VIRIDIS
Environmental Consultants

Ecological Impact Assessment

Milldale Private Wastewater Treatment Plant

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Cover photo: Existing gravel road within the proposed wastewater treatment plant area which poplars in the background at Milldale, Auckland (photo source: Viridis 2024).

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1 INTRODUCTION

1.1 Overview

This report has been prepared to accompany the application by Fulton Hogan Land Development (FHLD) for a resource consent to the Environmental Protection Authority (EPA) under the Fast-Track Approvals Act 2024 (FTAA).

Resource consent is required for the construction and operation of a Wastewater Treatment Plant (WWTP) involving earthworks, wastewater discharges and vegetation removal.

The Wastewater Treatment Plan site ('the site') is located within Lot 4 DP 353309 which has a total area of 10.45 ha. The site is on the northern side of Lysnar Road, Wainui and is located directly adjacent to the Milldale development and just outside the Wainui Precinct. The site is zoned as 'Future Urban Zone' under the Auckland Unitary Plan – Operative in Part (AUP-OP).

A full description of the site and surrounds is provided in the application AEE.

1.2 Assessment Scope

Viridis Limited (Viridis) was engaged by FHDL to undertake an Ecological Impact Assessment (EcIA) to accompany and inform the application under the FTAA.

The EcIA identifies and discusses the existing terrestrial and freshwater ecological values present within the zone of influence (ZOI) and surrounding environment, and determines the impact of the proposed development and associated activities on those values. Recommended measures to avoid, remedy, or mitigate adverse effects on terrestrial and freshwater ecology are provided as necessary. Recommendations for addressing anticipated residual adverse effects on the ecological values of the site through enhancement are also made where applicable.

The assessment has been informed by relevant regulations, including the AUP-OP, the National Policy Statement for Freshwater Management 2020 (NPS-FM), the National Environmental Standards for Freshwater 2020 (NES-F) and the National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB).

2 METHODOLOGY

2.1 Overview

The assessment included a desktop review and site visit, undertaken by a suitably qualified freshwater ecologist. The desktop review involved an examination of current and historical aerial imagery of the site, during which factors such as changes in vegetation and surface water were noted. A review of data on Auckland Council's Geomaps (such as current biodiversity layers, predicted watercourses and site topography) was also undertaken.

Site assessments were undertaken during March 2023, and November 2024. The presence and extent of freshwater and terrestrial features within the property and surrounding area were recorded and the quality of any associated habitat was visually assessed, in accordance with the methodology detailed in Sections 2.2 through 2.3, below.

In preparation for on-site assessments, recent and historical aerial imagery was reviewed, alongside available information regarding hydrology, topography, and mapped ecosystem types. Previous ecological reporting previously for the wider Milldale development undertaken by Viridis and other consultants have been drawn upon where applicable.

2.2 Terrestrial Ecology

The vegetation within the property was assessed during the site visit. The botanical value of both exotic and native vegetation was recorded, and the quality, extent and connectivity of vegetation was considered.

Terrestrial fauna habitat was assessed qualitatively, in conjunction with database reviews (e.g., Department of Conservation's (DOC) ARDs, Bioweb, eBird and iNaturalist) and considered indigenous lizards, birds, and bats[1]. A desktop review of local bat and herpetofauna records from specific databases was undertaken. Previous fauna survey results undertaken by other consultancies was reviewed where available. Opportunistic sightings of avifauna were recorded, and the conservation status of the species, as defined in Robertson et. al. (2021), was noted.

The ecological values of terrestrial features were determined in accordance with the methodology prescribed in the Environment Institute of Australia and New Zealand (EIANZ) guidelines (refer Section 2.4).

2.3 Freshwater Ecology

2.3.1 Watercourses

During the site assessment, the presence and extent of streams within the site were noted and the quality of freshwater habitat was visually assessed where accessible. Watercourses were classified in accordance with the AUP-OP definitions to determine ephemeral, intermittent, or permanent status. Ecological factors such as hydrological regime, aquatic habitat and riparian environment were assessed. Modifications to natural flow paths or the presence of artificial drainage channels were also noted. Riparian and catchment information was also reviewed alongside the NIWA New Zealand Freshwater Fish Database (NZFFD) for species potentially present within the site.

