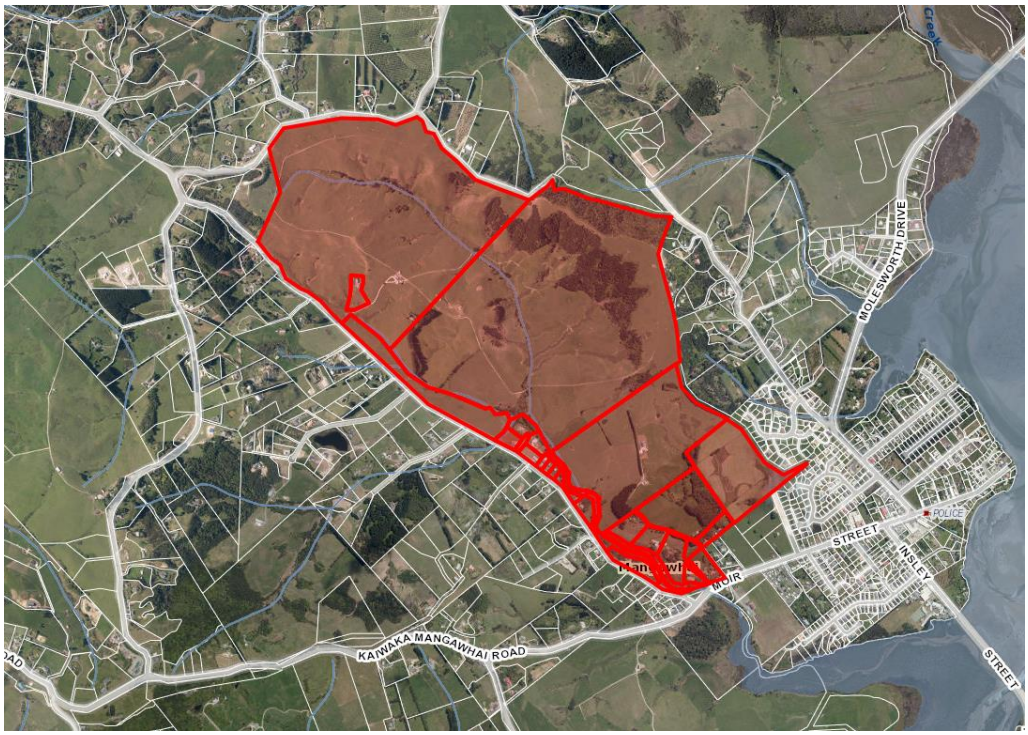


Figure 1. Outline of PPC project area (red shading) at Tara Road, Cove Road, Moir Road and Old Waipu Road, Mangawhai.

2. METHODS

Site assessments were undertaken during July and September 2022 by an experienced Bioresearches ecologist, to assess the ecological values within the site. Due to access restrictions, only the ecological features within the western portion of the site were ground-truthed. The ecological features within the eastern block have been conservatively mapped using aerial imagery.

Prior to the 2022 field surveys, a review of recent aerial images was undertaken to gain an understanding of the topography of the site. Assessments of freshwater habitats, vegetation and potential fauna habitats were noted during the site visit and photographs of the site were taken. These notes and photographs were used to assess the ecological values of the terrestrial, freshwater, and estuarine ecosystems. A desktop analysis of relevant databases was also undertaken.

2.1 Terrestrial Ecology

The vegetation and terrestrial fauna values within the property were assessed during the initial site visit. The botanical value of both exotic and native vegetation was recorded, and the quality and extent of vegetation present on site was considered. Additionally, a desktop review of terrestrial characteristics was undertaken.

Fauna habitats were assessed qualitatively, in conjunction with database reviews (e.g. Department of Conservation's ARDs, Bioweb, eBird, iNaturalist) and considered indigenous lizards, birds, and bats. A desktop analysis considered local records of bats and herpetofauna from specific databases.

2.2 Freshwater Ecology

During the site assessment, the presence and extent of streams and wetlands within the site were noted and the quality of any freshwater habitat was visually assessed. Watercourses were classified as per the Northland Regional Plan definitions to determine, in accordance with the definitions in this plan, the ephemeral, intermittent or permanent status of these watercourses.

The Ministry for the Environment's (MfE) latest guidance (MfE, 2020) and wetland delineation protocols (MfE, 2021), including vegetation assessments, hydric soils and wetland hydrology, were utilised to determine areas defined as a *'natural wetland'* under the National Policy Statement for Freshwater Management 2020 (NPS-FM). Wetland assessments included identifying native and exotic vegetation species, examining the structural tiers within wetland areas, and assessing the quality and abundance of aquatic habitats. Signs of wetland degradation such as pugging and grazing from stock access, structures such as culverts impeding hydrological function, and weed infestation were also noted.

Freshwater habitat was assessed, noting ecological aspects such as channel modification, hydrological heterogeneity, riparian vegetation extent, substrate type and any fish or macroinvertebrate habitat observed. Riparian and catchment information was also reviewed and the NIWA New Zealand Freshwater Fish Database (NZFFD) was examined for fish species potentially present within the site.

2.3 Ecological Impact Assessment

The overarching approach of this analysis and reporting is to ascertain the existing ecological values on the site and determine the impact of the proposed PPC and resulting residential development on those values.

The ecological value of the site, relating to species, communities and systems, were determined as per the EIANZ Ecological Impact Assessment guidelines (EcIAG) for use in New Zealand (Roper-Lindsay, Fuller, Hooson, Sanders, & Ussher, 2018). This report also identifies statutory guidelines and regulation with respect to ecology (such as watercourses, wetlands, high value vegetation and habitats) where relevant to the proposed development. Using this framework, the EcIAG describes a simple ranking system to assign value to species (Table 1) as well as other matters of ecological importance such as species assemblages and levels of organisation (Table 2). The overall ecological value is then determined on a scale from '*Negligible*' to '*Very High*' (Table 3).

Criteria for describing the magnitude of effects are given in Chapter 6 of the EcIAG (Table 4). The level of effect can then be determined through combining the value of the ecological feature/attribute with the score or rating for magnitude of effect to create a criterion for describing level of effects (Table 5). The cells in italics in Table 5 represent a 'significant' effect under the EcIAG. Cells with low or very low levels of effect represent low risk to ecological values rather than low ecological values per se. A moderate level of effect requires careful assessment and analysis of the individual case. For moderate levels of effects or above, measures need to be introduced to avoid through design, or appropriate mitigation needs to be addressed (Roper-Lindsay *et al.*, 2018).

Table 1. Factors to be considered in assigning value to species (Roper-Lindsay *et al.*, 2018).

Determining factors	Value
Nationally threatened species, found in the ZOI[1] either permanently or seasonally	Very High
Species listed as 'At-Risk' – declining, found in the ZOI, either permanently or seasonally	High
Species listed as any other category of 'At-Risk' found in the ZOI either permanently or seasonally	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pests, species having recreational value	Negligible

[1] ZOI (Zone of Influence) in Roper-Lindsay *et al.* (2018) defines the Zone of Influence as "*the areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities.*"

Table 2: Attributes to be considered when assigning ecological value or importance to a site or area of vegetation / habitat / community (as per Table 4 of Roper-Lindsay *et al.* 2018).

