

**ECOLOGICAL IMPACT ASSESSMENT  
FOR A PROPOSED SUBDIVISION AT  
2127 KAIPARA COAST HIGHWAY, MAKARAU**

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# ECOLOGICAL IMPACT ASSESSMENT FOR A PROPOSED SUBDIVISION AT 2127 KAIPARA COAST HIGHWAY, MAKARAU

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*Grazing land at 2127 Kaipara Coast Highway*

## **Contract Report No. 5807**

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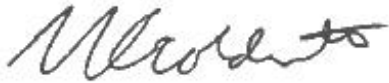
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## 1. INTRODUCTION

ABIB (Oamaru) Ltd, on behalf of its client, is preparing a consent application for a residential subdivision at 2127 Kaipara Coast Highway. The site is located 10 kilometres north of Kaukapakapa and covers c.134 hectares. Vegetation largely comprises rolling pasture on gentler slopes, with gullies characterised by indigenous forest and shrubland. Most of the woody vegetation is located at the southern end of the property and is contiguous with forest vegetation on the adjacent Pareparea Burial Reserve and Makarau Bridge Reserve. This vegetation has been classified as a Significant Ecological Area (SEA\_T\_6713). The property is zoned Rural Coastal Zone (Kaipara South Head and Harbour Coastal Area) under the Auckland Unitary Plan (AUP).

The proposed subdivision will create a cooperative farming development to be held by up to 25 owners (**Proposal**) on the 134-hectare site. The Proposal will create 25 residential lots of approximately 3,500m<sup>2</sup> each, with a share in a balance lot to be held as a communal arm lot comprising a mix of useable farm land and covenanted indigenous forest and wetland vegetation. The proposal includes:

- An agricultural cooperative farm managed in a sustainable manner via a Farm Management Plan and utilising the existing farm house.
- 25 lots for rural lifestyle living as part of a wider agricultural cooperative farm development managed via Design Guidelines.
- A new entranceway off Kaipara Coast Highway.
- An internal access road and a network of walking / cycle trails throughout the farm.
- Four communal orchards.
- A communal facility.
- A natural playground.
- Restoration planting and protection of gullies, wetlands, and streams.
- Fencing and protection of over 33 hectares of existing indigenous vegetation.
- Revegetation of over 15 hectares of terrestrial habitats and three hectares of wetland habitats.
- Extensive pest control and management plan.

A subdivision of this scale is a non-complying activity under the AUP. As such, the development has been strategically designed to avoid or minimise adverse ecological effects, and to provide additional ecological benefits through the protection and enhancement of indigenous habitats. Findings from initial ecological investigations at the site allowed the scheme plan and engineering works to be designed to avoid earthworks within areas of natural inland wetland or the clearance of high value indigenous vegetation. Indigenous fauna values have also been assessed and incorporated into the proposal through actions such as lighting design controls to

minimise disturbance of long-tailed bats, a ‘cat free’ covenant to prevent increased predation on indigenous fauna, and the implementation of a Fish Management Plan when carrying out stream works.

This report provides an assessment of the ecological effects of the proposed development, and includes:

- Maps and descriptions of the vegetation and habitat types present;
- An assessment of the ecological values of vegetation and habitat types;
- Descriptions of the magnitude and extent of potential ecological effects resulting from the proposed subdivision;
- How the proposal has avoided, minimised, or mitigated potential adverse ecological effects; and
- How the proposal provides additional ecological benefits to the local area.

## 2. ECOLOGICAL CONTEXT

### 2.1 Overview

The property at 2127 Kaipara Coast Highway is located within the Kaipara Ecological District. This ecological district covers the northern and southern peninsulas of the Kaipara Harbour and contains a mix of modified sand dunes and wetlands, pasture, regenerating kānuka (*Kunzea robusta*) forest/shrubland, estuarine habitats, and extensive pine plantations. Mature forest remnants are generally rare, although some large wetland systems remain around the inner coastline. The Kaipara Harbour is an internationally significant habitat for migratory and non-migratory bird species (Smale *et al.* 2009).

The original vegetation of the Kaipara Ecological District comprised a mix of dune forest and coastal-lowland broadleaved species forest with pōhutukawa (*Metrosideros excelsa*), taraire (*Beilschmiedia tarairi*), pūriri (*Vitex lucens*), and kohekohe (*Didymocheton spectabilis*), with locally common podocarps such as kahikatea (*Dacrycarpus dacrydioides*), tōtara (*Podocarpus totara*), and rimu (*Dacrydium cupressinum*). Dune forest would have been dominated by tōtara, pōhutukawa, and kānuka in the early stages of dune stabilisation, followed by development of a canopy of broadleaved tree species such as kohekohe, karaka (*Corynocarpus laevigatus*), pūriri, taraire, and tawa (*Beilschmiedia tawa*) (Singers *et al.* 2017). Kauri (*Agathis australis*) forest would have been more common on the steep west-terrain of the east coast of the Kaipara Harbour, and kahikatea swamp forest would have covered most of the flat coastal margins.

Since human occupation, the natural landscape of Kaipara Ecological District has undergone extensive modification and remaining indigenous habitats are highly modified and fragmented. However, sizeable areas of regenerating dune forest have established, often dominated by kānuka, tōtara, taraire, and karaka. Freshwater wetlands and swamp forests have been significantly reduced from their original extent.

Many former wetlands, including dune lake systems, have been modified or destroyed by vegetation clearance and drainage. Inland wetlands that still remain are small and scattered in the ecological district and consist mainly of raupō (*Typha orientalis*) reedland in farm valleys.

Coastal habitats such as intertidal flats, mānawa (mangrove; *Avicennia marina* subsp. *australasica*) forest, dunelands, salt marshes, and terrestrial margins provide extensive and rich feeding grounds for a variety of bird species including oceanic species, waders, marsh birds, and forest birds. Several species of birds classified as ‘Threatened’ and ‘At Risk’ by Robertson *et al.* (2021) occur in these habitats, including New Zealand fairy tern (*Sternula nereis davisae*; ‘Threatened - Nationally Critical’), kōtuku (white heron; *Ardea modesta*; ‘Threatened - Nationally Critical’), tūturiwhatu (northern New Zealand dotterel; *Charadrius obscurus aquilonius*; ‘At Risk - Recovering’), and taranui (Caspian tern; *Hydropogone caspia*; ‘Threatened - Nationally Vulnerable’).

Despite the small number of remaining freshwater wetlands and their modified and/or degraded character, they support a number of threatened bird species, including matuku (Australasian bittern; *Botaurus poiciloptilus*; ‘Threatened - Nationally Critical’), mātātā (North Island fernbird; *Bowdleria punctata vealeae*; ‘At Risk - Declining’), moho-pererū (banded rail; *Gallirallus philippensis assimilis*; ‘At Risk - Declining’), and pūweto (spotless crake; *Porzana tabuensis tabuensis*; ‘At Risk - Declining’).

All indigenous forest in the Kaipara Ecological District provides habitat for common indigenous bird species such as riroriro (grey warbler; *Gerygone igata*), tauhou (silveryeye; *Zosterops lateralis*), and pīwakawaka (North Island fantail; *Rhipidura fuliginosa placabilis*). Species such as tūi (*Prosthemadera novaeseelandiae*) and kererū (*Hemiphaga novaeseelandiae*) are more common in larger forest remnants. Skinks and geckos are present on the beaches and in shrubland and forest habitats. Threatened species include ornate skink (*Oligosoma ornatum*), Pacific gecko (*Dactylocnemis pacificus*), and elegant gecko (*Naultinus elegans elegans*), all of which are classified as ‘At Risk - Declining’ by Hitchmough *et al.* (2016).

A diverse range of aquatic fauna species occur in Kaipara Ecological District, including species classified as ‘Threatened’ and ‘At Risk’ by Dunn *et al.* (2018). These include īnanga (*Galaxias maculatus*; ‘At Risk - Declining’), longfin eel (*Anguilla dieffenbachii*; ‘At Risk-Declining’), and the non-threatened redfin bully (*Gobiomorphus huttoni*), Cran’s bully (*Gobiomorphus basalis*), banded kōkopu (*Galaxias fasciatus*), and shortfin eel (*Anguilla australis*). The largest whitebait species, giant kōkopu (*Galaxias argenteus*; ‘At Risk - Declining’), is also known to occur in this Ecological District.

## 2.2 Local context

The property is located on the southeastern edge of the Kaipara Harbour near the mouth of the Makarau River, and is bounded by the Makarau Bridge Recreation Reserve to the east, Makarau Stewardship Area to the west, and Pareparea Burial Reserve to the south. The low-lying plains west of the property would have formerly contained wetland vegetation, but have been reclaimed through drainage and converted to agricultural land uses.

The site contains approximately 17.9 hectares of forest classified as SEA under the AUP (SEA\_T\_6713). SEA\_T\_6713 also extends into the adjacent Pareparea Burial Reserve.

SEA\_T\_6713 qualifies as ecologically significant on the basis that it meets the “diversity” factor described in Schedule 3 of the AUP. The vegetation within this SEA is also likely to meet several of the other significance factors outlined in the AUP, including:

- Threat status and rarity: It is an indigenous habitat, community or ecosystem that occurs naturally in Auckland and has been assessed (using the IUCN threat classification system) to be threatened. Vegetation in this area is classified as WF11 (kauri, podocarp, broadleaved forest) and WF10 (kauri forest) in the Auckland GeoMaps system. Both of these ecosystem types are classified as ‘Endangered’ under the IUCN threat classification system (Singers *et al.* 2017).
- Stepping-stones, migration pathways, and buffers: It is part of a network of sites that cumulatively provide important habitat for indigenous fauna or when aggregated make an important contribution to the provision of a particular ecosystem in the landscape.

Other small SEA fragments occur at the southern end of the site (SEA\_T\_6714) and along the adjacent Makarau Bridge Recreation Reserve (SEA\_T\_2682a) and Makarau Stewardship Area (SEA\_T\_2336).

## 2.3 Site description

The c.134-hectare property is located west of Kaipara Coast Highway and occupies a ridge oriented north to south. From the ridgetop land slopes steeply east toward the Makarau River and west toward the low-lying plains on the edge of the Kaipara Harbour. Most of the site is used for pastoral grazing, with patches of mature and/or regenerating indigenous forest in gullies and on steeper sloping land.

Buildings on the site include one dwelling, a shed near the main entrance to the site, and a small number of farm buildings.

## 3. METHODS

### 3.1 Vegetation and habitat survey

The site was surveyed on 11-12 May 2021, during which time all vegetation and habitat types were described and mapped. The current ecological values of the vegetation and habitat types were also assessed. All vascular plant species observed were recorded and are presented in Appendix 1. Vegetation and habitat types were digitised onto aerial imagery using ArcGIS10.8.

As the initial site survey was carried out following heavy rain, an additional survey was carried out on 12 August 2021 to confirm the status of streams at the site under the definitions provided in the Auckland Unitary Plan. This stream survey occurred after a period of relatively settled weather with minimal rainfall in the preceding 48 hours.

Wetland areas were also reassessed on 17 March 2023 based on the pasture exclusion guidance provided by the Ministry for the Environment in December 2022 (Ministry for the environment 2022).

### 3.2 Fauna survey

Targeted fauna surveys were beyond the scope of this report, however, the suitability of the vegetation at the site to provide habitat for key indigenous fauna species was assessed and all fauna species observed at the site were recorded. Fauna species for which habitat values were specifically considered include:

- Long-tailed bat (*Chalinolobus tuberculatus*).
- Forest gecko (*Mokopirirakau granulatus*).
- Elegant gecko (*Naultinus elegans elegans*).
- Copper skink (*Oligosoma aeneum*).
- Ornate skink (*O. ornatum*).

### 3.3 Ecological Impact Assessment guidelines for use in New Zealand

The Environment Institute of Australia and New Zealand (EIANZ) guidelines for undertaking assessments of ecological effects in New Zealand (Roper-Lindsay *et al.* 2018) have been referred to when preparing this report. The ecological values of affected vegetation and habitats, and the magnitude and extent of the potential adverse ecological effects associated with the subdivision have been evaluated using the methods described in these guidelines. Professional opinion and expertise have been applied throughout the assessment to ensure that the results are ecologically robust.

## 4. VEGETATION AND HABITATS

### 4.1 Overview

Nine main terrestrial vegetation types were recorded at the site:

- Kānuka forest.
- Kahikatea forest.
- Kahikatea – kānuka treeland over exotic grassland.
- Kahikatea treeland over exotic grassland.
- Tōtara-kānuka-kahikatea treeland.
- Kānuka scrub.
- Blackberry-pōhuehue vineland.
- Gorse shrubland.
- Kikuyu grassland.

All areas of forest, treeland, and scrub at the site meet the criteria to be classified as SEA as they are likely to provide habitat for indigenous fauna species that have been classified as ‘Threatened’ or ‘At Risk’ (Factor 2b: Threat status and rarity). These fauna habitat values are discussed in more detail in Section 6. These vegetation types also form part of a network of sites that cumulatively provide important habitat for indigenous fauna (Factor 4c: Stepping-stones, migration pathways and buffers).

A further 13 wetland vegetation types were also identified:

- Raupō reedland.
- *Machaerina articulata* sedgeland.
- Wī rushland.
- Wī-kikuyu rushland.
- Kahikatea treeland over wī rushland.
- Kahikatea-kānuka treeland on wetland margin.
- Mānuka scrub.
- Mercer grass-giant umbrella sedge grassland.
- Wī-spike sedge-*Machaerina rubiginosa* rushland.
- Mercer grass-soft rush-raupō grassland.
- Soft rush-wī-Mercer grass rushland.
- Soft rush-kikuyu rushland.
- Mercer grass-soft rush grassland.

These vegetation types are described below and are illustrated in Appendix 2.

## 4.2 Terrestrial habitats

### 4.2.1 Vegetation type 1: Kānuka forest (c.28.06 hectares)

Kānuka forest is the most common indigenous vegetation type found on the property. Small fragments of kānuka forest (0.4 to 1.8 hectares in size) occur in gullies in the eastern part of the property. Larger and more intact patches of kānuka forest occur on the eastern boundary, and include an area contiguous with the forest in the adjacent Pareparea Burial Reserve.

A range of other mature trees are present in the canopy in varying abundances, with kahikatea and kauri locally abundant in some fragments. Six kānuka forest sub-types (Vegetation Types 1a to 1g) have been identified based on canopy composition, and are described in more detail below.

Understorey vegetation within areas of kānuka forest also varies significantly. Most areas of kānuka forest are heavily grazed by cattle with a sparse or absent understorey. Canopy height is typically between 10-20 metres with occasional taller emergent trees.