[1] The authors have been certified by the Department of Conservation Bat Recovery Group to assess high risk roost trees (competency 3.3).

2.3.2 Wetlands

The Ministry for the Environment (MfE) wetland delineation protocols (MfE 2022) were used to determine whether an area met the definition of a 'natural inland wetland' under the NPS-FM. Assessments were carried out within the 'growing season' for the Auckland region (MfE, 2021). As per the Clarkson (2014) vegetation tool methods, plant species within putative wetlands were identified, and each species was assigned one of the below wetland indicator status ratings (Clarkson *et al*., 2021):

- Obligate (OBL) – almost always in wetlands, rarely in drylands;
- Facultative wetland (FACW) – usually in wetlands but occasionally found in drylands;
- Facultative (FAC) – commonly occurs in both wetlands and drylands;
- Facultative upland (FACU) – occasionally in wetlands but usually in drylands; or
- Upland (UPL) – rarely in wetlands, almost always in drylands.

Based on the dominance and prevalence of hydrophytic (wetland) species, natural inland wetland presence/absence was determined. Where results of the vegetation assessment remained uncertain or conditions were modified or atypical, hydric soils and hydrological assessments were undertaken.

Value assessments included identifying native and exotic vegetation species, examining the structural tiers within wetland areas, and assessing the quality and abundance of aquatic habitats. Signs of wetland degradation such as pugging and grazing from stock access, structures such as culverts impeding hydrological function, and weed infestation were also noted.

2.4 Ecological Impact Assessment

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

Criteria for describing the magnitude of effects are given in Chapter 6 of the EcIAG. The level of effect can then be determined through combining the value of the ecological feature/attribute with the score or rating for magnitude of effect to create a criterion for describing level of effects (Table 1). A moderate level of effect requires careful assessment and analysis of the individual case. For moderate levels of effects or above, measures need to be introduced to avoid through design, or appropriate mitigation needs to be addressed (Roper-Lindsay et al. 2018).

Table 1. Criteria for describing the level of effects (from Roper-Lindsay et al. 2018).

Magnitude of Effect	Ecological Value				
	Very High	**High**	**Moderate**	**Low**	**Negligible**
Very High	*Very High*	*Very High*	*High*	*Moderate*	Low
High	*Very High*	*Very High*	*Moderate*	Low	Very Low
Moderate	*High*	*High*	*Moderate*	Low	Very Low
Low	*Moderate*	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

Notes: Where text is italicised, it indicates 'significant effects' where mitigation is required.

3 SITE DESCRIPTION

3.1 Site Context

3.1.1 Ecological district

The site is in the Rodney Ecological District. The district is characterised by hill country, ranging from steep to rolling, indented on the eastern coastline by sand dunes in the northeast. Parts of the district remain relatively unmodified and retain some extensive areas of bush. However, many of these areas are fragmented and isolated, with bush, wetlands, dunes, coastal environments and scrub no longer directly connected to each other. The rest of the district has been heavily modified, with large amounts of vegetation cleared to accommodate pasture. The district also contains several urban and semiurban areas, including Warkworth, Wellsford, and the Ōrewa-Silverdale-Whangaparāoa area.

The Rodney Ecological District would have historically been heavily forested. Vegetated remnants within the district included mixed podocarp-hardwood forest with tānekaha (*Phyllocladus trichomanoides*) and some areas of kauri (*Agathis australis*). Regenerating areas generally consist of conifers, including kauri, rimu (*Dacrydium cupressinum*), tānekaha, tōtara (*Podocarpus totara*) and kahikatea (*Dacrycarpus dacrydiodies*), with kānuka (*Kunzea ericoides*), mānuka (*Leptospermum scoparium*) and tree ferns interspersing. Coastal forest contains pōhutukawa (*Metrosideros excelsa*) and broadleaved species such as pūriri (*Vitex lucens*), with wetland areas of mangroves (*Avicennia marina*) and saltmarsh where habitat is suitable. Wetland habitat has been greatly reduced.