Matters	Attributes to be considered
Representativeness	*Criteria for representative vegetation and aquatic habitats:* • Typical structure and composition • Indigenous species dominate • Expected species and tiers are present • Thresholds may need to be lowered where all examples of a type are strongly modified. *Criteria for representative species and species habitats:* • Species assemblages that are typical of the habitat • Indigenous species that occur in most of the guilds expected for the habitat type
Rarity/distinctiveness	*Criteria for rare/distinctive vegetation and habitats:* • Naturally uncommon or induced scarcity • Amount of habitat or vegetation remaining • Distinctive ecological features • National Priority for Protection *Criteria for rare/distinctive species or species assemblages:* • Habitat supporting nationally threatened or At-Risk species, or locally uncommon species • Regional or national distribution limits of species or communities • Unusual species or assemblages • Endemism
Diversity and Pattern	• Level of natural diversity, abundance and distribution • Biodiversity reflecting underlying diversity • Biogeographical considerations- pattern, complexity • Temporal considerations, considerations of lifecycles, daily or seasonal cycles of habitat availability and utilisation
Ecological context	• Site history and local environment conditions which have influenced the development of habitats and communities • The essential characteristics that determine an ecosystems integrity, form, functioning and resilience (from 'intrinsic value' as defined in Resource Management Act 1991 (RMA)) • Size, shape and buffering • Condition and sensitivity to change • Contribution of the site to ecological networks, linkages, pathways and the protection and exchange of genetic material • Species role in ecosystem functioning – high level, key species identification, habitat as proxy

Table 3. Assigning value to areas (Roper-Lindsay *et al.*, 2018)

Value	Determining Factors
Very High	Area rates 'High' for at least three of the assessment matters of Representativeness, Rarity/distinctiveness, Diversity and Pattern, and Ecological Context. Likely to be nationally important and recognised as such.
High	Area rates 'High' for two of the assessment matters, and 'Moderate' and 'Low' for the remainder OR area rates 'High' for one of the assessment matters and 'Moderate' for the remainder. Likely to be regionally significant and recognised as such.
Moderate	Area rates 'High' for one of the assessment matters, 'Moderate' or 'Low' for the remainder OR area rates as 'Moderate' for at least two of the assessment matters and 'Low' or 'Very Low' for the remainder. Likely to be important at the level of the Ecological District.
Low	Area rates 'Low' or 'Very Low' for majority of assessment matters, and 'Moderate' for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates 'Very Low' for three assessment matters and 'Moderate', 'Low' or 'Very Low' for the remainder.

Table 4. Criteria for describing the magnitude of effects (Roper-Lindsay *et al.*, 2018)

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

Table 5. Criteria for describing the level of effects (Roper-Lindsay *et al.*, 2018). Where text is italicised, it indicates 'significant effects' where mitigation is required.

Magnitude of Effect	Ecological Value				
	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. EXISTING ENVIRONMENT

3.1 Background and Ecosystem Classification

The 218.3 ha site is situated at Tara Road, Cove Road, Moir Road and Old Waipu Road, Mangawhai, within the Rodney Ecological District of the Northland Region. The PPC area is approximately 3 km to the north of the boundary between the Auckland and Northland regions, and 3 km to the west of Mangawhai Central. Currently, the site consists of managed pasture used for dairy farming, watercourses and seepage wetlands, low density residential dwellings, and areas of native and native-exotic vegetation (Figure 1).

Figure 2. An aerial image of the subject site (red polygon) in relation to the surrounding environment, with the Mangawhai Harbour visible in close proximity to the east and the Brynderwyn Hills Forest Complex in the north/west.

The dominant land uses within the surrounding environment are a mix of agricultural farming, rural residential and urban development, and native bush tracts. The Mangawhai Harbour lies approximately 600 m to the east of the site (Figure 2). In the wider environment to the north-west lies the Brynderwyn Hills Forest Complex, an extensive area of mature podocarp-hardwood forest and regenerating kānuka secondary forest that is identified within the Department of Conservation's (DOC) Schedule of Biological Significance. The forest complex includes the Brynderwyn Hills Scenic Reserve and the Maranui Conservation Area.

Historically (pre-human era), the site would likely have been coastal broadleaved forest. This ecosystem type would have supported a diverse range of invertebrates, amphibians, reptiles, birds,

and bats. However, a review of the Retrolens historical images indicate that the site, and much of the surrounding landscape, has been cleared for more than 60 years and has been managed for agricultural purposes (Figure 3**Error! Reference source not found.**).

Figure 3. Historical aerial image of the site, dated 1961. The approximate site boundary is shown in red. Image sourced from Retrolens.

3.2 Terrestrial Ecology

The key terrestrial ecology values of the site are associated with approximately 16.6 ha of native bush remnants, of which 14.7 ha of this bush type is one contiguous area in the north-east of the site. Other terrestrial aspects include native-exotic bush areas, exotic shelterbelts, and pasture. The ecological values of these features are linked to the indigenous terrestrial fauna that are expected to utilise these as habitats.

3.2.1 Vegetation

Utilising observations from both site visits and/or aerial images, the vegetation has been classified and mapped the site's vegetation cover (Figure 4). The main terrestrial vegetation types are discussed below.