### Type 1a (16.8 hectares)

Vegetation Type 1a is the largest and most intact example of the kānuka forest type and is contiguous with indigenous forest on the neighbouring Pareparea Burial Reserve. Kānuka dominates the upper ridges and drier hillslopes with occasional kauri. Kahikatea and broadleaved species including karaka, taraire, and pūriri, are more dominant in gullies and on lower slopes (Plate 1).

Ponga (*Cyathea dealbata*) and nīkau (*Rhopalostylis sapida*) are present in the subcanopy. Groundcover species including *Carex banksiana*, hook sedge (*Carex uncinata*), and pānako (*Blechnum filiforme*) occur along with canopy tree seedlings. Large kahakaha (*Astelia hastata*) and kōwharawhara (*A. solandri*) occur in the branches of large pūriri. The indigenous vines akakiore (New Zealand jasmine, *Parsonsia heterophylla*), puawānanga (*Clematis paniculata*), and kareao (supplejack; *Ripogonum scandens*) are also present.

Understorey vegetation is grazed near the ridge top where stock have easy access. However, grazing damage becomes less evident (and understorey vegetation becomes denser) further down slope. Understorey species recorded in this area include small leaved coprosma species (*Coprosma areolata* and *C. rhamnoides*) (Plate 2) and the seedlings and saplings of canopy tree species.



Plate 1: Example of kānuka forest type 1a showing a range of canopy species including pūriri and kahikatea and a subcanopy of ponga and nīkau.  
11 May 2021.



Plate 2: Understorey plants including small-leaved *Coprosma* spp. are more frequently encountered further from the forest edge in forest type 1a.  
11 May 2021.

#### Type 1b (1.54 hectares)

Type 1b consists of a sparse canopy of kānuka that closely resembles treeland with occasional to frequent tōtara, kahikatea, pūriri and kōwhai (*Sophora chathamica*). This area is heavily grazed, lacks understorey vegetation, and features a ground cover dominated by exotic grasses. This vegetation type is most prevalent towards the lower elevations on the western edge of the property.

#### Type 1c (0.40 hectare)

Kānuka forest type 1c is an area of kānuka forest surrounding a pond at the bottom of a disused quarry (Plate 3). Occasional māhoe (*Melicytus ramiflorus*), and prickly mingimingi (*Leptecophylla juniperina*) are present at the bottom of the gully, while gorse (*Ulex europaeus*) is locally abundant on the top of the rock face. Dense patches of ferny azolla (*Azolla pinnata*) occur on the pond surface.



Plate 3: Kānuka forest type 1c grows on rocky substrate around the old quarry. Ferny azolla is locally abundant on the pond surface. 12 May 2021.

#### Type 1d (1.73 hectares)

This forest type occurs in two small fragments towards the southern end of the property. Kānuka is dominant with locally abundant kauri ricker and occasional rimu, kahikatea, and rewarewa (*Knightia excelsa*). These areas are grazed with a sparse understorey (Plate 4) but still contain indigenous groundcover species such as pātītī (*Microlaena stipoides*), rasp fern (*Doodia australis*), *Oplismenus hirtellus*, and thread fern.



Plate 4: Kānuka forest type 1d showing frequent kauri trees (trunks) and a grazed groundcover dominated by pātītī. 12 May 2021.

#### Type 1e (2.19 hectares)

This forest type contains a range of indigenous canopy species, of which kānuka is the most widespread. This vegetation type straddles a permanent stream and contains several tree species including occasional tawa, rewarewa, kōwhai, and pūriri (Plate 5). Although heavily grazed, understorey species such as non-palatable small-leaved coprosma (*Coprosma areolata* and *C. rhamnoides*), and ground cover species such as tarangārara (*Gahnia lacera*), pātītī, and nīkau palm seedlings are present in small numbers. Kahakaha and kareao can also be found in the subcanopy.

An area of kānuka forest type 1e at the northern end of the property also contains locally abundant kahikatea and kauri.



Plate 5: Kānuka forest type 1e featuring a sparse (heavily grazed) understorey with occasional small-leaved coprosma species. Mature pūriri features kahakaha on trunk. 12 May 2021.

#### Type 1f (1.42 hectares)

Type 1f is dominated by kānuka with locally abundant kahikatea (Plate 6). This habitat type is grazed but also includes several subcanopy species such as nīkau, māhoe, ponga, mamaku (*Cyathea medullaris*), tī kōuka (*Cordyline australis*), and karamū (*Coprosma robusta*). *Oplismenus hirtellus* and pātītī are locally abundant in the ground tier.

This vegetation type occurs adjacent to a small area of raupō reedland.

#### Type 1g (3.98 hectares)

This forest type occurs on the lower slopes along the eastern boundary and was surveyed from a vantage point on the ridge top. The canopy is dominated by kānuka with locally abundant kahikatea and frequent emergent tōtara. As with most other areas of kānuka forest at the site, the understorey appears to be mostly grazed.



Plate 6: Small area of locally abundant kahikatea within kānuka forest type 1f features a grazed understorey and locally abundant kahikatea. 12 May 2021.

#### 4.2.2 Vegetation type 2: Kahikatea forest (1.81 hectares)

Kahikatea forest is represented by three fragments occupying gullies on the western slopes of the property. The canopy is typically between 10 to 15 metres tall and all areas are heavily grazed with a sparse or absent understorey. A range of other species are also present in the canopy including frequent kānuka and occasional nīkau, tōtara, and pūriri. This vegetation type has been divided into three sub-types, as described below.

##### Type 2a (600 m<sup>2</sup>)

Vegetation type 2a consists of a very small fragment of kahikatea forest on the edge of a stream. The area is heavily grazed with no understorey (Plate 7).

##### Type 2b (1.22 hectares)

Vegetation type 2b follows a narrow gully on the western slopes of the property. The canopy features abundant kahikatea, frequent kānuka, and occasional tōtara and pūriri in the lower gully (Plate 8).



Plate 7: Vegetation type 2a, small kahikatea forest fragment with sparse understorey. 12 May 2021.



Plate 8: Kahikatea Forest in narrow gully with frequent kākūka. Gorse occurs in small patches on the forest edge. 12 May 2021.

Type 2c (0.53 hectare)

Kahikatea forest type 2c features frequent karaka, tawa, tōtara, pūriri, kohekohe, and rewarewa (Plate 9). This area is heavily grazed with no understorey. A possum (*Trichosurus vulpecula*) was seen in this habitat type and significant evidence of possum browse was recorded on mature kohekohe (Plate 10). Indigenous ground covers species including pātītī, *Oplismenus hirtellus*, and rasp fern, and the climbers tātarāmoa (bush lawyer; *Rubus cissoides*) and kareao were also recorded.



Plate 9: Kahikatea forest type 2c showing mostly absent understorey, and subcanopy of karaka, tī kōuka and kohekohe. 12 May 2021.



Plate 10: Possum browse on kohekohe in vegetation type 2c. 12 May 2021.

#### 4.2.3 Vegetation type 3: Kahikatea-kānuka treeland over exotic grasses (12.98 hectares)

The eastern side of the property features a large area of grazed kahikatea-kānuka treeland over grazed kikuyu (*Cenchrus clandestinus*) (Plate 11). Occasional remnant pūriri, karaka, rewarewa, kāpuka (*Griselinia littoralis*), and māhoe are also present. Some large pūriri trees contain established kōwharawhara and kahakaha (Plate 12). Indigenous understorey and ground cover species are mostly absent apart from occasional rasp fern and *Coprosma areolata* in shaded areas. Several gorse thickets are also present in this area.



Plate 11: Kahikatea treeland over grazed kikuyu. 12 May 2021.



Plate 12: Remnant pūriri with epiphytic kōwharawhara. 12 May 2021.

#### 4.2.4 Vegetation type 4: Kahikatea treeland over exotic grasses (0.18 hectare)

This vegetation type consists of a sparse canopy of kahikatea trees over an area of grazed exotic grasses. Occasional scattered wī (*Juncus edgariae* and *J. sarophorus*) is found beneath the canopy (Plate 13). This vegetation type differs from the wetland kahikatea treeland (Vegetation type 14 below) as ground conditions are drier and fewer wetland plants are present in the ground tier.

#### 4.2.5 Vegetation type 5: Tōtara-kānuka-kahikatea treeland (1.27 hectares)

Tōtara-kānuka-kahikatea treeland occurs on the steep bank that separates the hill slopes from the lower plains to the west. This vegetation type is characterised by a mixed canopy of tōtara, kānuka, and kahikatea over mostly grazed exotic grassland, with occasional tī kōuka, kowhai, and kauri (Plate 14).



Plate 13: Kahikatea treeland over exotic grassland with occasional wī.  
12 May 2021.



Plate 14: Sparse canopy of tōtara, kānuka, and kahikatea on lower western slopes. 12 May 2021.

#### 4.2.6 Vegetation type 6: Kānuka scrub (0.39 hectare)

A small area of kānuka scrub occurs on a steep section of hillslope at the eastern edge of the property, bordering Kaipara Coast Highway. This area is heavily grazed with a sparse understorey and a canopy of regenerating māhoe and kānuka (Plate 15).

#### 4.2.7 Vegetation type 7: Blackberry-pōhuehue vineland (700 m<sup>2</sup>)

An area of blackberry (*Rubus fruticosus*)-pōhuehue (*Muehlenbeckia complexa*) vineland occurs at the centre of the kānuka scrub (Plate 15). Blackberry and pōhuehue form a dense thicket one to two metres high, with occasional to frequent, ponga and inkweed (*Phytolacca octandra*).

#### 4.2.8 Vegetation type 8: Gorse shrubland (0.49 hectare)

Several areas of gorse shrubland are present, mainly surrounding the homestead at the Northern end of the property (Plate 16). These areas consist of abundant gorse with frequent blackberry, pampas (*Cortaderia selloana*), and Chinese privet (*Ligustrum sinense*) and occasional indigenous species such as ponga, tī kōuka, māhoe, and pōhuehue.



Plate 15: Blackberry-pōhuehue vineland is found at the eastern edge of the property surrounded by kānuka scrub, occasional emergent ponga can be seen along the edges. 12 May 2021.



Plate 16: Gorse is prevalent towards the north of the property with locally frequent pampas (right). 12 May 2021.

#### 4.2.9 Vegetation type 9: Kikuyu grassland (85.31 hectares)

Kikuyu grassland is the most extensive vegetation type across the property (Plate 17). A range of exotic grassland and pasture species such as brown top (*Agrostis capillaris*), rye grass (*Lolium perenne*), *Paspalum dilatatum*, and Mercer grass (*Paspalum distichum*), lotus (*Lotus pedunculatus*), narrow-leaved plantain (*Plantago lanceolata*), and clover (*Trifolium repens*) occur occasionally. Scattered indigenous trees such as kānuka, tōtara, and kahikatea, and exotics such as crack willow (*Salix fragilis*) and Sydney golden wattle (*Acacia longifolia*) are also present in some areas.

This vegetation type also includes occasional indigenous rushes such as wī and soft rush (*Juncus effusus*), which become more abundant in damp areas. Damp areas that contain more abundant rushes, but are still dominated by (>50% cover of) kikuyu, do not meet the definition of ‘natural inland wetland’ provided in the National Policy Statement for Freshwater Management (NPS-FM), and as such have not been mapped separately.



Plate 17: Grazed kikuyu covers most of the property with occasional wī and scattered trees. 12 May 2021.

## 4.3 Natural inland wetlands

### 4.3.1 Overview

The vegetation types described in this section meet the definition of ‘wetland’ provided in the Resource Management Act 1991 (RMA) as they are “*permanently or intermittently wet areas that support a natural ecosystem of plants and animals that are adapted to wet conditions*”. They also meet the definition of ‘natural inland wetland’ in the NPS-FM as outlined in Table 1.

Areas of damp pasture have not been described under this section as they comprise more the 50% exotic pasture species (kikuyu) and therefore do not meet the criteria to be classified as ‘natural inland wetland’ (exclusion e of the NPS-FM definition).

Small stock ponds have been dug in some of these wetland areas. Where the pond is considered to occur within an area that would otherwise be part of a natural inland wetland they have been mapped as such. Wetland vegetation in and around ponds that are located in sites not likely to have contained wetland vegetation prior to the pond being created have been defined as ‘deliberately constructed wetlands’ (Vegetation type 22 below).

All natural inland wetland areas that are dominated by indigenous plant species meet the criteria to be classified as SEA (Factor 2d: Threat status and rarity). It is also noted that natural inland wetlands that are dominated by exotic plant species also provide important ecosystem services and are worthy of protection. This is made clear in the NPS-FM, which states that the loss of extent of all natural inland wetlands (regardless of vegetation composition) should be avoided, their values should be protected, and their restoration promoted.

Table 1: Assessment of natural inland wetland areas against wetland criteria provided in the NPS-FM.

Criteria	Status
Wetland (as per the RMA definition)	Yes
In the coastal marine area	No
Deliberately constructed	No
Developed in or around a deliberately constructed water body	No
A geothermal wetland	No
A wetland that:	
i) is within an area of pasture used for grazing, and	Some
ii) has vegetation comprising more than 50% exotic pasture species, unless	No (all dominated by sedges, rushes, or non-pasture grasses)
iii) is a location of a habitat of a threatened species	Some
<b>Resulting classification</b>	<b>Natural inland wetland</b>

#### 4.3.2 Vegetation type 10: Raupō reedland (0.15 hectare)

Two areas of raupō reedland are present at the property. This vegetation type consists of almost 100% cover of raupō, with other plants mostly confined to the wetland margins (Plate 18). Soft rush, Yorkshire fog (*Holcus lanatus*), and Mercer grass are common around the edges of the reedland vegetation. Small patches of rautahi (*Carex lesssoniana*) and giant umbrella sedge (*Cyperus ustulatus*) also occur in some places.

Both areas of raupō reedland occur in areas where water levels are likely to have been increased by the construction of a vehicle crossing. However, the presence of other wetland vegetation types immediately downstream of these crossings indicates that wetland vegetation is also likely to have been present in these locations before they were built.



Plate 18: Dense raupō with soft rush and Mercer grass and soft rush on margins. 12 May 2021.

#### 4.3.3 Vegetation type 11: *Machaerina articulata* sedgeland (0.12 hectare)

*Machaerina articulata* is abundant in vegetation type 11 (Plate 19). Mercer grass and narrow-leaved carpet grass (*Axonopus fissifolius*) are locally abundant in areas impacted by stock. Other indigenous wetland plant species such as spike sedge (*Eleocharis acuta*), *Machaerina rubiginosa*, *M. juncea*, and swamp kiokio (*Parablechnum minus*) form a mosaic around the edges of this vegetation type. This area is actively grazed and heavy pugging is evident in some areas (Plate 20).



Plate 19: Dense swathe of *Machaerina articulata* at the centre of vegetation type 11. 12 May 2021.