Fauna habitat would have degraded and reduced over time as vegetation clearance and conversion to farmland occurred. Currently, the district contains a number of important breeding areas for birds, generally concentrated around the coast. Existing wetlands are known to support pāteke (*Anas chlorotis*) and banded rails (*Gallirallus philippensis*), however fernbird (*Poodytes punctatus*) habitat has been significantly reduced through land modification. Kākāriki (*Cyanoramphus novaezelandiae*) and North Island kāka (*Nestor meridionalis*) are known to occur in areas of remnant forest, however they are generally present in low numbers.

3.1.2 Local & site context

The site is in one of the most heavily modified parts of the district. The local area has been highly modified for farming, and more recently for urban development. The site is in the wider Ōrewa River catchment which flows in a generally easterly direction to the coast. The surrounding land uses include rural residential living and agricultural farming to the north and west; however, the site is immediately adjacent to the medium-high density suburbia of the Milldale community to the south.

Historically (pre-human era), much of the site is expected to have contained kauri, podocarp, broadleaved forest (WF11; Singers et al. 2017). This ecosystem type would have supported a diverse range of invertebrates, amphibians, reptiles, birds and bats (Singers et. al. 2017). However, a review of historical aerial imagery indicates that the site, and much of the surrounding landscape, was cleared more than 80 years ago for agricultural purposes (Figure 2).

At present, the parent site is characterised by undeveloped rural land that has historically been used for farming. The topography of the parent site generally slopes from north-west to south-east and has two stands of poplar trees. There is an unnamed tributary of the Waterloo stream that bisects the southern portion of the site.

The area subject to the works and enhancement planting covers a total land area of approximately 1.21 ha and has been positioned in the southern corner of the parent site, directly adjacent to Lysnar Road. For the purposes of this EcIA, a ZOI has been identified approximately 30 m around the proposed affected area within the site, with this ZOI being the primary assessment area (Figure 1). The works site is generally flat and has been utilised as a construction compound supporting the delivery of ongoing delivery of the Milldale development. A hard stand area has already been constructed in this area using quarried material.

Figure 1. Map showing the affected works area and assessed zone of influence within the wider site boundaries.

Figure 2. Map of historic aerial imagery of the site from 1940, showing agricultural land use (Aerial source: Retrolens).

4 TERRESTRIAL ECOLOGY

4.1 Terrestrial Vegetation

Vegetation within the site was assessed using observations from site visits and aerial imagery. The key vegetation types (excluding pasture) have been mapped as per Figure 3. The vegetation within the ZOI consisted primarily of managed and rank pasture, along with a stand of large exotic poplar trees (*Populus nigra*), and mixed native-exotic riparian vegetation along Waterloo Creek. The AUP-OP does not identify any areas of Significant Ecological Area (SEA) within the ZOI or wider site. An existing gravelled hard stand is present across close to half of the proposed works footprint.

Figure 3. Map showing key terrestrial vegetation types within the ZOI and wider site.

4.1.1 Mixed native-exotic riparian vegetation

Native-exotic vegetation was present along the riparian margin of the Waterloo Creek within the ZOI (Figure 4). This included kānuka (*Kunzea ericoides*) and cabbage tree (*Cordyline australis*), with emergent mature pines (*Pinus radiata* & *P. pinaster*), gum trees (*Eucalyptus* sp.), and silver wattles (*Acacia dealbata*). Early successional native species such as māhoe (*Melicytus ramiflorus*), māpou (*Myrsine australis*), hangehange (*Geniostoma ligustrifolium*), and silver fern (*Alsophila tricolor*) were also present.