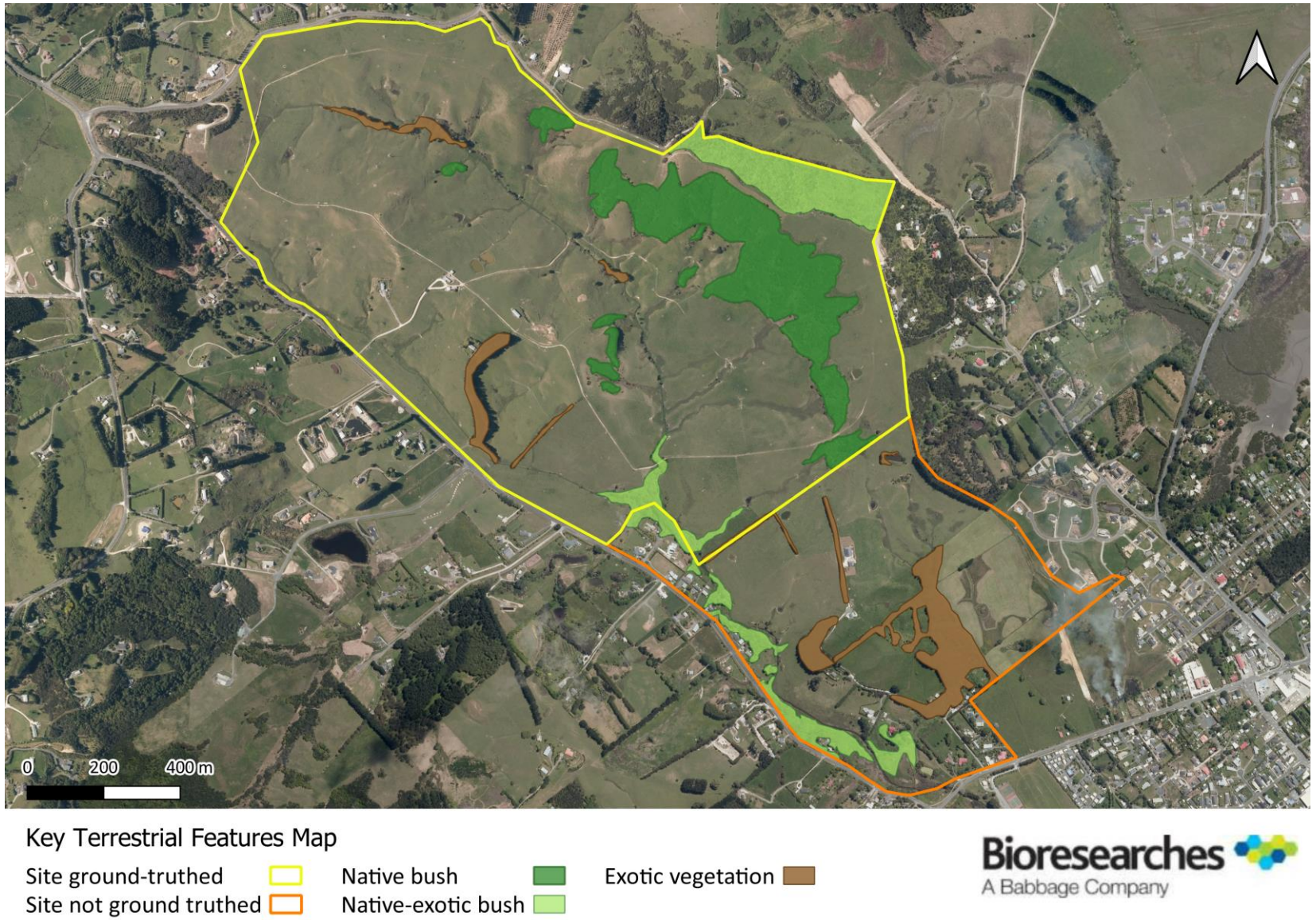


Figure 4. Key terrestrial features identified on site including native bush, and native-exotic bush.

3.2.1.1 Native bush remnants

The largest native bush remnant within the site is a 14.7 ha area of regenerating kānuka-mānuka scrub (Figure 4; Photos 1-3). The area has been identified as a Level 1 site under the Rodney Protected Natural Areas Program (PNAP) reconnaissance survey report as it is one of only three remaining coastal forests left in the Rodney Ecological District, and is within an 'At Risk' land environment. The bush is labelled as 'Old Waipu Road Remnant' (Goldwater *et al.*, 2012). The Old Waipu Road Remnant is located on moderate slopes and contains several headwater streams.

The canopy was largely kānuka (*Kunzea robusta*) and mānuka (*Leptospermum scoparium*) up to 8 m tall, with occasional tōtara (*Podocarpus totara*) emerging. In riparian areas, the canopy was dominated by tree ferns. Other native species within the canopy/subcanopy included tānekaha (*Phyllocladus trichomanoides*), pūriri (*Vitex lucens*), mamakū (*Cyathea medullaris*), pōhutukawa (*Metrosideros excelsa*) and tī kōuka (*Cordyline australis*). Lianes observed on native canopy trees included white rata (*Metrosideros perforata*) and bush lawyer (*Rubus cissoides*). Tasmanian blackwood (*Acacia melanoxylon*) trees were present in some areas and a single emergent pine (*Pinus radiata*) was observed.

The understorey has been severely impacted by grazing over time, with little to no understorey tier present in many parts of the bush, and often only unpalatable species remained. Where the understorey tier was represented, twiggy coprosma (*Coprosma rhamnoides*) was common, along with māhoe (*Melicytus ramiflorus*), ponga (*Cyathea dealbata*), māpou (*Myrsine australis*), and soft mingimingi (*Leucopogon fasciculatus*). Others observed included tree coprosma (*Coprosma arborea*), karamū (*Coprosma robusta*), hangehange (*Geniostoma ligustrifolium*), and mānuka, tōtara and tānekaha saplings.

The ground cover tier included indigenous ferns such as kiokio (*Parablechnum novae-zelandiae*), gully fern (*Pakau pennigera*), hard/scented fern (*Paesia scaberula*), rasp fern (*Doodia australis*), shaking brake (*Pteris tremula*), sedges such as kauri sedge (*Schoenus tendo*) and forest sedge (*Carex solandri*), and small herbaceous spreading species including basket grass (*Oplismenus hirtellus*) and centella (*Centella uniflora*).

Ecological weed species observed within the native bush remnants on site included Tasmanian blackwood, wild ginger (*Hedychium gardnerianum*), climbing asparagus (*Asparagus scandens*), woolly nightshade (*Solanum mauritianum*), Japanese honeysuckle (*Lonicera japonica*), pampas (*Cortaderia selloana*), Chinese privet (*Ligustrum sinense*), arum lily (*Zantedeschia aethiopica*) and tutsan (*Hypericum androsaemum*).

The ecological value of the Old Waipu Road Remnant has been considered as high, due to the representativeness of the remnant coastal forest present, the at-risk nature of the land environment and Level 1 significance classification under the PNAP, significance of the bush to provide a stepping-stone between the mainland and offshore islands, and the suitability of the area to provide habitat and resources for indigenous fauna.

Other small areas (<1 ha) of native bush are present on the site (Figure 4). These were not fenced and were heavily grazed, therefore the understorey was minimal. Similar to the Old Waipu Road Remnant, these small bush fragments had predominantly kānuka-mānuka canopies, aside from one area that was tōtara-dominant. The ecological value of these smaller bush areas was considered low, due to their small size, degraded nature and minimal understorey.

Photo 1. View of Old Waipu Road Remnant coastal forest, facing towards the northwest.

Photo 2. The eastern end of Old Waipu Road Remnant and degraded seepage wetland, facing north.

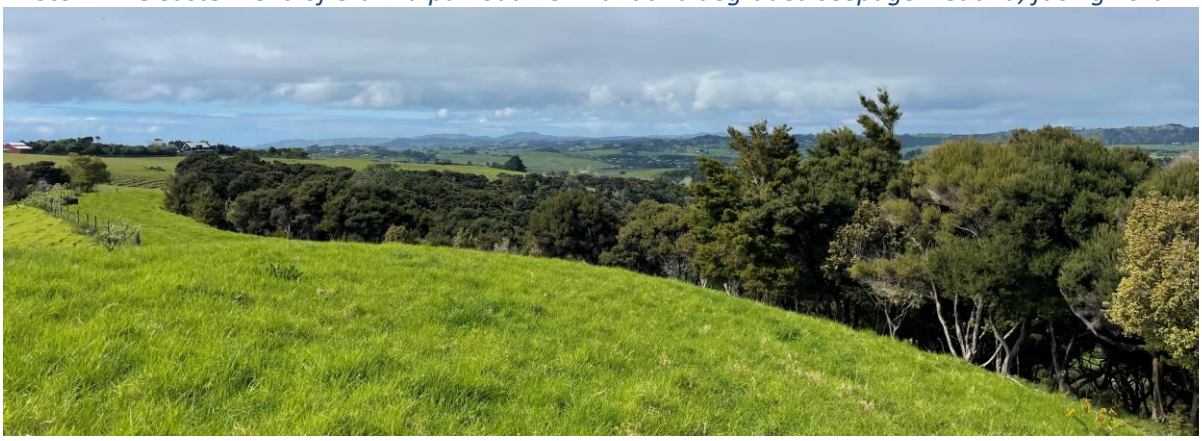


Photo 3. Northern edge of the Old Waipu Road Remnant, facing east.

Photo 4. Smaller isolated native bush patch to the northwest of the Old Waipu Road Remnant, facing north.