Plate 20: Swamp kikio amongst other wetland species within vegetation type 11. Pugging damage is visible in the foreground. 12 May 2021.

#### 4.3.4 Vegetation type 12: Wī rushland (2.74 hectares)

Wī rushland occurs in some areas of damp pasture (Plates 21 and 22). In addition to wī, other common species include Mercer grass, soft rush, Yorkshire fog, creeping buttercup (*Ranunculus repens*), lotus, and kikuyu. *Machaerina articulata* occurs occasionally. All areas show evidence of heavy stock grazing and pugging.

#### 4.3.5 Vegetation type 13: Wī–kikuyu rushland (0.93 hectares)

Wī-kikuyu rushland is similar in species composition to wī rushland, but contains a greater component of kikuyu and other common exotic grass species (Plate 23). *Machaerina articulata* and kahikatea occur occasionally and are most abundant in the wettest areas (Plate 24). This vegetation type is also actively grazed.



Plate 21: Dense wī in gully wetland. *Machaerina articulata* is visible in the foreground. 12 May 2021.



Plate 22: Grazed wī rushland on lowling flats on the western edge of the site.  
12 August 2021.



Plate 23: Wī-kikuyu rushland with evidence of grazing and pugging (left).  
12 May 2021.



Plate 24: Heavily pugged area of locally frequent *Machaerina articulata* with kikuyu and paspalum. Kahikatea trunks are visible in the back ground.  
12 May 2021.

#### 4.3.6 Vegetation type 14: Kahikatea treeland over wī (0.76 hectare)

One area of kahikatea treeland over wī rushland was recorded. This area consists of a sparse canopy of kahikatea trees interspersed with occasional kōwhai, tī kōuka, tōtara, and exotic crack willow. The groundcover is dominated by wī and soft rush, and kikuyu is common throughout (Plate 25). Occasional to frequent pūrei (*Carex virgata*), creeping buttercup, paspalum, and lotus were also recorded.

#### 4.3.7 Vegetation type 15: Kahikatea–kānuka treeland on wetland margin (0.30 hectare)

Vegetation type 15 shares a similar canopy composition to Vegetation Type 3, although this vegetation type occurs on the damp ground on wetland margins (Plate 26). Occasional tī kōuka and nīkau occur in the subcanopy, and soft rush is common to abundant in the understorey with frequent water pepper (*Persicaria hydropiper*).



Plate 25: Sparse kahikatea occur over a ground cover dominated by wī.  
12 May 2021.



Plate 26: Kahikatea and kānuka on damp ground adjacent to a wetland  
characterised by mānuka scrub wetland. 12 May 2021.

#### 4.3.8 Vegetation type 16: Mānuka scrub (0.18 hectare)

A small area of mānuka (*Leptospermum scoparium*) scrub forms a narrow gully wetland near the southern end of the property. Below the mānuka canopy, tī kōuka, and whēkī (*Dicksonia squarrosa*) form a sparse subcanopy. The understorey mostly consists of dense indigenous wetland plant species such as rautahi, *Machaerina articulata*, swamp kiokio, spike sedge, *Carex virgata*, and *Oplismenus hirtellus* (Plate 27). Localised patches of raupō and frequent pampas were recorded in canopy gaps and soft rush, creeping buttercup, and *Isolepis cernua* occur in heavily grazed/pugged areas.



Plate 27: Mānuka scrub with an understorey dominated by *Machaerina articulata* (centre) and rautahi (right). 12 May 2021.

#### 4.3.9 Vegetation type 17: Mercer grass-giant umbrella sedge grassland (454 m<sup>2</sup>)

Within vegetation type 18 heavily grazed Mercer grass forms a mosaic with locally common giant umbrella sedge and frequent soft rush (Plate 28). Other indigenous wetland plant species such as spike sedge and pūrei occur occasionally. A possum was seen in a kahikatea at the edge of this vegetation type.

#### 4.3.10 Vegetation type 18: Wī – spike sedge – *Machaerina rubiginosa* rushland (235 m<sup>2</sup>)

This vegetation type occurs on very wet ground featuring some areas of open water. It is characterised by a mixed swathe of wī, spike sedge, and *Machaerina rubiginosa* (Plate 29). Mercer grass is locally abundant on the margins. Occasional jointed rush, and lotus were also recorded.

#### 4.3.11 Vegetation type 19: Mercer grass-soft rush-raupō grassland (0.10 hectare)

This vegetation type occurs near the existing accessway in the northeastern corner of the property. The area has been heavily grazed and is dominated by Mercer grass with frequent soft rush and locally common raupō (Plate 30). Occasional water forget-me-not (*Myosotis laxa*) and watercress (*Nasturtium officinale*) were also recorded. Kikuyu is present in drier areas on the wetland margins.



Plate 28: Heavily grazed/pugged Mercer grass with locally common giant umbrella sedge and frequent soft rush. 12 May 2021.



Plate 29: Wet ground that supports a mosaic of spike sedge, wī, and *Machaerina rubiginosa*. 12 May 2021.



Plate 30: Locally common raupō (grazed) within wetland area otherwise dominated by Mercer grass. 12 May 2012.

#### 4.3.12 Vegetation type 20: Soft rush-wī-Mercer grass rushland (0.27 hectare)

Soft rush, wī, and Mercer grass form a mosaic in which any of these three species can be locally dominant (Plate 31). Creeping buttercup, Yorkshire fog, *Isolepis prolifera*, *I. cernua*, lotus, and spike sedge, are occasional to locally frequent. Kikuyu is common on the wetland margins. In a very wet section of gully near the northeast of the property this vegetation type also contains patches of *Machaerina rubiginosa* near a discarded trailer (Plate 32).



Plate 31: Soft rush-wī-Mercer grass rushland with high proportion of grazed Mercer grass. 12 May 2021.



Plate 32: Soft rush-wī-Mercer grass rushland with high proportion of soft rush. *Machaerina rubiginosa* is local abundant near the discarded trailer (top right). 12 May 2021.

#### 4.3.13 Vegetation type 21: Soft rush–kikuyu rushland (0.48 hectares)

Soft rush and kikuyu form a mosaic along a narrow band between the toeslope and a drain that marks the edge of the lower plains west of the property (Plate 33). Occasional to frequent wī is also present together with occasional small patches of raupō.



Plate 33: Soft rush-kikuyu rushland (right of drain) occurs on toeslopes, on edge of lower plains to the west of the property. 12 May 2021.

#### 4.4 Deliberately constructed wetlands

##### 4.4.1 Vegetation type 22: Mercer grass-soft rush grassland in and around pond (0.26 hectare)

Mercer grass and soft rush dominate the margins of ponds at the site. These areas are heavily grazed with extensive pugging (Plate 34). Other species present include locally frequent to occasional water pepper, spike sedge, wī, and starwort (*Callitriche stagnalis*). Ferny azolla occurs occasionally in areas of open water.



Plate 34: Mercer grass and soft rush in a pond at the southern end of the property. Occasional wī is also visible. 12 May 2021.

## 4.5 Aquatic habitats

### 4.5.1 Ephemeral streams

Most of the gullies at the site contain ephemeral streams in their upper headwaters, totalling c.1,101 metres of ephemeral stream length (Plate 35). Ephemeral streams did not contain flowing water at the time of the site survey on 13 August 2021. While some of these streams featured well-defined channels and/or no rooted terrestrial vegetation across the entire cross-sectional width, they did not meet any of the other criteria provided in the AUP definition of an ‘intermittent stream’ (Table 2). All of the ephemeral streams are accessible to stock and are heavily pugged.



Plate 35: Ephemeral streams in upper headwaters of gully. Kikuyu is growing across the entire cross-sectional width. 13 August 2021.

Table 2: Assessment of ephemeral streams against criteria provided in the AUP. Note: intermittent streams are those that meet at least three of the following criteria.

Criteria	Status
Natural pools	No
Well-defined channel, such that the bed and banks can be distinguished	In some places
Contains surface water more than 48 hours after a rain event	No
Rooted terrestrial vegetation is <i>not</i> established across the entire cross-sectional width	In some places
Organic debris resulting from flood can be seen on the floodplain	No
Evidence of substrate sorting process, including scour and deposition	No
<b>Resulting classifications</b>	<b>Ephemeral Streams</b>

#### 4.5.2 Intermittent and permanent streams

Intermittent and permanent streams flow along the middle and lower sections of the gullies at the site. All of these streams flow into the drainage network on the low-lying plains west of the site and are tributaries of the Makarau River.

These streams meet at least four of the criteria required to be classified as ‘intermittent’ streams (Table 3), although the exact boundary between intermittent and permanent reaches is difficult to determine. As both site surveys were carried out in winter (when the water table is high), it was not possible to determine if these streams flow continuously during the dry summer months. The boundary between permanent and

intermittent reaches has therefore been estimated based on water flows at the time of the surveys. Both permanent and intermittent streams are protected under the AUP and National Environmental Standards for Freshwater (NES-F).

On the western half of the property the permanent and intermittent reaches are typically 30 to 60 centimetres wide, and are heavily pugged. Despite the disruption caused by pugging, some evidence of substrate sorting can be seen where larger grained sediments have accumulated around larger boulders and cobbles. Occasional shallow muddy pools also occur (Plate 36)

Table 3: Assessment of intermittent streams against criteria provided in the AUP. Note: intermittent streams are those that meet at least three of the following criteria.

Criteria	Status
Natural pools	Yes
Well-defined channel, such that the bed and banks can be distinguished	Yes
Contains surface water more than 48 hours after a rain event	Yes (minimal rainfall in the 48 hours preceding the survey on 12 August 2021)
Rooted terrestrial vegetation is <i>not</i> established across the entire cross-sectional width	Yes
Organic debris resulting from flood can be seen on the floodplain	No
Evidence of substrate sorting process, including scour and deposition	Yes
<b>Resulting classifications</b>	<b>Intermittent/Permanent Streams</b>



Plate 36: Shallow muddy pool in section of intermittent stream heavily impacted by pugging. 12 May 2021.

A permanent stream flows into the property at the northeastern boundary via a pipe that extends under Kaipara Coast Highway. This stream flows only a short distance before it enters a small wetland area near the main entrance to the site (vegetation type 20). At the downstream end of this wetland water passes through a culvert under the main driveway, and the permanent stream continues north to the property boundary (Plate 39). Sections of flowing stream are typically 40 to 50 centimetres wide, muddy bottomed, and feature dense macrophyte growth. This section of stream is considered highly likely to contain flowing water during the entire year as the level of flow was greater than observed in the streams on the western half of the site.

There is a total of *c.*2,128 metres of intermittent and permanent streams at the site.



Plate 37: Permanent stream in northeast of the property, featuring dense growth of macrophytes including watercress, Mercer grass, and soft rush. 12 May 2021.

## 5. FLORA

Eighty-two species of indigenous plants and 55 naturalised plant species were recorded during the survey (Appendix 1). Most of the indigenous species on the property are not classified as nationally or regionally threatened (de Lange *et al.* 2018 and Stanley *et al.* 2005).

All indigenous Myrtaceae species have recently been reclassified as ‘At Risk’ or ‘Threatened’ as they are at risk of infection by myrtle rust (*Austropuccinia psidii*), a potentially devastating rust that has no known treatment (de Lange *et al.* 2018). However, Myrtaceae species at the site are still common and widespread throughout the Auckland region. As such, the threat classification of Myrtaceae species does not automatically qualify them to be considered species of conservation concern at this site.

Kauri is also classified as ‘Threatened – Nationally Vulnerable’ due to the risk posed by kauri dieback, a disease caused by the microscopic fungus-like organism *Phytophthora agathidicida*.

## 6. FAUNA

### 6.1 Birds

Nine indigenous bird species were recorded on the site. These were:

- Pīwakawaka (Fantail, *Rhipidura fuliginosa*).
- Pūkeko (*Porphyrio melanotus*).
- Kōtare (kingfisher, *Todiramphus sanctus*).
- Welcome swallow (*Hirundo neoxena neoxena*).
- Riroriro (Grey warbler, *Gerygone igata*).
- Kāhu (Australasian harrier, *Circus approximans*).
- Tūi (*Prothemadera novaeseelandiae*).
- Tauhou (Silvereye, *Zosterops lateralis*).
- Spur-winged plover (*Vanellus miles*).

Species such as kōtare, welcome swallow, and pūkeko were observed near wetland habitats, while species like pīwakawaka, tui, and riroriro were recorded in forest patches. One kāhu was seen flying over the site and spur-winged plover were recorded in open grassland. None of these species are classified as ‘Threatened’ or ‘At Risk’ (Robertson *et al.* 2021).

Small areas of raupō reedland and dense areas of rushes on the lower plains provide potential habitat for wetland birds including pūweto and matuku, which are classified as ‘At Risk – Declining’ and ‘Threatened – Nationally Critical’ respectively.

Six exotic species were recorded on the property. These were:

- Goldfinch (*Carduelis carduelis*).
- Blackbird (*Turdus medulla*).
- House sparrow (*Passer domesticus*).
- Chaffinch (*Fringilla coelebs*).
- Pheasant (*Phasianus colchicus*).
- Yellowhammer (*Emberiza citrinella*).

## 6.2 Aquatic fauna

Permanent and intermittent streams at the property are likely to support aquatic invertebrates, while permanent reaches may provide habitat for indigenous fish. The intermittent flows of upper reaches (intermittent and ephemeral streams) mean these sections of stream are not likely to support significant numbers of indigenous fish. Habitat values for indigenous fish in all streams at the site are also reduced by heavy pugging.

There are no records of indigenous fish on the property in the New Zealand Freshwater Fish Database (NIWA 2021). However, several records have been recorded from within the Makarau River catchment into which all streams and overland flow paths on the property drain. Records of freshwater fish species within the Makarau River catchment and its tributaries from the last 20 years are presented in Table 4. Five fish species have been recorded from the catchment, of which two are classified as ‘At Risk – Declining’ by Dunn *et al.* (2018).

Table 4: Aquatic fauna species recorded within the Makarau Stream catchment (NIWA 2021).

Species Name	Common Name	Threat Classification	Most recent record
<i>Anguilla australis</i>	Shortfin eel	Not Threatened	2003
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk - Declining	2001
<i>Galaxias maculatus</i>	Inanga	At Risk - Declining	2019
<i>Gobiomorphus basalis</i>	Crans bully	Not threatened	2001
<i>Gobiomorphus huttoni</i>	Redfin bully	Not threatened	2001
<i>Paranephrops</i>	Kōura	Not Threatened	2003

## 6.3 Long-tailed bats

Long-tailed bats occur in the Auckland Region and are classified as ‘Threatened-Nationally Critical’ (O’Donnell *et al.* 2018). They are known to favour forest edge and riparian habitats of both indigenous and exotic forest types, having adapted to roosting in exotic tree species such as pine (*Pinus* spp.) and macrocarpa (*Cupressus macrocarpa*). They also forage over farmland and urban areas (O’Donnell *et al.* 2013).