Pest plant abundance was high, particularly along the bush edges, with dense invasion by Chinese privet (*Ligustrum sinense*). Other pest species included crack willow (*Salix* × *fragilis*) and hawthorn (*Crataegus monogyna*), alongside exotic trees such as golden elm (*Ulmus glabra* 'Lutescens'). Patches of gorse scrub were also present (Figure 3).

Despite the high presence of pest and exotic species reducing its botanical quality, the vegetation forms part of a riparian corridor that contributes to filtration, shading, and bank stability for Waterloo Creek. It

may also provide moderate-value habitat for indigenous birds and potentially herpetofauna. As such, it was conservatively assessed as having **moderate** ecological value.

Figure 4. Photos showing examples of the mixed native-exotic vegetation within the riparian margin of Waterloo Creek.

4.1.2 Exotic tree stands

Two large stands of exotic trees were present within the site (Figure 3). Within the ZOI, poplar trees (*Populus nigra*) encompassed approximately 5m – 15m southwest from the centre line of the intermittent watercourse (Figure 6; Arborlab 2024).

The tree stands were isolated, were limited to a monoculture of exotic trees only, contained no understorey, and provided negligible habitat for herpetofauna, and only low value habitat for avifauna. They were assessed as having **low** ecological value.

a) **b)**

Figure 5. Photos showing the poplar stand within the ZOI, looking towards a) the northwest, and b) north.

Figure 6. Photos showing the poplar stand, a) standing on the northern side of the stand facing northwest, and b) standing under the trees showing the lack of understorey vegetation.

4.1.3 Pasture grass

The site has a long history of agricultural land use, and the remaining vegetation within the site was limited to managed and unmaintained exotic pasture grass areas (Figure 7 & Figure 8).

Dominant species were kikuyu (*Cenchrus clandestinus*), perennial ryegrass (*Lolium perenne*), dallis grass (*Paspalum dilatatum*), and others such as narrow-leaved plantain (*Plantago lanceolata*), dock (*Rumex* sp.), thistle (*Cirsium* sp.), hawkbit (*Leontodon taraxacoides*), and occasional soft rush (*Juncus effusus*) and lotus (*Lotus pedunculatus*).

The exotic grassed areas were assessed as having **negligible – low** ecological value; they had negligible botanical value, and provided only very low levels of filtration, however areas of longer, unmaintained grass may provide suitable habitat for skinks (Section 4.2.2).

a) **b)**

Figure 7. Examples of pasture areas within the west of the ZOI.


Figure 8. Examples of pasture areas within the east of the ZOI, adjacent to the Waterloo Creek riparian margin.

4.1.4 Terrestrial Connectivity and Ecological Function

As the terrestrial vegetation was largely limited, edge effects were considered to be high throughout the site. Edge communities increase with fragmentation of vegetation within a landscape, and are heavily influenced by increased exposure to sunlight, wind and competition from pest plants. These factors restrict establishment of some native flora and fauna to forest interiors. Connectivity between areas of vegetation is important to facilitate ecological function, and loss of connectivity can impair reproductive function for both flora and fauna communities.

There was little habitat available within the site for highly mobile fauna such as birds and bats, that move between habitats while foraging, nesting and roosting. Significantly higher quality habitat persists in the surrounding environment, including the SEA within the Ōrewa River Stewardship Area to the east which provides a corridor to the Ōrewa Estuary, the extensive Nukumea Scenic Reserve approximately 1.5 km to the north, and areas further afield including Okura Bush, Riverhead Forest and forested areas north of Ōrewa. The vegetation within the ZOI and wider site provides very little linkage or stepping stones for species moving between these habitats and others in the wider Auckland area.

The connectivity and ecological function of the vegetation to the surrounding area was of **low** ecological value.

4.2 Terrestrial Fauna Habitat

4.2.1 Avifauna (Birds)

Birds seen/heard were opportunistically recorded during site visits. Table 2 provides a list of species that are expected to be present within the site, at least periodically. Records were retrieved from eBird.org for nearby sites (accessed December 2024), and observations made during site visits in the general Milldale area by Viridis ecologists and various other ecologists in recent years were drawn upon (e.g., RMA Ecology Ltd, 2020).