3.2.1.2 Native-exotic vegetation

Two main areas of native-exotic vegetation are present within the site (Figure 4). The larger area (approximately 6.5 ha) of this vegetation type is located in close proximity to the north of the Old Waipu Road Remnant, separated only by a ridgeline (Photo 5). This area was ungrazed and low-growing, and was more native dominant (kānuka-mānuka scrub) towards the west, and exotic dominant towards the east. The exotic species present within this area were largely ecological weeds species, similar in composition to those found invading the native bush areas.

Upon historic aerial review, the native-exotic 6.5 ha block has been present since at least the 1960's as has the Old Waipu Road Remnant. Due to a much higher abundance of pest plant species, this native-exotic area has a lower botanical value. However, the suitability of the area to provide habitat and resources for at-risk indigenous fauna increases the ecological value to moderate (Section 3.2.5.1 Herpetofauna).

Photo 5. Native-exotic bush block in the north of the PPC area. View towards Mangawhai Harbour in the east.

Other areas of native-exotic vegetation are also shown in Figure 4. The area of native-exotic vegetation within the south of the eastern block has not been ground-truthed, and therefore has been mapped based on aerial imagery. A large part of this vegetation is contiguous with a wetland, and is potentially comprised of common natives such as kānuka, mānuka, cabbage tree, and exotic/pest trees.

3.2.1.3 Exotic vegetation

Exotic vegetation within the site have been mapped as per Figure 4. These features are limited to shelterbelts, and a planted area in the eastern block. The exotic vegetation in the eastern block has not been ground-truthed, but appears to be comprised of planted stands of exotic trees such as pine (*Pinus* sp.), poplar (*Populus* sp.) and willow (*Salix* sp.).

The exotic vegetation within the site has low botanical values, and may provide habitat for common indigenous avifauna, however is unlikely to provide suitable habitat for herpetofauna. The ecological value of the exotic vegetation areas has been assessed as low.

3.2.2 Connectivity and Ecological Function

Connectivity between areas of vegetation is important to facilitate ecological function. Edge communities are heavily influenced by increased exposure to light, drying winds and competitive weeds. This 'edge effect' restricts some native flora and fauna to forest interiors. Patch fragmentation increases the edge effect and decreases the availability of habitat for interior species. Loss of ecological connectivity can also impair reproductive function for both flora and fauna.

The native and native-exotic vegetation within the site are fairly isolated within the surrounding environment and there is no direct connectivity to other terrestrial habitat. However, Goldwater *et al.* (2012) considered the Old Waipu Road Remnant to be significant in providing a stepping-stone between the mainland and offshore islands, and it is within proximity (approx. 4 km) to the Brynderwyn Hills Forest Complex (Figure 2). Mobile indigenous species are expected to be moving between the two largest bush vegetation fragments within the site given their close proximity and the suitability of the areas to provide habitat and resources for indigenous fauna.

Due to the relatively narrow width of these bush fragments and their disconnection from other terrestrial habitats, the bush fragments on the site are subject to edge effects, as evidenced by the damaged understorey and pest plant invasions. The native bush was considered to have a low amount of direct ecological connectivity, but a moderate ecological function (including acting as an ecological stepping-stone).

The remaining areas of vegetation (shelter belts, amenity plantings and pasture) were considered to have a negligible amount of ecological connectivity and function.

3.2.3 Pest Animals

No formal pest animal surveys were undertaken. Due to the surrounding urban and rural land uses, it is expected that the typical density of rats, mice, feral cats, mustelids and hedgehogs are present within the site.

3.2.4 Fauna

3.2.4.1 Herpetofauna

Herpetofauna (reptiles and amphibians) comprise a significant component of New Zealand's terrestrial

fauna. There is currently 135 endemic herpetofauna taxa recognised in New Zealand (Hitchmough *et al.,* 2021), 85.9% of which are considered '*Threatened*' or '*At Risk*'. All indigenous reptiles and amphibians are legally protected under the Wildlife Act 1953, and vegetation and landscape features that provide significant habitat for native herpetofauna are protected by the Resource Management Act 1991. Statutory obligations require management of resident reptile and amphibian populations if they are threatened by a disturbance i.e., land development.

No formal herpetofauna surveys were undertaken by Bioresearches. A review of historic lizard records from within 10 km of the project area indicated that four indigenous lizard species and one indigenous frog species have been recorded within the wider landscape (DOC BIOWEB Herpetofauna database; accessed December 2022; Table 6). However, these observations were from 1993-2012. Low detection of native lizards is likely partly due to the land modification within the Mangawhai area, but also may be the result of limited survey efforts which have led to a lack of data.

Table 6. Herpetofauna that may be present within the project footprint and/or have been recorded within 10 km of the project footprint (mainland taxa only), including conservation threat status (Hitchmough, *et al.*, 2016) and potential occurrence in the project area.

	Common name	Species name	NZ threat status	Distance to nearest record	Habitat potential within site
Indigenous	*Mokopirirakau granulatus*	Forest gecko	At Risk – Declining	<1 km	✓
	Naultinus elegans	Elegant gecko	At Risk – Declining	~5 km	✓
	Dactylocnemis pacificus	Pacific gecko	At Risk – Relict	-	✓
	Oligosoma ornatum	Ornate skink	At Risk – Declining	-	✓
	Oligosoma aff. smithi	Tatahi skink	At Risk – Declining	-	x
	Oligosoma moco	Moko skink	At Risk – Relict	<5 km	✓
	Oligosoma smithi	Shore skink	At Risk – Naturally Uncommon	<5 km	✓
	Oligosoma striatum	Striped skink	At Risk – Declining	-	x
	Oligosoma aenuem	Copper skink	At Risk – Declining	-	✓
	Leiopelma hochstetteri	Hochstetter's frog	At Risk - Declining	-	x
Exotic	*Lampropholis delicata*	Plague skink	Introduced & Naturalised	<5 km	✓
	Ranoidea aurea	Green and golden bell frog	Introduced & Naturalised	<5 km	✓
	Ranoidea raniformis	Southern bell frog	Introduced & Naturalised	-	✓

Forest gecko, elegant gecko and pacific gecko are typically arboreal (tree dwelling) and normally associated with regenerating scrubland and forests. Pacific and forest geckos will also inhabit clay banks and rock walls within and around such forests or scrubland. For populations of these species to persist, vegetated areas with good connectivity need to be relatively stable over time. Additionally, geckos prefer dense foliage typical of early seral vegetation communities.

Copper skink and ornate skink are generally found in dense ground cover or under logs or other debris around forest edge habitats. Copper skink are widespread, however ornate skinks tend to be patchily distributed. Moko skink are relatively common on offshore islands, and mainland populations that are rare, however one was recorded within 5 km of the site in 2013. Within the largest two bush blocks, edge habitat was common due to the elongated shape of the fragments. The damaged understorey

within the Old Waipu Road Remnant provided little groundcover and debris and the habitat suitably for native skinks was low, however the area may provide suitable habitat for indigenous arboreal gecko species. The larger native-exotic block was ungrazed and may provide high quality habitat for indigenous geckos and skinks.

Overall, the two largest bush fragments on the site are considered to contain high quality herpetofauna habitat. Despite the high-quality habitat available for indigenous skinks and geckos within the site, the lack of connectivity to other terrestrial habitats decreases the likelihood of stable populations of native herpetofauna to persist.

Due to the small size of the remaining bush fragments on the site and lack of understorey tier vegetation, it is considered unlikely that these areas support native herpetofauna. The lack of suitable habitat for native lizards outside of the two largest bush blocks meant that the herpetofauna habitat value within the rest of the site was considered low.