The Department of Conservation bat distribution database contains a record of long-tailed bat presence from 2014 that is located on the eastern boundary of the site.

There are also several other records in the wider area that are within the home range of long-tailed bats (19 kilometres, O'Donnell 2001). Confirmed records nearby, and the presence of diverse mature forest vegetation, indicate that long-tailed bats are likely to occur at the site. Some of the larger trees feature cavities, large epiphytic *Astelia* species, and peeling bark, all of which provide potential roosting habitat for long-tailed bats.

#### 6.4 Herpetofauna

No lizards were observed during the survey, although suitable habitat for several indigenous lizard species occurs at the property. The canopy and sub-canopy trees at the site provide potential habitat for indigenous arboreal gecko species such as forest gecko and elegant gecko.

Ground-dwelling species such as copper skink and ornate skink often occur on bush margins and in forest/scrub habitats. Both these species may use ground cover vegetation, leaf litter, and woody debris on the property.

Ornate skink, copper skink, forest gecko, and elegant gecko are classified as 'At Risk - Declining' under the New Zealand threat classification for reptiles (Hitchmough *et al.* 2021).

All indigenous lizards are protected under the Wildlife Act (1953).

#### 6.5 Introduced pest mammals

Pest animals recorded at the site include possums and feral cats (*Felis catus*) (Plate 38). Other pest animals likely to be present include rats (*Rattus rattus* and *R. norvegicus*), mice (*Mus musculus*), hedgehogs (*Erinaceus europaeus*), and mustelids (stoats, *Mustela erminea*; ferrets, *M. furo*; and weasels, *M. nivalis vulgaris*).



Plate 38: Feral kitten found near the old quarry. 12 May 2021.

## 7. ASSESSMENT OF ECOLOGICAL VALUES

### 7.1 Terrestrial and wetland vegetation and habitat values

The site contains mature forest vegetation that is contiguous with the forest in the adjacent Pareparea Burial Reserve. This vegetation is classified as a SEA in the AUP and is of very high ecological value.

Several gullies within the site also contain forest, treeland, and scrub fragments that meet the criteria to be classified as SEA, although they have not been identified as such in the AUP. Indigenous forest extent has been substantially reduced throughout the Kaipara Ecological District and remaining fragments provide an important network of local habitats for indigenous fauna and flora. These fragments also act as ‘stepping stones’ for mobile avifauna moving between larger areas of indigenous vegetation within the wider landscape. The indigenous forest fragments support a range of common bird species and contain good potential habitat for indigenous reptiles. While the canopy in these areas features a diverse range of mature secondary successional species, understorey vegetation is largely absent due to grazing by cattle. Although pest plant species are present, their densities are low to moderate and they are currently having only a limited impact. Overall, the smaller forest fragments at the site are of high ecological value.

Natural inland wetlands at the site generally contain a mix of indigenous and exotic species and are impacted by grazing. Areas that are dominated by indigenous species (i.e., Vegetation Types 10, 11, 12, 13, 14, 15, 16, and 18) all qualify as SEA on the basis that they are “*indigenous vegetation or habitat of indigenous fauna that occurs within an indigenous wetland*” (Factor 2d: Threat status and rarity).

Natural inland wetlands that are dominated by exotic species are also worthy of protection as they provide important ecological services such as nutrient uptake, flood attenuation, and sediment filtering. However, at this site the ability of wetlands to provide such services is reduced by heavy pugging and grazing.

The ecological values of the vegetation and habitat types mapped are described in more detail below. These assessments are based on the key ecological attributes identified in the EIANZ guidelines (Roper-Lindsay *et al.* 2018) and are further informed by professional opinion and expertise.

The ecological values of the terrestrial and wetland habitats mapped at the site are described in more detail in Table 5 below.

Table 5: Ecological value assessment for affected vegetation and habitat types (as per the Roper-Lindsay *et al.* 2018).

Vegetation/Habitat Type	Attributes to be considered	Assigned Value
Vegetation Type 1a (Kānuka forest contiguous with Pareparea Burial Reserve)	Representativeness – <i>Representative of mature forest types in the Auckland Region.</i>	High
	Rarity/distinctiveness – <i>Long-tailed bats (Threatened – Nationally Critical) and indigenous lizards (At Risk – Declining) likely to be present.</i>	Very High
	Diversity & Pattern – <i>High diversity of indigenous canopy and understorey species. Likely high diversity of indigenous fauna.</i>	High
	Ecological Context – <i>Large forest area that forms part of a much larger forest remnant that extends in to the adjacent reserve.</i>	High
	<b>Overall Ecological Value</b>	<b>High-Very High</b>
Vegetation Types 1b-g and 2a-c (Kānuka and kahikatea forest fragments)	Representativeness – <i>Representative canopy species. Lacks intact understorey due to heavy grazing.</i>	Moderate
	Rarity/distinctiveness – <i>Long-tailed bats (Threatened – Nationally Critical) and indigenous lizards (At Risk – Declining) likely to be present.</i>	Very High
	Diversity & Pattern – <i>Diverse range of canopy species. Lower plant diversity in understorey due to heavy grazing.</i>	Moderate
	Ecological Context – <i>Forest fragments that contribute to a network of available habitats in the wider landscape. Provide stepping-stones for highly mobile species</i>	High
	<b>Overall Ecological Value</b>	<b>High</b>
Vegetation Types 3, 4, and 5 (Indigenous treeland over exotic grassland)	Representativeness – <i>Not representative of an indigenous ecosystem type.</i>	Low
	Rarity/distinctiveness – <i>Long-tailed bats (Threatened – Nationally Critical) and indigenous lizards (At Risk – Declining) likely to be present.</i>	Very High
	Diversity & Pattern – <i>Generally low plant diversity, although some remnant trees with epiphytes are still present.</i>	Moderate
	Ecological Context – <i>Mature trees contribute to a network of available habitats in the wider landscape. Provide stepping-stones for highly mobile species.</i>	Moderate
	<b>Overall Ecological Value</b>	<b>Moderate</b>
Vegetation Type 6 (Kānuka scrub)	Representativeness – <i>Canopy representative of early successional forest but understorey highly modified.</i>	Low-Moderate
	Rarity/distinctiveness – <i>May provide habitat for indigenous geckos (At Risk – Declining).</i>	High
	Diversity & Pattern – <i>Generally low plant diversity.</i>	Low
	Ecological Context – <i>Contributes to a network of available habitats in the wider landscape. Provides stepping-stone for highly mobile species</i>	Moderate
	<b>Overall Ecological Value</b>	<b>Moderate</b>

Vegetation/Habitat Type	Attributes to be considered	Assigned Value
Vegetation Type 7 (Blackberry-pōhuehue vineland)	Representativeness – <i>Not a representative of an indigenous ecosystem type.</i>	Low
	Rarity/distinctiveness – <i>May provide habitat for indigenous skinks (some At Risk – Declining).</i>	High
	Diversity & Pattern – <i>Generally low plant diversity. Abundant pest plants.</i>	Low
	Ecological Context – <i>Dominated by common pest plant species in local area.</i>	Low
	<b>Overall Ecological Value</b>	<b>Low-Moderate</b>
Vegetation Type 8 (Gorse shrubland)	Representativeness – <i>Not a representative of an indigenous ecosystem type. Dominated by pest plant species.</i>	Negligible
	Rarity/distinctiveness – <i>May provide habitat for indigenous lizards (Some At Risk – Declining).</i>	Moderate
	Diversity & Pattern – <i>Generally low plant diversity. Abundant pest plants.</i>	Negligible
	Ecological Context – <i>Dominated by common pest plant species in local area.</i>	Low
	<b>Overall Ecological Value</b>	<b>Low</b>
Vegetation Type 9 (Kikuyu grassland)	Representativeness – <i>Not a representative of an indigenous ecosystem type. Dominated by exotic species.</i>	Negligible
	Rarity/distinctiveness – <i>Heavily grazed, providing limited habitat values to indigenous fauna.</i>	Negligible
	Diversity & Pattern – <i>Very low plant diversity. Abundant pest plants.</i>	Negligible
	Ecological Context – <i>Does not contribute to the broader ecological networks.</i>	Negligible
	<b>Overall Ecological Value</b>	<b>Negligible</b>
Vegetation Type 10 (Raupō reedland)	Representativeness – <i>Representative of an indigenous ecosystem type (WL19).</i>	High
	Rarity/distinctiveness – <i>Raupō reedland ecosystems classified as Endangered by IUCN (Singers et al. 2017). May provide habitat for wetland bird species such as spotless crane and Australasian bittern (At Risk and Threatened respectively).</i>	Very High
	Diversity & Pattern – <i>Moderate diversity of indigenous species.</i>	Moderate
	Ecological Context – <i>Very small patches, but contribute to a network of available wetland habitats in the wider landscape.</i>	Moderate
	<b>Overall Ecological Value</b>	<b>High</b>
	Vegetation Type 11 ( <i>Machaerina articulata</i> sedgeland)	Representativeness – <i>Impacted by grazing but generally representative of an indigenous ecosystem type (WL11).</i>
Rarity/distinctiveness – <i>Machaerina sedgeland ecosystems classified as Critically Endangered by IUCN (Singer et al. 2017).</i>		Very High
Diversity & Pattern – <i>Moderate diversity of indigenous species.</i>		High
Ecological Context – <i>Small patch but contributes to a network of available wetland habitats in the wider landscape.</i>		Moderate
<b>Overall Ecological Value</b>		<b>High</b>

Vegetation/Habitat Type	Attributes to be considered	Assigned Value
Vegetation Types 12, 13 and 18 (Natural wetlands dominated by indigenous sedge and rush species)	Representativeness – <i>Dominated by indigenous species, but contain high proportion of exotic species. Substantially affected by grazing and pugging.</i>	Moderate
	Rarity/distinctiveness – <i>Wetlands are a highly threatened ecosystem type, with less than 10% of their original extent remaining in New Zealand. Given the limited amount of wetland habitat remaining, even small fragmented and degraded areas should be considered valuable, as this is all that remains in most areas.</i>	Moderate
	Diversity & Pattern – <i>Low diversity of indigenous plants, significantly impacted by pugging.</i>	Low
	Ecological Context – <i>Contribute to a network of available wetland habitats in the wider landscape. Wetland habitats also provide important services for local aquatic habitats, including:</i> <ul style="list-style-type: none"> <li>• <i>flood flow attenuation</i></li> <li>• <i>groundwater replenishment</i></li> <li>• <i>sediment and nutrient retention</i></li> </ul>	Moderate
	<b>Overall Ecological Value</b>	<b>Moderate</b>
Vegetation Types 14 and 15 (Kahikatea treeland over wī rushland and kahikatea-kānuka treeland on wetland margins)	Representativeness – <i>Representative of early successional kahikatea forest (MF4). Still contains substantial component of exotic species in ground tier.</i>	Moderate
	Rarity/distinctiveness – <i>Successional trajectory toward kahikatea forest ecosystem, classified as Critically Endangered by IUCN (Singer et al. 2017).</i>	Moderate
	Diversity & Pattern – <i>Moderate diversity of indigenous plants, significantly impacted grazing by pugging.</i>	Moderate
	Ecological Context – <i>Contribute to a network of available wetland habitats in the wider landscape. If stock excluded, will mature into very high value ecosystem.</i>	Very High
	<b>Overall Ecological Value</b>	<b>High</b>
Vegetation Type 16 (Mānuka scrub)	Representativeness – <i>Dominated by indigenous plant species.</i>	High
	Rarity/distinctiveness – <i>May provide habitat for indigenous lizards and birds (some Threatened or At Risk).</i>	Very High
	Diversity & Pattern – <i>High diversity of indigenous plants, partially impacted grazing by grazing and pugging.</i>	Moderate-High
	Ecological Context – <i>Contribute to a network of available indigenous wetland habitats in the wider landscape.</i>	High
	<b>Overall Ecological Value</b>	<b>High</b>

Vegetation/Habitat Type	Attributes to be considered	Assigned Value
Vegetation Types 17, 19, 20, 22 (Natural wetland habitats dominated by exotic plant species)	Representativeness – <i>Not representative of indigenous ecosystem types, although some indigenous species present</i>	Negligible
	Rarity/distinctiveness – <i>Wetlands are a highly threatened ecosystem type, with less than 10% of their original extent remaining in New Zealand. Given the limited amount of wetland habitat remaining, even small fragmented and degraded areas should be considered valuable, as this is all that remains in most areas. .</i>	Moderate
	Diversity & Pattern – <i>Low diversity of indigenous plants, significantly impacted by pugging.</i>	Low
	Ecological Context – <i>Contribute to a network of available wetland habitats in the wider landscape. Wetland habitats also provide important services for local aquatic habitats, including:</i> <ul style="list-style-type: none"> <li>• <i>flood flow attenuation</i></li> <li>• <i>groundwater replenishment</i></li> <li>• <i>sediment and nutrient retention</i></li> </ul>	Moderate
	<b>Overall Ecological Value</b>	<b>Low-Moderate</b>
Vegetation Type 22 (Deliberately constructed Wetland)	Representativeness – <i>Not representative of indigenous ecosystem types, although some indigenous species present.</i>	Low
	Rarity/distinctiveness – <i>Does not provide habitat for rare or threatened indigenous species.</i>	Low
	Diversity & Pattern – <i>Low diversity of indigenous plants, significantly impacted by pugging.</i>	Low
	Ecological Context – <i>Not part of natural the hydrology of the site. Common exotic vegetation type on farms in the local area.</i>	Low
	<b>Overall Ecological Value</b>	<b>Low</b>

## 7.2 Freshwater stream habitat values

Watercourses at the site are heavily impacted by grazing and pugging. This reduces habitat values for indigenous fauna by disrupting the natural bed and bank structures, and reduces water quality through increased sediment and effluent discharges. Although they are not permanently flowing, ephemeral and intermittent streams provide important drainage, rainfall interception, and filtration, and can be a significant contributor of sediment to downstream environments when disturbed.

Intermittent and ephemeral streams are unlikely to support large numbers indigenous fish but may support some aquatic invertebrates during periods of high flow. The cumulative effect of grazing and pugging on these headwater streams can have an important influence on catchment hydrology and water quality, and may therefore influence the overall ecological value of the receiving environments. Maintaining the natural functioning of these headwater watercourses, including ephemeral reaches, will play an important part in helping to protect downstream receiving aquatic habitats within the Makarau River and Kaipara Harbour.