The avifauna community within the Milldale area is relatively diverse, albeit consisting largely of a combination of common exotic and native species that are abundant in the wider Auckland region including urban, urban fringe, and rural areas.

Avifauna habitat within the ZOI was limited to the exotic poplar tree stand and the established native-exotic riparian vegetation along the Waterloo Creek. However, this vegetation was narrow with high

edge effects, and isolated from larger areas of dense indigenous forest habitat that would provide significantly hight quality habitat. Overall, the avifauna ecological values of the site were considered to be **low.**

Table 2. Birds known to be present in the site and wider Milldale area.

Common name	Species name	Conservation status	Observed on site
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised	✓
Australasian harrier	*Circus approximans*	Not Threatened	✓
Blackbird	*Turdus merula*	Introduced and Naturalised	
Black backed gull	*Larus dominicanus dominicanus*	Not Threatened	
Canada goose	*Branta canadensis*	Introduced and Naturalised	✓
Fantail	*Rhipidura fuliginosa placabilis*	Not Threatened	✓
Goldfinch	*Carduelis carduelis*	Introduced and Naturalised	
Grey warbler	*Gerygone igata*	Not Threatened	
Kererū	*Hemiphaga novaeseelandiae*	Not Threatened	
Kingfisher	*Todiramphus sanctus vagans*	Not Threatened	✓
Mallard	*Anas platyrhynchos*	Introduced and Naturalised	✓
Myna	*Acridotheres tristis*	Introduced and Naturalised	✓
Paradise shelduck	*Tadorna variegata*	Not Threatened	✓
Pheasant	*Phasianus colchicus*	Introduced and Naturalised	✓
Pied stilt	*Himantopus himantopus*	Not Threatened	
Pūkeko	*Porphyrio melanotus melanotus*	Not Threatened	✓
Silvereye	*Zosterops lateralis lateralis*	Not Threatened	
Shining cuckoo	*Chrysococcyx lucidus*	Not Threatened	
Skylark	*Alauda arvensis*	Introduced and Naturalised	
Song thrush	*Turdus philomelos*	Introduced and Naturalised	
Sparrow	*Passer domesticus*	Introduced and Naturalised	
Spurwinged plover	*Vanellus miles novaehollandiae*	Not Threatened	✓
Tūī	*Prosthemadera novaeseelandiae novaeseelandiae*	Not Threatened	✓
Welcome swallow	*Hirundo neoxena neoxena*	Not Threatened	✓
White faced heron	*Egretta novaehollandiae*	Not Threatened	✓
Yellowhammer	*Emberiza citrinella*	Introduced and Naturalised	

4.2.2 Herpetofauna (Lizards)

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

4.2.3 Chiroptera (Bats)

New Zealand has two species of endemic bats on the mainland. The most widespread is the long-tailed bat (*Chalinolobus tuberculatus*, Threatened – nationally critical), although colonies are assumed to be small and their health is largely unknown (O'Donnell et al., 2023).

The lesser short-tailed bat has three described subspecies; the northern lesser short-tailed bat (*Mystacina tuberculata aupourica,* Threatened – nationally vulnerable), the central lesser short-tailed bat (*Mystacina tuberculata rhyacobia,* At-risk – declining) and the southern lesser short-tailed bat (*Mystacina tuberculata tuberculata,* Threatened – nationally increasing) (O'Donnell et al., 2023). There are no known populations of the short-tailed bat on the mainland in the Auckland region, with the closest known population being the northern lesser short-tailed bat population on Te Hauturu-o-Toi/Little Barrier Island.

Bats roost in tree features such as hollows, under split/flaking bark, in dense epiphytes, and also in rocky overhangs. Over the warmer breeding season, large communal roosts occur in similar habitat. Long-tailed bats in particular are known to be highly mobile, with large home ranges and can travel large distances each night during foraging. They have large home ranges (>5,000 ha) and can travel large distances (~25 km) each night during foraging. Long-tailed bats are known to utilise forest edge habitats

and will also utilise linear features in the landscape, including vegetation edges, cullies, waterways, and road corridors as they transit between roosts and foraging sites.