3.2.4.2 Avifauna

Bird surveys were not undertaken during the site visit; however, a previous bird survey was undertaken during 2019 on the western block (Ecology New Zealand, 2019). Of the seven indigenous bird species recorded during the survey, all are common, endemic/native and non-threatened. These included grey warbler (*Gerygone igata*), silvereye (*Zosterops lateralis*), tūī (*Prosthemadera novaeseelandiae*), welcome swallow (*Hirundo neoxena*), fantail (*Rhipidura fuliginosa*), pūkeko (*Porphyrio melanotus*) and swamp harrier (*Circus approximans*). Six introduced species were also observed; all are naturalised within the region.

It is unlikely that 'At Risk' or 'Threatened' species are present within the site, even on an intermittent basis. Although the vegetation is isolated and has a damaged understorey, the species present are expected to provide suitable nesting habitat and food resources for indigenous birds, therefore the native and native-exotic vegetation was considered to be of moderate avifauna habitat value. Due to the lack of suitable habitat for native avifauna outside of the regenerating native and exotic vegetation, the avifauna habitat value within the rest of the site was considered low.

3.2.4.3 Bats

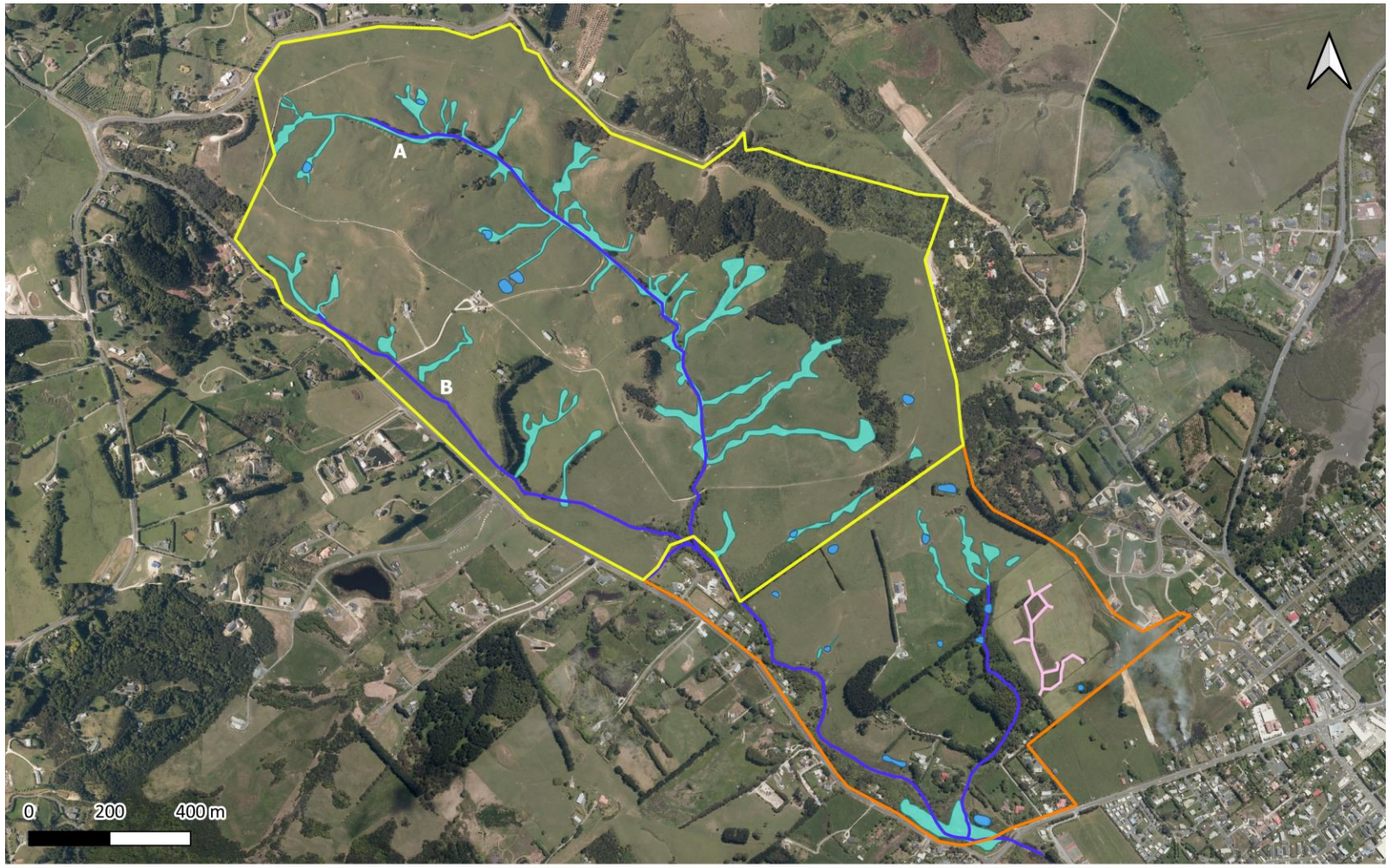
Long-tailed bats (*Chalinolobus tuberculatus*) are classified as 'Nationally Vulnerable' in the North Island (O'Donnell *et al.,* 2013). This classification is given the qualifier "Data Poor" which indicates that there is low confidence in the rating due to poor data available on the species populations and distribution (Townsend *et al*., 2008). Long-tailed bats have large home ranges of up to 5,629 ha (O'Donnell, 2001). This species has been recorded within the Brynderwyn Hills, 10 to 15 km north/west of the site. A lack of bat records closer to the site does not necessarily indicate that bats are not present, but a rather a potential lack of survey data. However, the majority of the larger trees within the site are kānuka and mānuka, and these species do not provide suitable roosting habitat for bats.

The closest records of short-tailed bats (*Mystacina tuberculata*) are on Hauturu/Little Barrier Island, south-east of the site. This species has far more specific habitat requirements than long-tailed bats

(mature forest with minimal introduced predators) and is far less mobile. Consequently, neither species of bat are expected to utilise the site as habitat.

3.3 Freshwater Ecology

Aerial images of the site indicated the presence of two main watercourses within the western block, fed by network of seepage wetlands (Figure 5). Features within the western block were ground-truthed and classified during the site visits as permanent or intermittent streams, ephemeral flow paths, natural wetlands, or constructed features. The freshwater assessments were undertaken in winter during July 2022. The catchments on-site were expected to be saturated during the site visit, allowing for the flow of any intermittent streams. Streams within the eastern block have been conservatively mapped based on aerial imagery and topography (Figure 5).



Key Freshwater Features Map

Site ground-truthed
Site not ground truthed
Constructed pond
Streams
Artificial drains
Wetlands

Bioresearches
A Babbage Company

Figure 5. Freshwater features identified on site, including natural wetlands, watercourses, constructed wetlands, and artificial channels.

3.3.1 Streams and riverine wetlands

Permanent stream/wetland environments have been identified within the site as per Figure 5. All tributaries present originate within the site and ultimately drain to the Mangawhai Estuary to the southeast. The watercourses within the eastern block were unable to be ground-truthed and have been mapped based on contours and aerial imagery (Figure 5).