In areas where the riparian margins are vegetated, the vegetation is predominately mature indigenous forest that provides a high level of shade. Although the habitat values of permanent stream reaches are reduced by pugging, these streams are still likely to support some indigenous fish species, including some that may be classified as ‘At Risk – Declining’ (e.g., longfin eel). The ecological values of the streams mapped at the site are described in more detail in Table 6 below.

Table 6: Ecological value assessment for streams at the site (as per the Roper-Lindsay *et al.* 2018).

<b>Vegetation/Habitat Type</b>	<b>Attributes to be considered</b>	<b>Assigned Value</b>
Ephemeral Streams	Representativeness – <i>Catchment is highly modified due to agricultural land use. Ephemeral stream predominately in upper catchment where there is no canopy cover.</i>	Low
	Rarity/distinctiveness – <i>Do not support rare or threatened plant or animal species.</i>	Low
	Diversity & Pattern – <i>Habitat heterogeneity, complexity and patterns disrupted by pugging.</i>	Low
	Ecological Context – <i>Ephemeral streams with very little in stream or riparian habitats. Heavily pugged, reducing water quality to downstream reaches.</i>	Low
	<b>Overall Ecological Value</b>	<b>Low</b>
Intermittent Streams	Representativeness – <i>Catchment is highly modified due to agricultural land use. Some reaches shaded by indigenous forest canopy.</i>	Low
	Rarity/distinctiveness – <i>Habitat values for indigenous fish limited by intermittent nature of these streams and by heavy pugging. May provide low quality habitat for At Risk fish species during periods of flow.</i>	Moderate
	Diversity & Pattern – <i>Habitat heterogeneity, complexity and patterns disrupted by pugging.</i>	Low
	Ecological Context – <i>Instream habitats disrupted by pugging. Some reaches well shaded by indigenous canopy.</i>	Moderate
	<b>Overall Ecological Value</b>	<b>Moderate</b>
Permanent Streams	Representativeness – <i>Catchment is highly modified due to agricultural land use.</i>	Low
	Rarity/distinctiveness – <i>May provide habitat for indigenous fish species classified as At Risk – Declining (e.g., longfin eel, īnanga). Habitat values reduced by heavy pugging</i>	Moderate
	Diversity & Pattern – <i>Habitat heterogeneity, complexity and patterns disrupted by pugging.</i>	Low
	Ecological Context – <i>Instream habitats disrupted by pugging. Some reaches well shaded by indigenous canopy.</i>	Moderate
	<b>Overall Ecological Value</b>	<b>Moderate</b>

### 7.3 Indigenous fauna values

Table 7 provides a summary of the ecological value of indigenous fauna species that are present, or potentially present, at the site.

Table 7: Ecological value of indigenous fauna species in the local area.

Species	Determining Factors	Assigned Value	Presence
Long-tailed bat	Threatened – Nationally Critical	Very High	Likely
Common indigenous birds: <ul style="list-style-type: none"> <li>• Pīwakawaka</li> <li>• Pūkeko</li> <li>• Kōtare</li> <li>• Welcome swallow</li> <li>• Riroriro</li> <li>• Kāhu</li> <li>• Tūī</li> <li>• Tauhou</li> <li>• Spur winged plover</li> </ul>	Not Threatened. Nationally and locally common indigenous species.	Low	Confirmed present
At Risk or Threatened indigenous wetland birds: <ul style="list-style-type: none"> <li>• Pūweto</li> <li>• Matuku</li> </ul>	At Risk – Declining and Threatened - Nationally Critical.	High-Very High	Possible
Indigenous lizards: <ul style="list-style-type: none"> <li>• Forest gecko</li> <li>• Elegant gecko</li> <li>• Copper skink</li> <li>• Ornate skink</li> </ul>	At Risk – Declining Hitchmough <i>et al.</i> 2021).	High	Likely
Indigenous fish	Not Threatened and At Risk – Declining.	Low-High	Likely

## 8. POTENTIAL ADVERSE ECOLOGICAL EFFECTS AND PROPOSED ACTIONS TO AVOID, REMEDY, OR MITIGATE THESE EFFECTS

### 8.1 Overview

The proposed subdivision will result in the addition of 25 new dwellings at the site. The lots have been placed to avoid the need for the construction of these dwellings to require the clearance of indigenous vegetation, and all are located outside of areas classified as ‘natural wetland’ as defined in the NPS-FM. However, the addition of these dwellings and the resulting human activity have the potential to result in adverse ecological effects.

The construction of the accessways on the site will also require some earthworks and the extension, installation, and/or upgrade of some culverts.

Potential adverse effects of the proposed development can be summarised as:

- Loss of permanent and intermittent stream habitat.
- Harm to indigenous fish.
- Increased predation pressure and disturbance by pets.
- Lighting disturbance to indigenous bats.
- Encroachment into riparian margins and wetland buffers
- Sediment runoff from earthworks near streams and wetlands.
- Increased impervious surfaces.
- Discharge of wastewater within 100 metres of a natural wetland.
- Bird mortality or injury from window strike.
- Proliferation of pest plant species from residential gardens.
- Accidental spread of kauri dieback.

Each of these effects is described in detail below. The magnitude of each effect has been defined as outlined in the EIANZ guidelines. A summary table (Table 8) is provided at the end of this section to illustrate the time frame, magnitude, value of the affected ecological feature, proposed mitigation action, and the overall level of each of these effects.

## 8.2 Loss of permanent and intermittent stream habitat

The open sections of permanent and intermittent stream proposed to be enclosed within culverts for the construction of the accessways include:

- c.15 metres of permanent stream under the new entrance to the site (Culvert 1).
- c.6.5 metres of intermittent stream immediately downstream of the old quarry (Culvert 3).
- c.6.0 metres of permanent stream under the access way between lots 20 and 22 (Culvert 4).
- c.12 metres of intermittent stream under the access way between lots 17 and 18 (Culvert 5).

This represents a loss of around 1.86% of intermittent and permanent stream habitat at the site. While the loss of these stream reaches could result in the loss of any fauna present in the streams at the time of the works, the reduction in the overall extent of instream habitat at the site will be very low.

All of the new or upgraded culverts will be less than 30 metres long, and as such their installation is a permitted activity under the AUP. The proposed works will not result in fish barriers, as all new culverts will comply with the fish passage requirements outlined in Regulation 70 of the NES-F.

Overall, the loss of these sections of stream will represent a minor alteration to the stream system at the site. The magnitude of this effect in the absence of compensation actions would be considered ‘low’.

The proposal includes fencing and restoring almost all<sup>1</sup> of the 20-metre-wide riparian margin around all of the remaining permanent and intermittent streams at the site, as shown in the management and maintenance programme prepared by Kaipara Coast Landscape Architecture. While four short sections of intermittent or permanent stream are proposed to be lost through the installation of culverts, the proposal as a whole will result in a net benefit to stream habitats and water quality across the entire site. The ratio of stream length lost to stream length restored will be approximately 1:50.

### 8.3 Harm to indigenous fish

Indigenous fish may be present in the affected stream reaches at the time of works, although it is noted that the instream habitat value of the affected section of intermittent stream is very low due to damage caused by pugging (Plate 39). Given the limited habitat value of the intermittent stream, and relatively small proportion of stream habitats affected at the site, the proposed work (in the absence of fish management) would likely have only a minor adverse effect on the wider indigenous fish community. The magnitude of this effect would therefore be ‘low’.

Under the Freshwater Fisheries Regulations 1983 it is an offence to intentionally kill or destroy indigenous fish, unless they are taken for the purpose of scientific research or for human consumption. As such, regardless of the level of the effect associated with potential harm to indigenous fish described above, a Fish Management Plan (FMP) will be prepared, approved by Auckland Council, and implemented before any stream reclamation works take place. The FMP will detail methods for capturing indigenous fish species and identify a suitable release site beyond the extent of works. It will also detail methods of capture and euthanasia for pest fish species (if present) to ensure that they are not inadvertently introduced to neighbouring watercourses or catchments.

By preparing and implementing a robust FMP the level of adverse effect on indigenous fish will be ‘negligible’.

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<sup>1</sup> The small amount of encroachment into the 20-metre-wide riparian margin is discussed in more detail in section 8.6 below.



Plate 39: Heavy pugging in intermittent stream proposed to be enclosed within a culvert below the old quarry. Pugging has created a thick layer of very wet mud with no habitat value for indigenous fish. Red circle indicates approximate location of existing culvert discharge point. 12 August 2021.

#### 8.4 Increase predation pressure and disturbance by pets

The introduction of 25 households and their associated pets into the area has the potential to increase predation pressure on indigenous fauna. Regardless of how well fed they are, cats are known to be highly destructive to indigenous wildlife through direct predation and the spread of diseases such as toxoplasma (Van Heezik 2019). The introduction of several new cats into an area that already supports a feral population would exacerbate predation pressure on indigenous fauna species. Dogs can also harm indigenous fauna species through direct predation or disturbance (chasing and barking).

Given the high predation pressures already present at the site, the cumulative effect of the addition of more cats and dogs is likely to exacerbate this further and could cause some indigenous species to become locally extinct. The potential magnitude of the effect of pets in the absence of appropriate controls would therefore be considered 'moderate-high'.

Under the current proposal control of pest animals (including rats, possums, mustelids, and feral cats) will occur throughout the restoration areas at the site. This will substantially increase the value of these areas as habitat for indigenous fauna, and will reduce browsing and seed predation on indigenous plants.

Strict rules are also proposed to control pet ownership at the site, including enforcement of a 'cat free' covenant and a requirement to keep dogs on leashes when not within their

own property. The requirement to keep dogs on leashes will also be important to prevent harm and stress to livestock, as most of the site will still function as a working farm.

The actions above will provide a net ecological benefit to the site by decreasing predation pressure on indigenous fauna.

## 8.5 Lighting disturbance to bats

There is a growing body of evidence that long-tailed bats exhibit light avoidance, whereby areas subject to artificial light are less frequented by bats, and may act as partial barriers to movement (Waka Kotahi 2017). Artificial lighting at the site, if not designed appropriately, could have an adverse effect on habitat use by long-tailed bats. Given the large number of dwellings proposed in close proximity to forest fragments, and the long access roads, inappropriate lighting design could result in a 'high' magnitude of effect on long-tailed bats.

The Amberfield subdivision in Hamilton proposes to put a large number of dwellings in a rural area that is known to provide high-quality habitat for long-tailed bats. The recent interim Environment Court Decision for the Amberfield subdivision states that an acceptable upper light limit for bats is 0.3 lux and that light levels should be less than 0.1 lux to protect high quality bat habitat. The decision now requires that light spill should be attenuated to 0.1 lux within three metres of the boundary of the Bat Protection Area. Lights in public areas are to have a temperature of 2,700 Kelvins and those in residential areas are to have a temperature of 3,000 Kelvins.

As the proposed development site is not currently subject to light pollution, and as long-tailed bats have been recorded on the property boundary, the same light controls have been applied to this development. At this site the 'Bat Protection Area' includes all areas of established indigenous forest.

Other actions to prevent light spill resulting from the proposal include:

- Not installing street lights along access roads.
- Installing blackout curtains on windows in close proximity to the Bat Protection Area.
- All external light fittings are to be directed away from indigenous forest vegetation and be fitted with bulbs that have minimal light spill.
- All external light fittings will be triggered by movement sensors to minimise the duration of potential light impact.
- Light fittings and bulbs used should be selected according to recommendations from international literature and consultation with the Bat Recovery Group and the Department of Conservation.

Given the actions being taken to reduce lighting effects on long-tailed bats, the overall level of this effect is likely to be 'low'.

## 8.6 Encroachment into wetland buffers and stream margins

The proposal requires a small amount of encroachment within 20 metres of wetlands and intermittent and permanent streams at the site (Appendix 3). The development has been designed to minimise this encroachment wherever possible, while still achieving the required protection of landscape values, and extensive efforts have been made to further minimise encroachment of earthworks within 10 metres of wetlands and streams.

Zone	Area of Encroachment	Total Area	% Encroachment	Activity Status
0-20 metre stream margin	1,810	87,787	2.06%	Vegetation removal Restricted Discretionary (AUP)
0-10 metre wetland buffer	1,629	70,573	2.31%	Vegetation removal and earthworks Non-Complying (NES-F)
10-20 metre wetland buffer	5,278	81,070	6.51%	Vegetation removal Restricted Discretionary (AUP)

Affected vegetation in the stream margin and wetland buffer areas comprises exotic grassland of negligible ecological value. The magnitude of the effect of the loss of this vegetation is low, and the potential effect on the streams and wetlands themselves is also likely to be low provided best practice sediment and erosion controls are in place (See section 8.7 for further discussion of the effects of sedimentation).

To compensate for the encroachment into the stream margins and wetland buffers, all remaining areas within 20 metres of intermittent or permanent streams, and within 10 metres of natural inland wetlands, will be protected and restored through indigenous planting. The wetlands themselves will be monitored following the exclusion of stock and enhancement planting will be carried out if natural regeneration is not apparent within three years. This will provide a net ecological benefit to these freshwater habitats. Currently, grazing and pugging are having a substantial detrimental effect, impacting on indigenous plants, disrupting delicate soils, and causing sedimentation in downstream habitats

Restoring the natural wetlands and most (97.69%) of their 10-metre-wide buffers will also increase their resilience and ability to provide ecological services such as water storage and transpiration, and nutrient uptake, as well as provide improved habitat for wetland bird species. Overall, the protection and enhancement of wetlands, the 10-metre-wide wetland buffers, and the 20-metre-wide stream margins will result in an improvement to the ecological values and water quality at the site.

## 8.7 Sediment runoff from earthworks near streams and wetlands

Watercourses on the property flow into the drainage network on the low-lying flats west of the site, which feeds into the Makarau River and Kaipara Harbour. Carrying out earthworks at the site has the potential to result in sediment discharges into stream and wetland environments.

The site contains yellow ultic soils with clayey subsoils. Clay particles are easily mobilised during rain events and their small size also means that they tend to remain suspended in the stream environment and are often deposited in estuarine receiving environments. In the absence of appropriate sediment and erosion control, the potential magnitude of the effect of sediment discharges from earthworks would be 'high'.

The potential impacts of sediment discharges from earthworks will be minimised by ensuring that the design and implementation of the works complies with industry best practice. An Erosion and Sediment Control Plan (ESCP) will be submitted for approval by Auckland Council before earthworks take place and will be consistent with the recommendations outlined in GD2016/005 – Erosion and Sediment Control Guide for Land Disturbing activities in the Auckland Region. All erosion control structures will be checked and maintained regularly (particularly before heavy rain is forecast) to ensure that they are always in working order.

By ensuring that best practice sediment and erosion control is implemented the overall level of this effect will be 'low'.