Automatic bat monitor (ABM) surveys in 2015 and 2020 within the Milldale area detected no bat activity (Opus Limited 2015; RMA Ecology Ltd 2020). These surveys targeted key bat habitat features, including mature trees, exotic shelterbelts, streams, and open areas adjacent to vegetation. Since then, extensive earthworks and residential development have likely further reduced habitat suitability due to increased lighting, noise, and disturbance.

The nearest long-tailed bat records are from 2015, approximately 4 km northeast of the site, and from 2022/2023 within SEA vegetation on and adjacent to the Whangaparāoa Peninsula, 6 km to the southeast (DOC database, accessed May 2024). Due to low detection rates in the wider area, Milldale is not considered a high-use area for bats.

While mature trees within the ZOI could provide roost features, the vegetation is isolated with high edge effects, making it low quality for bats. In contrast, nearby SEA native bush fragments offer significantly better roosting and foraging habitat.

Given the presence of some potential habitat but a low likelihood of use, the site's ecological value for bats was conservatively assessed as **moderate**.

5 FRESHWATER ECOLOGY

5.1 Watercourses

All watercourses within the site were classified and mapped according to definitions within the AUP-OP and shown in Figure 9. Watercourse classifications were undertaken during March 2023 and re-assessed within the ZOI in November 2024. One intermittent and one permanent stream were present within the ZOI (Figure 9). Three wetlands were present outside of the ZOI but within the wider site.