Two main streams are present within the western PPC area, separated by a ridgeline. These watercourses, labelled as Watercourse A and Watercourse B, form a confluence before flowing into the eastern block adjacent Tara Road. Watercourse A is fed predominantly via a series of seepage wetlands from the surrounding slopes (Figure 5; Photo 6). Parts of Watercourse A were dominated by the invasive exotic species, reed sweet grass (*Glyceria maxima* – OBL), in the upper portion of the tributary, forming a wetland environment that had no defined channel, no riparian vegetation and limited surface water (Figure 5). The quality of Watercourse A improved towards the lower portion where there was a defined channel (Photo 7), with runs and pools present, and low-quality shading from limited riparian vegetation.

Watercourse B had a more defined channel and had been artificially straightened and deepened throughout. The watercourse consisted largely of a uniform run with little hydrological heterogeneity and was soft bottomed with anaerobic silt sediment. The water quality was poor, with little to no flow, brown colouration, and surface scums observed. Stream ecological valuations (SEV) including fish and macroinvertebrate surveys were undertaken by Freshwater Solutions within Watercourses A and B during 2019 (Freshwater Solutions Limited, 2019). The SEV scores for Watercourses A and B were 0.468 and 0.266 (out of a total of 1) respectively, indicating that the streams, in particular Watercourse B, are of a low ecological value and are degraded due to the agricultural land use.

Photo 6. Overview of gully containing Watercourse A and associated wetlands, facing southeast.

Photo 7. Example of middle portion of Watercourse A showing a defined channel within limited riparian vegetation.

3.3.1.1 Aquatic fauna

Surveys for macroinvertebrates as part of the SEVs found taxa typical of degraded soft bottomed stream environments and were indicative of 'poor' stream health (73 and 49, respectively) due to the

presence of pollutant-tolerant species and no EPT (mayflies, caddisflies and stoneflies) taxa (Freshwater Solutions, 2019).

Fish surveys from 2019 within Watercourses A and B recorded the presence of short-fin eel (*Anguilla australis*), a single unidentified bully species, and pest fish species *Gambusia* (Freshwater Solutions, 2019). A review of the NNFFD records within catchments that drain into the Mangawhai Estuary and Harbour shows records of other common indigenous fish such as banded kōkopu (*Galaxias fasciatus*), as well as 'at-risk' indigenous species such as longfin eel (*Anguilla dieffenbachia*), redfin bully (*Gobiomorphus huttoni*) and īnanga (*Galaxias maculatus*). Although the site is in close proximity to the estuary which may increase the likelihood of fish migrating upstream to the site, the degraded water quality within the watercourses at present are likely to be restricting longfin eel and īnanga presence.

Overall, the watercourses within the PPC area were considered to be of a low-moderate ecological value based on the limited riparian vegetation and stock-damaged that has resulted in the formation of degraded wetland environments, polluted water quality, poor macroinvertebrate scores and presence of only common indigenous and pest fish. Due to the close proximity of the site to the coast, the ecological value as been assessed as low-moderate due to the possibility of at-risk migrant fish being present.

3.3.2 Wetlands

3.3.2.1 Seepage wetlands

The site contains a large number of palustrine, seepage wetlands that are spring-fed from the surrounding slopes (Figure 5). The seepage wetlands were within pasture and had been heavily impacted by stock access, grazing and high nutrient loading over time (Photos 8 & 9). These factors have allowed for the invasion of common exotic species, such as soft rush (*Juncus effusus* – FACW), mercer grass (*Paspalum distichum* – FACW), jointed rush (*Juncus articulatus* – FACW), reed sweet grasss (OBL) and creeping buttercup (*Ranunculus repens* – FAC).

Of the native species observed, sharp spike sedge (*Eleocharis acuta* – OBL) and budding clubrush (*Isolepis prolifera* – OBL) were most common; these spreading species are typically able to persist in degraded wetlands. Other native species observed included common twig rush (*Machaerina rubiginosa* – OBL), lake club-rush (*Schoenoplectus tabernaemontani* – OBL), raupō (*Typha orientalis* – OBL), *Carex lessoniana* and *C. virgata* (FACW), and grass-leaved rush (*Juncus planifolius* – FACW).

Due to the hydrophytic vegetation composition (dominance of FACW/OBL species) and presence of primary hydrological indicators (e.g. saturated ground), the seepage wetlands within the property meet the definition of 'natural wetlands' under the NPS-FM and the NES-F regulations will apply to these areas. The current ecological value of these seepage wetlands has been considered as low due to the dominance of exotic species, stock-damage and lack of buffer vegetation.

Photo 8. Example of a grazed/stock damaged wetland within the PPC area.

Photo 9. Degraded seepage wetland to the south of the Old Waipu Road Remnant.

3.3.2.2 Indigenous wetland

An indigenous wetland is present in the southeastern corner of the site (Figure 5). This wetland has not been visually inspected, however appears to be a contiguous area of more than 1 ha, and views from Google Street View and aerial imagery indicate the vegetation is raupō-dominant towards the west, and becomes mangrove (*Avicennia marina* subsp. *australasica*) scrub towards the east where there is saline input from the adjacent estuary. Both of these dominant species are obligate wetland species, therefore the wetland meets the definition of a 'natural wetland' under the NPS-FM.

Although this area has not been ground-truthed, the indigenous wetland is considered to be of a high ecological value due to the raupō-reedland ecosystem type having an 'endangered' threat status, its connection with the coastal/estuarine environment, and the potential habitat it may provide for 'At-Risk' and/or 'Threatened' indigenous avifauna (Singers, *et al*. 2017).

3.3.3 Constructed features

3.3.3.1 Artificial drains

Multiple drains and ponds are present within the site (Figure 5). These features have been constructed for farm drainage purposes. The series of drains within the eastern block are artificially straightened and channelised, do not flow with the natural topography, and a review of the historic aerials indicates they were formed during recent years. The drains do not appear to have clear connectivity to natural freshwater features. Artificial drainage channels are excluded from the relevant stream protection rules under the Kaipara District Plan (KDP) and the National Policy Statement for Freshwater Management 2020 (NPS-FM).

3.3.3.2 Constructed ponds

Many constructed ponds, including effluent ponds, are present within the site (Figure 5; Photos 10 & 11)). The ponds may contain pollutant-tolerant fish species such as short-fin eel and *Gambusia*. Man-made ponds are excluded from the definition of 'natural wetlands' as they meet the definition of a constructed wetland under the NPS-FM definitions. Therefore, these features are not subject to the National Environmental Standards for Freshwater 2020 (NES-F). Additionally, these waterbodies may

develop associated wetland habitat as a direct or unintentional result of being built and maintained and the definition of a constructed wetland also extends to the incidental wetlands created as a result of these waterbodies.

Photo 10. Constructed pond in the middle of the PPC area.

Photo 11. Constructed pond to the east of the Old Waipu Road Remnant.

3.4 Summary of Ecological Values

The terrestrial ecological value of the site is predominately linked to the presence of the Old Waipu Road Remnant, a piece of coastal forest that is a Level 1 site of significance under the Rodney PNAP. The native-exotic vegetation in close proximity to the coastal forest, despite being of a lower botanical value due to invasion of pest species, likely provides suitable habitat for indigenous herpetofauna. The remainder of the site itself is largely comprised of low-ecological value managed pasture.

The freshwater values of the site are linked to the presence of modified permanent stream/wetland environments and seepage wetlands that have been degraded due to the surrounding land uses. The values of the site are summarised in Table 7.

Table 7. Summary of the terrestrial and freshwater ecological values on site.