## 8.8 Increased impervious surfaces

The proposed development will increase the area of impermeable surfaces at the property. Surface run-off from impermeable ground can greatly increase the amount and rate of stormwater flow. After heavy rainfall events, large amounts of fast-moving water can flow into gullies and streams, creating a scouring effect that is harmful to aquatic fauna and can result in streambank erosion and sedimentation. Roofs, roads, and driveways are the main contributors to surface run-off.

In the context of the wider catchment, the effect of increased stormwater run-off from the new impervious surfaces at the site will result in only a minor shift away from existing baseline conditions. As such, the potential magnitude of this effect is 'low'.

A range of low impact design features are also proposed to reduce the effects of high flows and contaminated run off from impervious surfaces. Specific features that will be used at the site include:

- Stormwater tanks to capture roof water for domestic use and to provide for the temporary storage and controlled release of roof runoff.
- Swale or bio-retention devices to control driveway runoff.
- Discharge of captured stormwater at appropriate locations, incorporating energy dissipation and flow dispersion structures.

The proposed roads at the site will service fewer than 5000 vehicles per day and are therefore not classified as high use roads. As such, water quality treatment of water from the roads is not considered necessary and is not a requirement under AUP E9.

## 8.9 Wetland catchment alteration

There is the potential for the development to alter the flow of water through the site and into wetland habitats. If this was to occur, the development could result in changes to the hydrological functioning of the wetlands. The magnitude of this effect would depend on the extent of change to the contours of the site, but has the potential to be moderate-high.

To address this, the stormwater network at the site has been designed to ensure that the catchment flow and volume of each wetland area remain as close to pre-development levels as practicable to prevent significant effect on wetland hydrology.

## 8.10 Discharge of wastewater to land

The proposed development is not serviced by reticulated sewerage. As such, onsite treatment of wastewater is required. The locations of proposed wastewater dispersal fields for the dwellings are shown in the management and maintenance programme prepared by Kaipara Coast Landscape Architecture. As the wastewater will be dispersed to land, these discharges do not require consent under the NES-F.

If the wastewater systems are not appropriately designed or maintained, the resulting discharges have the potential to increase water and nutrient levels within wetland environments that occur down slope. However, any elevated nutrient inputs from wastewater discharge at this site will be partially counter-balanced by the permanent exclusion of stock from the wetland and wetland buffer areas, and reduced effluent runoff from areas that are currently grazed and will be transitioned to residential use. The current stock effluent discharges at the site mean that the wetlands are already subject to high nutrient loads. Overall, any nutrient discharges from the proposed wastewater dispersal fields are likely to result in only a minor shift away from the baseline conditions and the magnitude of this effect would therefore be considered 'low'.

All wastewater systems will be designed to comply with TP58 and the rate of discharge will be sufficiently low to ensure water is able to soak into the ground at the discharge site, rather than flowing overland and discharging to nearby streams and wetlands. An appropriate setback has been provided between the stream and wetland habitats and the proposed wastewater dispersal fields (KGA Geotechnical 2021).

The fencing and restoration of wetlands will also ensure that wetland habitat in the area is able to cope with potential increased water inputs. By removing stock and allowing indigenous sedges and rushes to establish, the capacity of these wetlands to regulate water flows and absorb nutrients will be increased. The net level of this effect from the proposal is therefore considered 'low' to 'negligible'.

## 8.11 Bird mortality or injury from window strike

Glass windows are a hazard to birds that inadvertently fly into them. While window strike on a single dwelling is a relatively rare event, at a global level such incidents are through to kill between 100 million to one billion birds per year (Klem 2014). Fatal strikes can occur wherever birds and windows coexist and the risk is heightened when large areas of glass are included as an architectural feature of a structure or when the structure is located in valuable bird habitats such as forests (Klem 2014). There has been little research carried out regarding the cumulative effects of bird strike in New Zealand. However, research from the United States indicates that building collisions are second only to predation by feral and domestic cats as the most significant human induced threat to birds (Loss *et al.* 2014).

Birds can die instantly when flying into windows or sustain multiple soft tissue injuries and fractures to bones around the chest area. Other types of injuries include crop rupture and bleeding around the heart. Although no studies to date have been undertaken on bird window strike in New Zealand, there is anecdotal evidence to suggest that species such as kererū, kākā (*Nestor meridionalis*), and ruru (*Ninox novaeseelandiae*) are vulnerable to window strike. Migratory species such as shining cuckoo (*Chrysococcyx lucidus lucidus*) have also been killed by window strike (N. Goldwater, pers. obs.).

Within the project area, there is the potential for birds travelling through the forest fragments to collide with windows, particularly if the dwellings occur in existing flight paths. As the development will result in the construction of several dwellings in close proximity to forest fragments where birds are not habituated to the presence of such structures, bird strike deaths are likely to occur. However, as the forest species likely to be affected are relatively common in the local area, the potential magnitude of this effect on the wider population is 'low'.

There are options that can be implemented to further reduce the likelihood of birds striking windows, and for minimising injury to birds involved in collisions. For rural residences, mitigation techniques could include reducing vegetation near windows, applying closely spaced UV light-reflecting decals to windows (e.g., WindowAlert™), or installing UV light-reflecting glass (Klem *et al.* 2004). Note that UV light is not visible to humans so these features will not exacerbate the visual effects of the proposal.

In addition, structural design controls could also be considered, including avoiding large expanses of glass or not placing windows directly opposite one another to create the illusion of a throughfare.

## 8.12 Proliferation of pest plant species from residential gardens

Residential gardens are a common source of pest plants. The seeds and propagules from exotic species planted in gardens can spread to nearby indigenous habitats through the dumping of garden waste, and through bird and wind dispersal.

Pest plants are not currently a major issue in most indigenous forest habitats at the site. However, if this risk is not managed appropriately, the magnitude of the effect of introductions of pest plants could be 'high', particularly once stock are excluded from the forest remnants.

To address this risk, prior to planting occurring within any of the residential lots, a planting plan showing location, species, grade, and numbers of plants proposed to be planted is to be lodged with the Goodland Coastal Farm Design Review Panel for approval. No plant species listed in the National Plant Pest Accord (NPPA) or the Auckland Regional Pest Management Plan (ARPMP, Auckland Council 2020, in any category, will be permitted to be planted or cultivated, either in the ground or in pots. Many species not listed in the NPPA or ARPMP can also establish from dumped garden refuse, for example fruit salad plant (*Monstera deliciosa*) and hydrangea (*Hydrangea macrophylla*) and should not be planted at the site.

Planting of fruit trees and edibles is encouraged, but will still be limited only to species that are not listed in the ARPMP or NPPA, and do not pose a threat to adjacent forest areas. Edible pest plant species such as loquat (*Eriobotrya japonica*) and blackberry will be prohibited both within residential lots and in communal orchard areas.

Natural areas, especially along lot boundaries and forest edges, will be surveyed annually for new pest plant incursions. Exotic plants within natural areas should be controlled when they are first recorded in order to increase the likelihood and efficiency of achieving total control.

The dumping of garden waste into any of the Vegetation Restoration/Regeneration Areas at the site will also be strictly prohibited.

With these controls in place, the overall level of this effect will be 'low'.

### 8.13 Accidental spread of kauri dieback

While kauri trees observed did not appear to be suffering from kauri dieback at the time of the site surveys, it can take years for infected trees to show symptoms. Care should therefore be taken to avoid the spread of kauri dieback into or out of the site. If kauri dieback is not currently present and is brought into the site, or if it is spread to other sites as a result of the works being undertaken, the magnitude of the effect of the resulting infection could be 'high'.

To address this risk, all machinery and vehicles used will be cleaned thoroughly before and after entering the site, and standard kauri dieback protocols will be followed. If these controls are implemented correctly the risk of spreading kauri dieback will be 'low'.

### 8.14 Enhancement of retained vegetation and additional revegetation

The proposed ecological restoration areas at the site cover a total of 71.24 hectares. Within these areas 33.47 hectares of existing indigenous vegetation will be restored, and 33.47 hectares will be revegetated. This will include:

- 15.04 hectares of terrestrial revegetation planting.
- 3.32 hectares of wetland revegetation planting.
- 12.73 hectares of terrestrial infill planting.

As a result, 98.14% of all intermittent and permanent streams at the site will be fenced and protected.

Some of the restoration areas will contain narrow (single track) walking and cycling paths c.0.8 metres wide. These will be narrow enough to ensure that canopy closure can be achieved over the tracks and as such they will not result in habitat fragmentation.

Grazing in the low-lying flats on the western edge of the property will also be discontinued, including in the neighbouring Makarau Stewardship Area. Although this area is classified as “Arable, moderate limitation” under the NZLRI Land use Capability classification system<sup>1</sup>, continuing to graze this area would not provide good ecological outcomes. These low-lying flats once formed part of an extensive wetland habitat that has been drained to create grazing land. However, the water table in this area is still very high and the vegetation is dominated by rushes. Allowing this area to revert to wetland would significantly increase the extent of wetland habitats in the local area, provide improved habitat values for Threatened and At Risk wetland birds such as Australasian bittern and spotless crane, and provide improved natural water treatment for water discharging to the Kaipara Harbour.

Pest animal control will be carried out throughout all restoration areas to limit the populations of rats, possums, mustelids, and feral cats at the site. This will improve habitat values for indigenous fauna, including lizards, birds, and long-tailed bats.

Overall, the restoration, revegetation, and pest animal control work proposed are above and beyond what is required to compensate for the adverse effects of the proposed development, and will therefore provide net ecological benefits to the site. The development will also ensure more sustainable farm practices are used (such as keeping stock out of waterways). Of the 134-hectare site, over half (53%) will be restored and enhanced.

A detailed management and maintenance programme, which includes a fencing plan, has been provided by Kaipara Coast Landscape Architecture.

## 8.15 Summary

Table 8 provides a summary of the level of potential effects that will remain if all of the proposed actions described above are carried out in full.

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<sup>1</sup> <https://iris.scinfo.org.nz/layer/48076-nzlri-land-use-capability-2021/>

Table 8: Summary of potential adverse effects associated with the proposed development before and after mitigation actions are implemented.

Potential Effect	Ecological Feature Affected	Ecological Value	Timescale of effect	Magnitude of effect	Initial Level of Effect	Measure to Address Effect	Final Level of Effect
Loss of stream habitat	Intermittent Stream	Moderate	Permanent	Low	Low	Fencing and restoration of all remaining stream habitats across the rest of the property.	Net Gain
	Permanent	Moderate	Permanent	Low	Low		
Harm to indigenous fish	Indigenous fish community	Low-High	Permanent	Low	Low	Preparation and implementation of a Fish Management Plan.	Very low
Increased predation pressure and disturbance by pets	Long-tailed bats	Very High	Permanent	Moderate-High	High-Very High	Control of possums, rats, mustelids, and, feral cats. Enforcement of a 'cat free' covenant. Dogs to be on lead when not on their own properties.	Net Gain
	Common indigenous birds	Low	Permanent	Moderate-High	Low		
	At Risk or Threatened indigenous wetland birds	High-Very High	Permanent	Moderate-High	High-Very High		
	Indigenous skinks	High	Permanent	Moderate-High	High-Very High		
	Indigenous geckos	High	Permanent	Moderate-High	High-Very High		
Lighting disturbance to bats	Long-tailed bats	Very High	Permanent	High	Very High	Implementation of appropriate lighting design and light spill attenuation.	Low
Encroachment into wetland buffers and stream margins	Kikuyu grassland	Negligible	Permanent	Low	Very Low	Protection and enhancement of all remaining 10-metre wetland buffer areas and 20-metre stream margins.	Net Gain
	Intermittent and permanent streams	Moderate	Permanent	Low	Low		
	Natural inland wetlands	Moderate-Very High	Permanent	Low	Low-Moderate		
Sediment runoff from earthworks near streams and wetlands	Streams	Low-High	Temporary	High	Low-Very High	Preparation and implementation of an appropriate Erosion and Sediment Control Plan (ESCP).	Low
	Natural inland wetlands	Moderate-Very High	Temporary	High	Moderate-Very High		
Increased impervious surfaces	Streams	Low-High	Permanent	Low	Very Low-Low	Inclusion of appropriate low impact design features.	Very low

Potential Effect	Ecological Feature Affected	Ecological Value	Timescale of effect	Magnitude of effect	Initial Level of Effect	Measure to Address Effect	Final Level of Effect
Wetland catchment alterations	Natural inland wetlands	Moderate-Very High	Permanent	Moderate-High	Moderate-Very High	Design of stormwater system to ensure hydrology maintained	Very low
Discharge of wastewater to land	Natural inland wetlands	Moderate-High	Permanent	Low	Low	Appropriate design of wastewater treatment system, dispersal fields, and discharge rates. Protection and enhancement of wetland habitats	Low-Very low
Bird mortality or injury from window strike	Common indigenous birds	Low	Permanent	Low	Very Low	Not required, but may consider increased visibility of windows and design controls to reduce use of high-risk features (such as opposite windows).	Very low
Proliferation of pest plants from residential gardens	All terrestrial and wetland habitats	Low-Very High	Permanent	Moderate	Very Low-High	Ban on planting pest plants and dumping of garden waste.	Low
Accidental spread of kauri dieback	Kauri trees	Very High	Permanent	High	Very High	Implementation of appropriate soil hygiene measures.	Low
Increased quality and extent of indigenous habitats	Vegetation restoration areas as marked on the Communal Farm Management Plan	Negligible – Very High	Permanent	Positive	Net Gain	None required.	Net Gain

## 9. CONCLUSIONS

ABIB (Oamaru) Ltd on behalf of its client, is preparing a consent application for a 25-lot residential subdivision at 2127 Kaipara Coast Highway. The site covers c.134 hectares and largely comprises rolling pasture on gentler slopes, with gullies characterised by indigenous forest and shrubland.

A subdivision of this scale is a non-complying activity under the AUP and as such, the development has been strategically designed to avoid or minimise adverse effects to the extent possible, and to provide additional ecological benefits through the protection and enhancement of indigenous habitats. A summary of how the proposal meets the ecological outcomes sought by subdivisions in rural areas under the AUP is provided in Table 9.