Ecological Feature	Assigned Ecological Value
Native vegetation	High
Native-exotic vegetation	Moderate
Exotic vegetation	Low
Exotic Shelterbelt	Negligible
Other Vegetation (amenity plantings and pasture)	Negligible
Permanent stream/wetland margins	Low
Seepage wetlands	Low
Drainage channels	Negligible
Constructed ponds	Negligible

4. ASSESSMENT OF ECOLOGICAL EFFECTS

The proposed PPC seeks to rezone approximately 218.3 ha of land from Rural to Residential under the Kaipara District Plan. Additional development area provisions are also proposed as part of this PPC in the form of a Mangawhai Hills Development Area. All Northland-wide and Residential zone provisions within the KDP will apply to the re-zoned land and will enable Kaipara District Council to regulate and manage future subdivision development.

The main threats to the long-term viability of ecosystems in the Northland/Auckland regions include; habitat destruction, fragmentation, edge effects and invasion by pest plants and animals. These threats are often augmented through an increase in human population density.

This section assesses the potential effects of the proposed PPC on the current and potential ecological values within the site and the associated wider landscape.

4.1 Terrestrial Ecology

4.1.1 Vegetation

The main area that holds significant ecological value on site is the remnant native coastal forest. The area is considered to be of a high ecological value and may provide habitat for at-risk fauna.

Under the existing Rural zoning, it is a restricted discretionary activity to remove vegetation that is a part of a continuous area of predominantly indigenous vegetation over five hectares in area, or a continuous area of predominantly indigenous vegetation greater than 6 m in height and over one hectare in area (Chapter 12.10.2a). Vegetation clearance for walking tracks within native vegetation up to 1.5 m wide is a permitted activity.

No indigenous vegetation removal is required as a part of the PPC proposal. The Structure Plan seeks to incorporate all of the identified native bush on the site within public ecological areas. Approximately 16.6 ha of existing identified native bush fragments within the site are proposed to be protected under the proposed Mangawhai Hills Development Area. Therefore, the proposal will provide long-term protection of the native vegetation within the PPC area.

In addition, the PPC proposes to extend the ecological corridors within the site by requiring subdivision to be undertaken generally in accordance with the Mangawhai Hills Development Area Concept Structure Plan which details extensive revegetation planting to link existing indigenous vegetation (Appendix 1). The assigning of approximately 85 ha of land as ecological areas will retain the existing ecological values, protect this land from further degradation and provides the opportunity to further significantly enhance the terrestrial ecological values through the enhancement of the existing native vegetation, revegetation planting of steep land and the planting and protection of the 10 m riparian margins. These potential plantings will greatly increase the quantity and diversity of native vegetation as well as result a large increase in ecological connectivity and terrestrial habitat.

As such, it is considered that the Structure Plan will likely result in an overall large ecological gain in regard to terrestrial ecology.

Accordingly, it is considered that the proposed rezoning of the site will result in negligible adverse effects on the existing native vegetation.

4.1.2 Pest Mammals

The rezoning of the site from Rural Zoning to Residential Zoning is expected to lead to an increase in the human population density within the area. An increase in human population density has been found to decrease possum and rodent numbers, and expectedly, increase domestic cats in residential areas (Miller, 2020). Due to the surrounding residential and commercial properties to the west/south, roaming domestic cats would likely be within the site at present, resulting in no significant impact due to cat increases. In turn, mustelids numbers can become very limited where cats are in abundance. However, possums are likely to inhabit the bush patches on site where food sources are abundant, irrespective of an increase in surrounding urbanisation. Hedgehogs are often abundant in urban areas due to the abundance of anthropogenic food and shelter (Miller, 2020).

The current site is not known to have pest control measures, and most pests are likely at carrying capacity. Pest control is likely to be implemented on site once the number of residents increase. Additionally, the proposed native vegetation protection and enhancement will likely require pest control, which will aim to decrease possum, mustelid, hedgehog and rodent densities within the proposed ecological spaces.

The reduction in agricultural land with a re-zone to Residential will likely result in an overall decrease in the possum, mustelid, and rodent abundance, and an overall increase in hedgehog and cat numbers in urban areas. Overall, urbanisation of the PPC area is expected to provide positive outcomes for reducing pest mammal populations within the site.

4.1.3 Terrestrial Fauna

The protection and enhancement of the ecological features within the site is likely to increase and improve the quality of the terrestrial habitat for indigenous fauna over time. The revegetation planting proposed will result in increased habitat for indigenous fauna.

Any potential direct adverse effects on native terrestrial fauna as a result of subsequent development works (e.g. earthworks) would be assessed at the resource consenting phase and can be appropriately mitigated through the implementation of fauna management plans.

4.2 Freshwater Ecology

All streams within the site are considered to be of low ecological value due to their highly modified nature, poor water and habitat quality, and lack of riparian vegetation. The proposed rezoning will not affect stream protection measures required by the KDP's objectives, policies and rules.

Multiple stream crossings are proposed to form primary and secondary roads within the PPC area (Appendix 1). Where practicable, the new roads are proposed in locations that will utilise existing culverts/vehicle crossings within the site, and upgrades will be provided where necessary. Where crossings are proposed over wetlands, arched culverts or bridges will be utilised to avoid full or partial wetland drainage.

It is proposed that the remaining 10 m riparian yard on both banks is protected and enhanced though revegetation planting. As such, it is considered that the proposed rezoning will not result any significant adverse effects on the freshwater values of the site and in fact there will likely be a significant enhancement of freshwater values through the planting of riparian yards and the removal of stock.

4.2.1 Stormwater

The main threats to the freshwater ecology, as a result of a change to Residential, are in relation to stormwater through:

- The potential increase in impervious surfaces as a result of subsequent development; and/or,
- The potential increase in pollutant runoff as a result of subsequent development.

The proposed zone change is expected to result in an increase in impervious surfaces. This increase can amplify the adverse stormwater effects on the receiving environment by resulting in scouring, erosion or high levels of contaminant input if not designed and mitigated appropriately.

Chester Limited have provided an assessment of stormwater management and discharge considerations in a Stormwater Management Plan (SMP) (Chester Limited, 2022), which is included in the PPC application. The national, regional and local regulations and guidelines outline the requirement of a Water Sensitive Design (WSD) approach to be undertaken for stormwater for any future development. The aim of this is to protect and enhance downstream environments and mimic natural water systems and processes for stormwater management. To achieve this, stormwater objectives for the future development of the site have been outlined by Chester Ltd. The SMP, along with the proposed development area provisions, recommend that Auckland Council technical guidance documents, GD04 Water Sensitive Design and GD01 Stormwater Management Devices, should be referred to as a good standard for future stormwater design, with the aim of:

- Reducing stormwater runoff volumes via retention/detention;
- Moderating stormwater peak flowrates; and,
- Managing stormwater runoff quality by minimising contaminants entering waterways.

To align with the NPS-FM and NES-F, future stormwater design will be required to avoid adverse effects on the natural wetlands within the site, by minimising erosion through appropriate setbacks (minimum 10 m from natural wetlands) achieving net neutrality and avoiding partial/complete drainage.

The SMP recommends a high-level approach for stormwater management within the PPC area which includes:

- Stormwater quality
    - Treatment of the Water Quality Volume (WQV) or Water Quality Flow (WQF) from all private driveways and public roads by a water quality device for the relevant contaminants.
    - WQF to use the 10mm/hr rainfall intensity and WQV to use the 1/3 of the 2 Year ARI 24-hour rainfall depth with climate change as substitution for the percentile rainfall event in Auckland Council's GD01.

  - Inert building materials are to be utilised (e.g. inert roof material) to prevent leaching of contaminants.

- Stormwater retention

  - Re-use / rainwater harvesting is required for all residential properties via rainwater tanks.
  - Stormwater retention of the first 5mm of rainfall for all impermeable surfaces is to be provided with the retention volume either to be re-used or infiltrated within a 72-hour period.
  - If it has been determined that there is not enough water demand or soakage available to provide retention via re-use or infiltration over a 72-hour period, then retention is to be substituted with detention with the volume to be discharged over a 24-hour period.

- Stormwater Detention

  - Stormwater detention for the difference between runoff volumes between the pre and post-development scenario for the 1/3 of the 2 Year ARI 24-hour rainfall depth with climate change to be provided minus any retention volume provided for all impermeable surfaces with the discharge to be over a 24-hour period.
  - Pre-development scenario to be considered as 100% grass cover.

- Stormwater conveyance

  - Primary stormwater networks to be designed up to the Design AEPs in Table 6.2 of the KDC Engineering Standards. Kerb and channels along roads are to be avoided where practical. Culverts are to be designed in accordance with KDC engineering standards.
  - Fish passage to be provided for any infrastructure constructed across the two identified watercourses.
  - Roadways to be designed as secondary flow networks where practical and are to accommodate up to the 1% AEP rainfall event.
  - Ensure identified overland flow paths remain unobstructed and can safely convey runoff.

- Stormwater discharge

  - Utilise soakage systems wherever possible as a primary means of stormwater disposal even if the full design soakage is not achievable.
  - Where the full design soakage cannot be achieved, an overflow to the approved discharge point is to be provided.
  - All soakage systems are subject to a soakage and geotechnical assessment.
  - To accommodate the NES-F, stormwater catchments (as identified in Figure 4-1) that discharge into natural wetlands are to ensure that the post-development scenario also discharge/runoff into the same natural drainage point to prevent drying up of the downstream environment.

- Stormwater temperature
  - Buildings, infrastructure, stormwater devices and outlets are to consider temperature control where appropriate.
- Setbacks

- To accommodate the NES-F a 10m setback is proposed from all natural wetland edges.
- Buildings and infrastructure to be located outside the 1% AEP flood and coastal hazards.

The SMP concludes that the future development of the site can be appropriately serviced and kept in line with the stormwater objectives.

4.3 Relevant Policy Documents

4.3.1 National Policy Statement for Freshwater Management 2020

The NPS-FM provides national direction for decisions regarding water quality and quantity, and integrated management of land, freshwater and coastal environments under the RMA. The NPS-FM contains national objectives for protecting ecosystems, indigenous species and the values of outstanding water bodies and wetlands.

The main objective of the NPS-FM is to ensure health and well-being of water bodies and freshwater ecosystems are prioritised. The PPC is in accordance with the objective of the NPS-FM as all freshwater ecosystems have been identified within the site, no reclamation or stream works are proposed and any potential significant adverse effect can be appropriately avoided, minimised, remedied or offset. Furthermore, the PPC proposes opportunities to protect and enhance the freshwater ecosystems.

4.3.2 Northland Regional Policy Statement

Consistent with the relevant objectives within the Northland Regional Policy Statement, the PPC proposes/provides for the following:

- Improvement of freshwater and coastal water quality through the enhancement and protection of streams and wetlands within the site. The retirement of land from agricultural farming along with the planting of riparian yards will aid in the reduction in harmful microbes and sediment reaching the downstream estuarine/coastal environment (Objective 3.2 Region-wide water quality).
- Stormwater management through water sensitive design to maintain flows to freshwater features (streams and wetlands) on site (Objective 3.3 Ecological flows and water level).
- Protection of significant indigenous vegetation and habitats of indigenous fauna, as well as enhancement of the existing areas through planting to extent ecological corridors and the designation of open ecological spaces (Objective 3.4 Indigenous ecosystems and biodiversity; Objective 3.15 Active management).

4.3.3 Operative Kaipara District Plan 2022

The operative KDP sets out a number of policies and objectives that gives effect to the RMA to promote the sustainable management of natural and physical resources. This section addresses the objectives and policies set out in the KDP pertaining to ecology.

4.3.3.1 Chapter 3A – Mangawhai Growth Area

Consistent with the relevant objectives within Chapter 3A of the KDP (Objectives 3A.4.4 & 3A4.6), the PPC provides for public open ecological spaces and parks within the Mangawhai Structure Plan Area. All areas of terrestrial and freshwater ecological value of note within the site are proposed to be protected, and areas of degraded ecological quality are to be enhanced.

4.3.3.2 Chapter 6 – Ecological Areas

Consistent with the objectives and policies in Chapter 6 of the KDP, through the proposed terrestrial vegetation protection and enhancement, the PPC will provide ample opportunity to maintain and enhance the quality of the existing ecological features and their fauna habitat values, and create ecological corridors within the site through revegetation planting, while allowing for appropriate subdivision.

Additionally, it has been demonstrated above that the adverse environmental effects of the PPC, including significant adverse effects from urban development on receiving waters, can be appropriately avoided, remedied or mitigated through water sensitive design.

5. SUMMARY AND RECOMMENDATIONS

Bioresearches have assessed the proposed PPC for the site. The impact of rezoning from Rural to Mangawhai Hills Development Area, which provides for large lot residential development has been considered in relation to the terrestrial and freshwater values present on site. It is considered that the PPC is appropriate for the site. Future subdivision and development in accordance with the zoning and the Mangawhai Hills Conceptual Structure plan is anticipated to result in the appropriate protection and enhancement of indigenous terrestrial and freshwater biodiversity values of the site. It is recognised that the operative KDP, the NES-F and the proposed development area provisions provide a framework that manage any proposed future development at the resource consenting phase to ensure development aligns with the appropriate polices and regulations.

The significant ecological values on site are the linked to the remnant coastal forest. The adverse effects of the PPC on these natural features can be appropriately and effectively managed through the provisions of the proposed Mangawhai Hills Development Area. Additionally, the PPC provides opportunities to protect and enhance the terrestrial and freshwater values of the site. Appropriate stormwater management, revegetation planting, pest-control, maintenance programmes and biodiversity enhancement are expected to be implemented during development of the site and provide for an overall net ecological gain.

Bioresearches supports the proposed private plan change for the site, given that the existing ecological values will be appropriately protected, enhanced, and managed.

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Appendix 1: Conceptual Open Space Plan

5.2 Open Space Network

The proposed open space network is largely driven by natural and proposed native vegetation, existing hydrology (including streams and wetlands) and topography.

The open space network is a primary structuring element on site in terms of the location of primary and secondary roads, walking and cycling connections, the community hub location and the overall density distribution.

Some of the key drivers include: enhancing and protecting ecological corridors, improving connectivity and public access to local natural environment and to provide blue / green infrastructure to enhance biodiversity, environmental health and stormwater management.

Legend

- Plan Change Area
- Indicative Primary & Secondary Roads
- Indicative Lineal Open Space
- Indicative Primary & Secondary Roads
- Indicative Lineal Open Space
- Streams
- Indicative Social Open Space
- Opportunities for Active Open Space
- Existing Native Vegetation
- Additional Native Revegetation (incl southern slopes)
- Riparian Restoration
- Predominantly exotic vegetation

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