Table 9: Summary of how ecological objectives for rural subdivision (E39) are met

E39.2 Objectives relevant to ecology	How this objective is met
Land is subdivided in a manner that provides for the long-term needs of the community and minimises adverse effects of future development on the environment.	Proposal minimises adverse effect of future development by protecting streams, wetlands, and forest habitats in perpetuity.
Subdivision maintains or enhances the natural features and landscapes that contribute to the character and amenity values of the areas.	Natural features including streams, wetlands, and forest habitats are maintained and enhanced. These areas will feature walking and cycling tracks to enhance amenity values.
Rural lifestyle subdivision is primarily limited to the Rural – Countryside Living Zone, and to sites created by protecting, restoring or creating significant areas of indigenous vegetation or wetlands.	Although the proposal is not based on A16 or A18, the proposal includes protecting, restoring, and creating indigenous habitats and provides net ecological benefits to the site.
Subdivision maintains or enhances the natural features and landscapes that contribute to the character and amenity values of rural areas.	Natural features at the site are maintained and enhanced.
Rural subdivision avoids or minimises adverse effects in areas identified in the Outstanding Natural Features Overlay, Outstanding Natural Character Overlay, High Natural Character Overlay, Outstanding Natural Landscape Overlay and Significant Ecological Areas Overlay.	All areas of SEA or SEA quality habitat will be protected and enhanced. Development is also concentrated away from areas classified as ONF, ONC, HNC, or ONL.
Subdivision maintains the function of flood plains and overland flow paths to safely convey flood waters while taking into account the likely long-term effects of climate change.	Floodplains, wetlands, and stream will be protected and enhanced. Retiring low-lying flats.

All the potential adverse effects have been appropriately addressed through the proposed cooperative farming development by including:

- Fencing and restoring streams and wetlands.
- Fish management.
- Appropriate design of wastewater systems.
- Pest animal control and pet restrictions.
- Appropriate lighting design.
- Sediment controls during construction.
- Appropriate stormwater management.
- Consideration of design controls to increase visibility of windows to birds and reduce bird strike.
- Implementation of appropriate soil hygiene measures.
- Management of cultivated pest plants.

In addition, approximately half of the site will be actively managed to enhance ecological values through pest plant control, pest animal control, and/or revegetation planting.

Overall, the potential adverse effects of the proposed development will be appropriately managed and the additional ecological restoration proposed will result in net benefits for the biodiversity of the site, including:

- Improved water quality through the exclusion of stock from streams and wetlands and the provision of buffer planting.
- Improved forest regeneration and plant diversity.
- Reduced predation on indigenous fauna.
- Reduced pest plant abundance.
- Improve forest regeneration through stock exclusion.
- Increased extent of forest habitat through revegetation planting.

## ACKNOWLEDGMENTS

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## VASCULAR PLANT SPECIES RECORDED AT 2127 KAIPARA COAST HIGHWAY

### INDIGENOUS SPECIES

#### Gymnosperms

<i>Agathis australis</i>	kauri
<i>Dacrycarpus dacrydioides</i>	kahikatea
<i>Dacrydium cupressinum</i>	rimu
<i>Phyllocladus trichomanoides</i>	tānekaha
<i>Podocarpus totara</i> var. <i>totara</i>	tōtara

#### Monocot. trees and shrubs

<i>Cordyline australis</i>	tī kōuka, cabbage tree
<i>Rhopalostylis sapida</i>	nīkau

#### Dicot. trees and shrubs

<i>Beilschmiedia tarairi</i>	taraire
<i>Beilschmiedia tawa</i>	tawa
<i>Coprosma arborea</i>	tree coprosma, māmāngi
<i>Coprosma areolata</i>	
<i>Coprosma crassifolia</i>	
<i>Coprosma rhamnoides</i>	
<i>Coprosma robusta</i>	karamū, kāramuramu
<i>Corynocarpus laevigatus</i>	karaka
<i>Didymocheton spectabilis</i>	kohekohe
<i>Geniostoma ligustrifolium</i> var. <i>ligustrifolium</i>	hangehange
<i>Griselinia littoralis</i>	kāpuka
<i>Hedycarya arborea</i>	porokaiwhiri; pigeonwood
<i>Knightia excelsa</i>	rewarewa
<i>Kunzea robusta</i>	kānuka
<i>Leptecophylla juniperina</i> var. <i>juniperina</i>	prickly mingimingi
<i>Leptospermum scoparium</i> agg.	mānuka
<i>Melicytus ramiflorus</i> subsp. <i>ramiflorus</i>	māhoe
<i>Myrsine australis</i>	māpou, matipou, māpau
<i>Nestegis lanceolata</i>	white maire, maire rauriki
<i>Piper excelsum</i> subsp. <i>excelsum</i>	kawakawa
<i>Pseudopanax arboreus</i>	whauwhaupaku, puahou, five finger
<i>Pseudopanax crassifolius</i>	horoeaka, lancewood
<i>Sophora chathamica</i>	kōwhai
<i>Streblus heterophyllus</i>	tūrepo
<i>Vitex lucens</i>	pūriri

#### Monocot. lianes

<i>Ripogonum scandens</i>	supplejack, kareao
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#### Dicot. lianes

<i>Clematis paniculata</i>	puawānanga
<i>Metrosideros perforata</i>	aka
<i>Muehlenbeckia australis</i>	puka
<i>Muehlenbeckia complexa</i>	pōhuehue
<i>Parsonsia heterophylla</i>	akakaikiore
<i>Rubus cissoides</i> agg.	tātarāmoa, tātaraheke, bush lawyer

## Lycopods and psilopsids

*Lycopodium volubile*

waewaekoukou

## Ferns

*Adiantum hispidulum*

huruhuru tapairu, maidenhair fern

*Asplenium flaccidum*

makawe, ngā makawe o Raukatauri

*Asplenium polyodon*

petako

*Blechnum filiforme*

pānako

*Blechnum minus*

swamp kiokio

*Blechnum novae-zelandiae*

kiokio

*Cyathea dealbata*

ponga, silver fern

*Cyathea medullaris*

mamaku

*Dicksonia squarrosa*

whekī

*Diplazium australe*

*Doodia australis*

pukupuku

*Histiopteris incisa*

mātātā, water fern

*Leptolepia novae-zelandiae*

*Microsorium pustulatum*

kōwaowao, pāraharaha, hound's tongue

*Microsorium scandens*

mokimoki

*Pteris tremula*

turawera, shaking brake

*Pyrrosia elaeagnifolia*

leather-leaf fern

## Grasses

*Microlaena avenacea*

bush rice grass

*Microlaena stipoides*

pāfītī, meadow rice grass

*Oplismenus hirtellus* subsp. *imbecillis*

## Sedges

*Carex dissita*

*Carex flagellifera*

manaia

*Carex lambertiana*

*Carex lessoniana*

toetoe-rautahi

*Carex uncinata*

kamu matau a Maui, kamu

*Carex virgata*

pūrei

*Eleocharis acuta*

spike sedge

*Gahnia lacera*

tarangārara, toetoe kiwi, tatangi

*Isolepis cernua*

*Isolepis prolifera*

*Machaerina articulata*

*Machaerina juncea*

*Machaerina rubiginosa*

*Machaerina tenax*

## Rushes

*Juncus australis*

wī, wīwī

*Juncus edgariae*

wī, wīwī

*Juncus planifolius*

*Juncus sarophorus*

wī, wīwī

## Monocot. herbs (other than orchids, grasses, sedges, and rushes)

*Astelia hastata*

kahakaha

*Astelia solandri*

kōwharawhara



## Composite herbs

*Senecio bipinnatisectus*

Australian fireweed

## Dicot. herbs (other than composites)

*Persicaria decipiens*

tutunawai

## **NATURALISED AND EXOTIC SPECIES**

### Gymnosperms

*Pinus radiata*

radiata pine

### Monocot. trees and shrubs

*Alocasia brisbanensis*

elephant's ears

### Dicot. trees and shrubs

*Acacia longifolia*

Sydney golden wattle

*Allocasuarina littoralis*

she-oak

*Banksia integrifolia*

banksia

*Casuarina cunninghamiana*

sheoak, common river oak

*Grevillea robusta*

silky oak

*Ligustrum sinense*

Chinese privet

*Magnolia grandiflora*

laurel magnolia

*Populus* sp.

poplar

*Rubus* sp. (*R. fruticosus* agg.)

blackberry

*Salix* ×*fragilis*

crack willow

*Solanum mauritianum*

woolly nightshade

*Syzygium smithii*

lillypilly, monkey apple

*Ulex europaeus*

gorse

### Dicot. lianes

*Calystegia silvatica*

greater bindweed

*Passiflora tarminiana*

banana passionfruit

### Ferns

*Azolla pinnata*

ferny azolla

### Grasses

*Agrostis capillaris*

browntop

*Agrostis stolonifera*

creeping bent

*Axonopus fissifolius*

narrow-leaved carpet grass

*Cenchrus clandestinus*

kikuyu grass

*Cortaderia selloana*

pampas

*Dactylis glomerata*

cocksfoot

*Holcus lanatus*

Yorkshire fog

*Lolium perenne*

tall fescue

*Paspalum dilatatum*

rye grass

*Paspalum distichum*

paspalum

*Sporobolus africanus*

Mercer grass

ratstail

## Rushes

<i>Juncus articulatus</i>	jointed rush
<i>Juncus effusus</i> var. <i>effusus</i>	soft rush, leafless rush
<i>Juncus tenuis</i> var. <i>tenuis</i>	track rush
<i>Juncus</i> sp.	

## Monocot. herbs (other than orchids, grasses, sedges, and rushes)

<i>Landoltia punctata</i>	purple-backed duckweed
---------------------------	------------------------

## Composite herbs

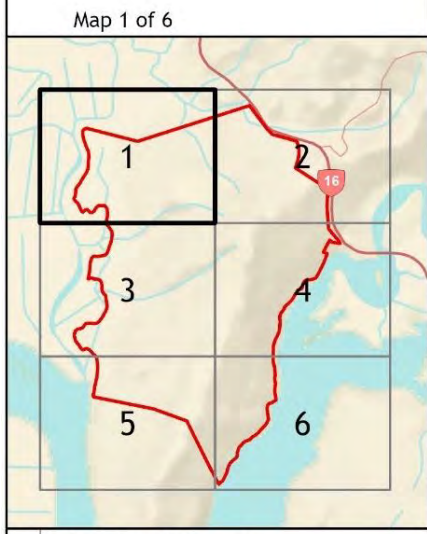
<i>Cirsium vulgare</i>	Scotch thistle
<i>Crepis capillaris</i>	hawksbeard
<i>Erigeron sumatrensis</i>	broad-leaved fleabane
<i>Helminthotheca echioides</i>	oxtongue
<i>Hypochaeris radicata</i>	catsear
<i>Jacobaea vulgaris</i>	ragwort

## Dicot. herbs (other than composites)

<i>Callitriche stagnalis</i>	starwort
<i>Daucus carota</i>	wild carrot
<i>Lotus pedunculatus</i>	lotus
<i>Lythrum hyssopifolia</i>	hyssop loosestrife
<i>Myosotis laxa</i> subsp. <i>caespitosa</i>	water forget-me-not
<i>Nasturtium officinale</i>	watercress
<i>Persicaria hydropiper</i>	water pepper
<i>Physalis peruviana</i>	cape gooseberry
<i>Phytolacca octandra</i>	inkweed
<i>Plantago lanceolata</i>	narrow-leaved plantain
<i>Prunella vulgaris</i>	selfheal
<i>Ranunculus repens</i>	creeping buttercup
<i>Rumex conglomeratus</i>	clustered dock
<i>Solanum nigrum</i>	black nightshade
<i>Torilis arvensis</i>	spreading hedge parsley
<i>Trifolium repens</i>	white clover

VEGETATION AND HABITAT  
TYPES AT 2127 KAIPARA COAST  
HIGHWAY, MAKARAU

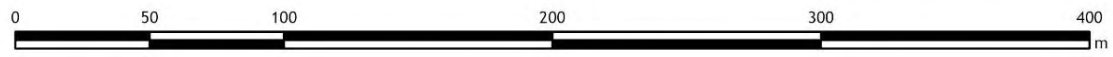
- Legend**
- Earthworks areas and lots
  - Ephemeral stream
  - - - Intermittent stream
  - Permanent stream
  - Culvert (Cu1-5)
  - **VegetationHabitatType**
  - 1e. Kānuka forest (e)
  - 1f. Kānuka forest (f)
  - 2b. Kahikatea forest (b)
  - 2c. Kahikatea forest (c)
  - 4. Kahikatea treeland over exotic grasses
  - 5. Totara-kānuka-kahikatea treeland
  - 8. Gorse shrubland
  - 9. Kikuyu grassland
  - 12. Wī rushland
  - 20. Soft rush-wī-Mercer grass-rushland
  - 21. Soft rush-kikuyu rushland
  - 22. Mercer grass-soft rush grassland



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 Roads/Lots updated 6 Dec 2021

Report: 5807  
 Ref: 06 1662  
 Client: Abib (Oamaru) Ltd.  
 Name: Figure\_Vegetation.aprx [Fig1\_Vegetation]  
 Path: E:\gis\KaiparaCoastHighway\mxd

**Vegetation and habitat types at 2127 Kaipara Coast Highway, Makarau**



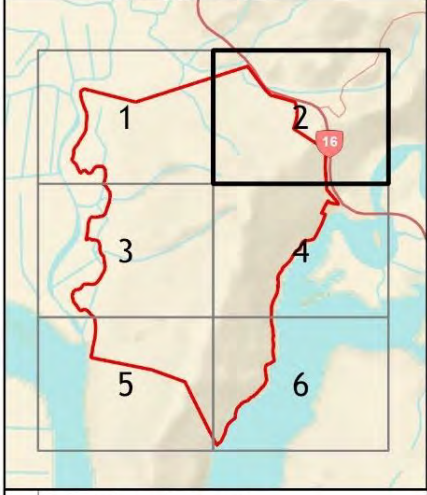
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 www.wildlands.co.nz, 0508 WILDNZ

Scale: 1:2,500  
 Date: 20/07/2023  
 Cartographer: TP  
 Format: A3R

- Legend
- Earthworks areas and lots
  - Ephemeral stream
  - Intermittent stream
  - Permanent stream
  - Culvert (Cu1-5)
  - VegetationHabitatType
  - 1b. Kānuka forest (b)
  - 1c. Kānuka forest (c)
  - 1e. Kānuka forest (e)
  - 1f. Kānuka forest (f)
  - 1g. Kānuka forest (g)
  - 3. Kahikatea-kānuka treeland over exotic grasses
  - 6. Kānuka scrub
  - 7. Blackberry-pohuehue vineland
  - 8. Gorse shrubland
  - 9. Kikuyu grassland
  - 19. Mercer grass-soft rush-raupō grassland
  - 20. Soft rush-wī-Mercer grass-rushland
  - 22. Mercer grass-soft rush grassland



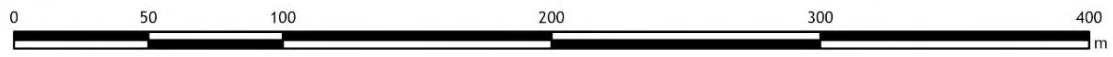
Map 2 of 6



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**Vegetation and habitat types at 2127 Kaipara Coast Highway, Makarau**



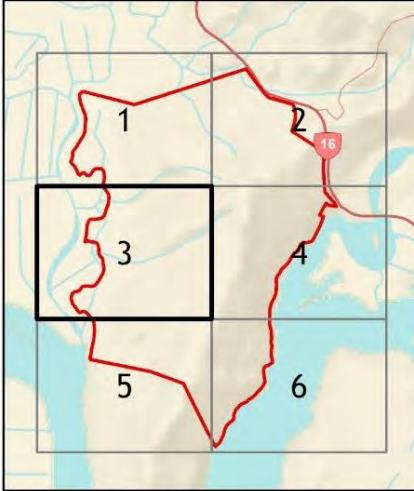
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Scale: 1:2,500  
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- Legend
- Earthworks areas and lots
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  - Intermittent stream
  - Permanent stream
  - Culvert (Cu1-5)
  - VegetationHabitatType
  - 1b. Kānuka forest (b)
  - 1d. Kānuka forest (d)
  - 1e. Kānuka forest (e)
  - 1f. Kānuka forest (f)
  - 2a. Kahikatea forest (a)
  - 2b. Kahikatea forest (b)
  - 5. Totara-kānuka-kahikatea treeland
  - 8. Gorse shrubland
  - 9. Kikuyu grassland
  - 10. Raupō reedland
  - 11. Machaerina articulata sedgeland
  - 12. Wī rushland
  - 13. Wī-kikuyu rushland
  - 14. Kahikatea treeland over wī
  - 15. Kahikatea-kānuka treeland on wetland margin
  - 16. Mānuka scrub
  - 17. Mercer grass-giant umbrella sedge grassland
  - 18. Wī-spike sedge-Machaerina rubiginosa rushland
  - 21. Soft rush-kikuyu rushland
  - 22. Mercer grass-soft rush grassland



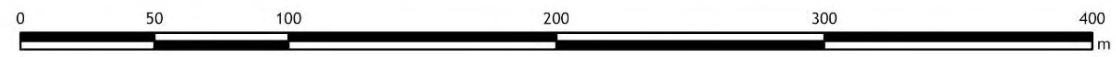
Map 3 of 6



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 Name: Figure\_Vegetation.aprx (Fig1\_Vegetation)  
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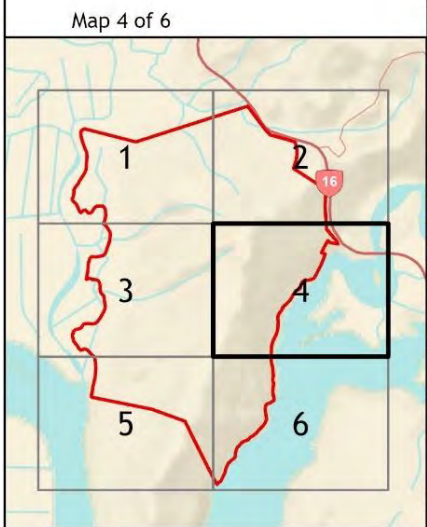
**Vegetation and habitat types at 2127 Kaipara Coast Highway, Makarau**



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 Format: A3R

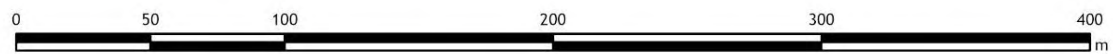
- Legend**
- Earthworks areas and lots
  - Ephemeral stream
  - ▬ Intermittent stream
  - ▬ Permanent stream
  - ▬ Culvert (Cu1-5)
  - ▭ VegetationHabitatType
  - 1d. Kānuka forest (d)
  - 1g. Kānuka forest (g)
  - 3. Kahikatea-kānuka treeland over exotic grasses
  - 9. Kikuyu grassland
  - 15. Kahikatea-kānuka treeland on wetland margin
  - 20. Soft rush-wī-Mercer grass-rushland



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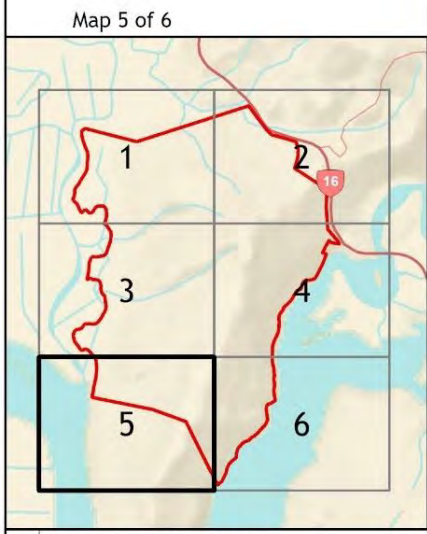
**Vegetation and habitat types at 2127 Kaipara Coast Highway, Makarau**



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 Date: 20/07/2023  
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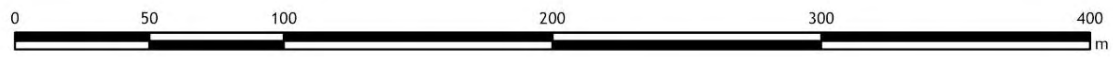
- Legend**
- Earthworks areas and lots
  - Ephemeral stream
  - - - Intermittent stream
  - Permanent stream
  - Culvert (Cu1-5)
  - VegetationHabitatType**
  - 1a. Kānuka forest (a)
  - 1b. Kānuka forest (b)
  - 1d. Kānuka forest (d)
  - 9. Kikuyu grassland
  - 22. Mercer grass-soft rush grassland



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**Vegetation and habitat types at 2127 Kaipara Coast Highway, Makarau**



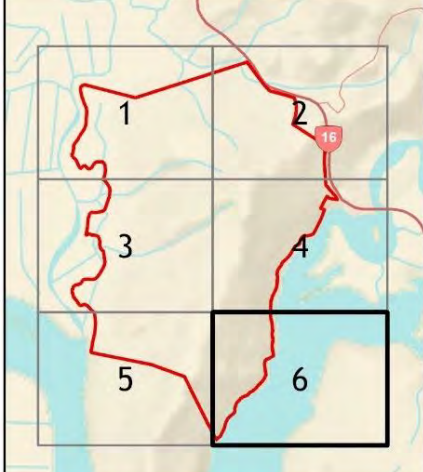
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 Format: A3R

- Legend**
- Earthworks areas and lots
  - Ephemeral stream
  - ▬ Intermittent stream
  - ▬ Permanent stream
  - ▬ Culvert (Cu1-5)
  - ▬ VegetationHabitatType
  - 1a. Kānuka forest (a)
  - 3. Kahikatea-kānuka treeland over exotic grasses
  - 9. Kikuyu grassland



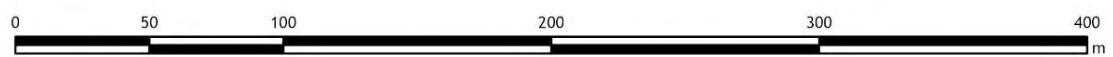
Map 6 of 6



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Auckland Council LINZ

RIPARIAN AND WETLAND  
BUFFER AREAS AT 2127 KAIPARA  
COAST HIGHWAY, MAKARAU

**Legend**

- Earthworks areas and lots
- Ephemeral stream
- Intermittent stream
- Permanent stream
- Culvert (Cu1-5)

**Buffer zones**

- Wetland buffer (10m)
- Wetland buffer (20m)
- Riparian buffer (20m)

**VegetationHabitatType**

- Kānuka forest (e)
- Kānuka forest (f)
- Kahikatea forest (b)
- Kahikatea forest (c)
- Totara-kānuka-kahikatea treeland
- Gorse shrubland
- Kikuyu grassland
- Wī rushland
- Soft rush-wī-Mercer grass-rushland
- Soft rush-kikuyu rushland
- Mercer grass-soft rush grassland

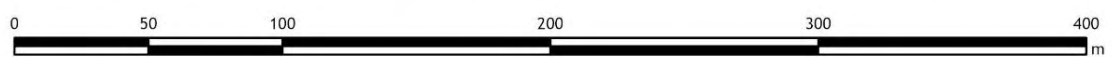
Map 1 of 6

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Earthworks areas within riparian margins and wetland buffers at 2127 Kaipara Coast Highway



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- Legend**
- Earthworks areas and lots
  - Ephemeral stream
  - Intermittent stream
  - Permanent stream
  - Culvert (Cu1-5)
- Buffer zones**
- Wetland buffer (10m)
  - Wetland buffer (20m)
  - Riparian buffer (20m)
- VegetationHabitatType**
- 1b. Kānuka forest (b)
  - 1c. Kānuka forest (c)
  - 1e. Kānuka forest (e)
  - 1f. Kānuka forest (f)
  - 1g. Kānuka forest (g)
  - 3. Kahikatea-kānuka treeland over exotic grasses
  - 6. Kānuka scrub
  - 7. Blackberry-pohuehue vineland
  - 8. Gorse shrubland
  - 9. Kikuyu grassland
  - 19. Mercer grass-soft rush-raupō grassland
  - 20. Soft rush-wī-Mercer grass-rushland
  - 22. Mercer grass-soft rush grassland



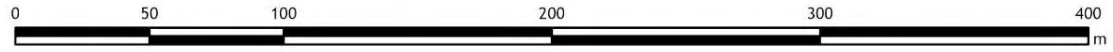
Map 2 of 6



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**Earthworks areas within riparian margins and wetland buffers at 2127 Kaipara Coast Highway**



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**Legend**

- Earthworks areas and lots
- Ephemeral stream
- Intermittent stream
- Permanent stream
- Culvert (Cu1-5)

**Buffer zones**

- Wetland buffer (10m)
- Wetland buffer (20m)
- Riparian buffer (20m)
- VegetationHabitatType

**VegetationHabitatType**

- 1b. Kānuka forest (b)
- 1d. Kānuka forest (d)
- 1e. Kānuka forest (e)
- 1f. Kānuka forest (f)
- 2a. Kahikatea forest (a)
- 2b. Kahikatea forest (b)
- 5. Totara-kānuka-kahikatea treeland
- 8. Gorse shrubland
- 9. Kikuyu grassland
- 10. Raupō reedland
- 11. Machaerina articulata sedge/land
- 12. Wī rushland
- 13. Wī-kikuyu rushland
- 14. Kahikatea treeland over wī
- 15. Kahikatea-kānuka treeland on wetland margin
- 16. Mānuka scrub
- 17. Mercer grass-giant umbrella sedge grassland

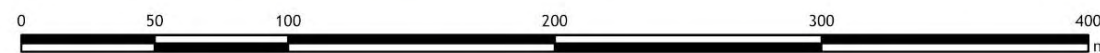
Map 3 of 6

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Earthworks areas within riparian margins and wetland buffers at 2127 Kaipara Coast Highway



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**Legend**

- Earthworks areas and lots
- Ephemeral stream
- Intermittent stream
- Permanent stream
- Culvert (Cu1-5)

**Buffer zones**

- Wetland buffer (10m)
- Wetland buffer (20m)
- Riparian buffer (20m)

**VegetationHabitatType**

- 1d. Kānuka forest (d)
- 1g. Kānuka forest (g)
- 3. Kahikatea-kānuka treeland over exotic grasses
- 9. Kikuyu grassland
- 15. Kahikatea-kānuka treeland on wetland margin
- 20. Soft rush-wi-Mercer grass-rushland

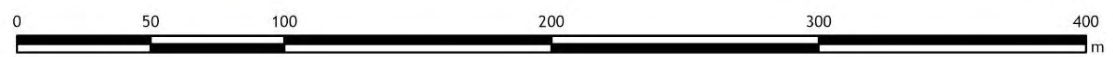
Map 4 of 6

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Earthworks areas within riparian margins and wetland buffers at 2127 Kaipara Coast Highway



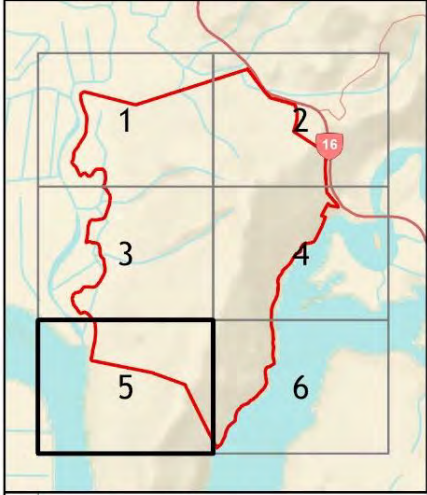
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- Legend**
- Earthworks areas and lots
  - Ephemeral stream
  - Intermittent stream
  - Permanent stream
  - Culvert (Cu1-5)
- Buffer zones**
- Wetland buffer (10m)
  - Wetland buffer (20m)
  - Riparian buffer (20m)
- VegetationHabitatType**
- 1a. Kānuka forest (a)
  - 1b. Kānuka forest (b)
  - 1d. Kānuka forest (d)
  - 9. Kikuyu grassland
  - 22. Mercer grass-soft rush grassland



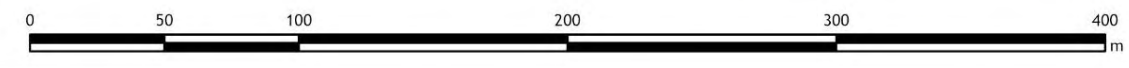
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**Earthworks areas within riparian margins and wetland buffers at 2127 Kaipara Coast Highway**



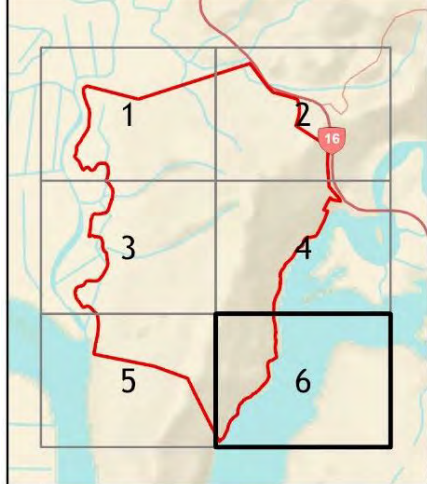
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- Legend**
- Earthworks areas and lots
  - Ephemeral stream
  - Intermittent stream
  - Permanent stream
  - Culvert (Cu1-5)
- Buffer zones**
- Wetland buffer (10m)
  - Wetland buffer (20m)
  - Riparian buffer (20m)
  - VegetationHabitatType
- 1a. Kānuka forest (a)  
 3. Kahikatea-kānuka treeland over exotic grasses  
 9. Kikuyu grassland



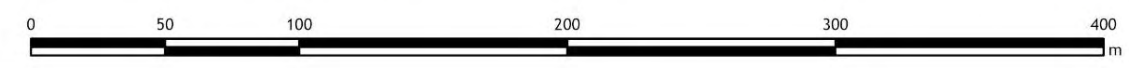
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**Earthworks areas within riparian margins and wetland buffers at 2127 Kaipara Coast Highway**



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