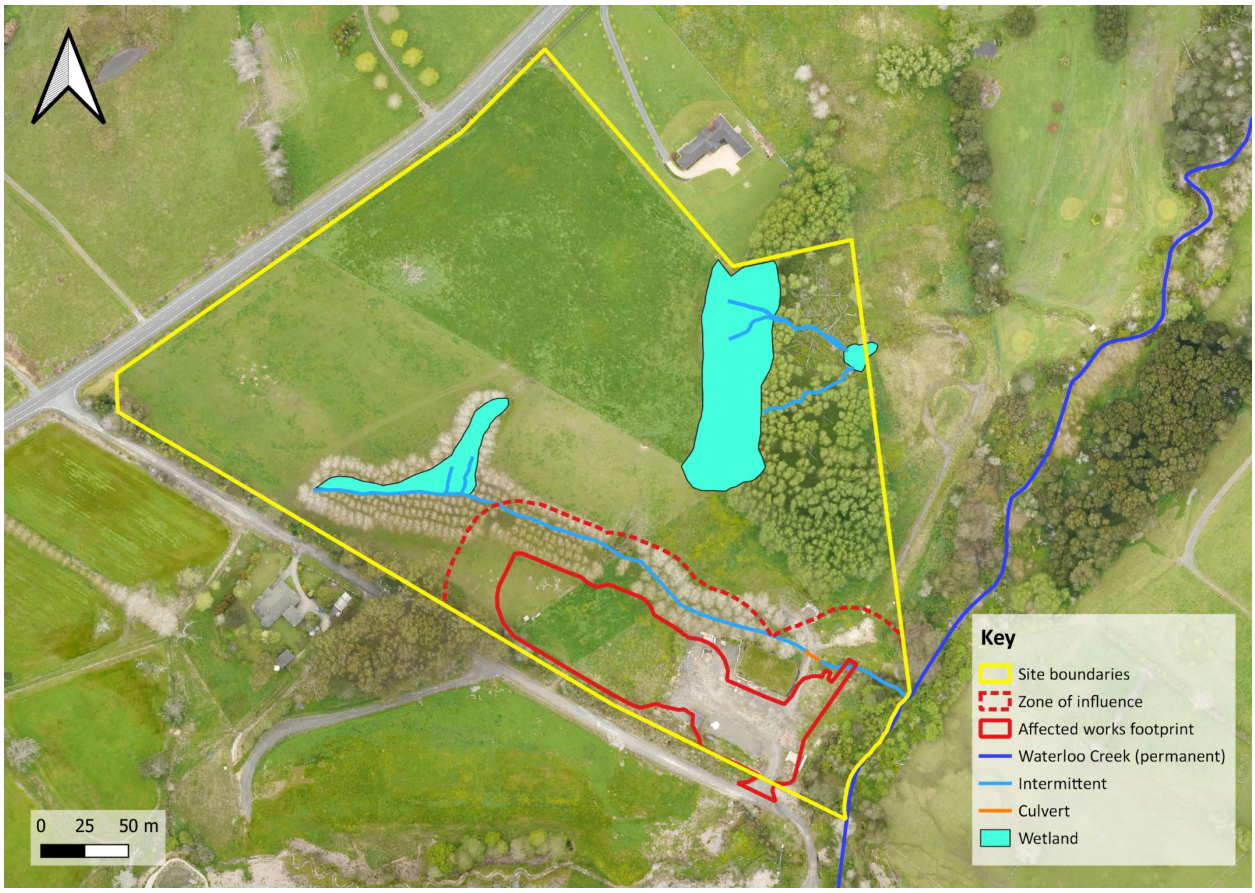

Figure 9. Map showing key freshwater features within the site.

5.1.1 Permanent stream – Waterloo Creek

Waterloo Creek is a tributary to the Ōrewa River, a high order permanent stream that drains to the Ōrewa Estuary in the east. This watercourse formed a natural boundary of the site in the east.

Waterloo Creek has been highly degraded due to historical and ongoing agricultural land use. The riparian vegetation is of generally low ecological quality, with a high abundance of pest and exotic species. In some areas, dense vegetation and steep banks restrict access to the stream from the site. Due to the agricultural land use within the wider catchment, the stream is primarily soft-bottomed with some gravel. A recent macroinvertebrate survey undertaken by Babbage Consultants Limited (2025) indicated a tolerant benthic macroinvertebrate community that reflected high sediment and nutrient loading, and overall poor water quality and stream health.

A review of the NZFFD for the Waterloo Creek showed shortfin eel (*Anguilla australis* – not threatened) and the pest fish gambusia (*Gambusia affinis* – listed unwanted organism) have been recorded previously (Dunn et al. 2018). Previous fish surveys in a permanent tributary of Waterloo Creek and parts of the now-developed Milldale area have recorded only a small number of shortfin eels (Opus

Limited 2015, RMA Ecology Limited 2020). More mobile species such as longfin eel and banded kōkopu may be present in Waterloo Creek; however, poor water quality and potential fish barriers likely limit indigenous fish diversity.

Based on the potential presence of 'At-Risk' species, the Waterloo Creek stream has conservatively been assessed as being of **moderate** ecological value.

5.1.2 Intermittent stream

An intermittent tributary of Waterloo Creek was identified within the ZOI (Figure 9). This watercourse runs parallel to the proposed works and discharges into Waterloo Creek to the east.

The stream has been significantly modified through artificial deepening, straightening, realignment, and channel clearance for farm drainage (Figure 10). An existing culvert was located just upstream of the confluence with Waterloo Creek, and this culvert is to be retained.

The riparian margin was predominantly vegetated with a canopy of tall exotic poplar trees (Section 4.1.2). Downstream of the culvert, riparian vegetation was sparse, consisting mainly of gorse patches and scattered young planted native species, including *Carex* sedges and toetoe (*Austroderia toetoe*).

During March 2023, the stream had low flow, while in November 2024, it was completely dry. The substrate was entirely soft-bottomed. Hydrological heterogeneity was low, with run habitat being dominant. While the stream may intermittently support highly mobile shortfin eels, intermittent aquatic habitat is expected to be limited to slow-flowing or stagnant water. Due to its intermittent nature, it is highly unlikely that other fish species would be present at any time of the year.

Overall, the intermittent stream was considered to have **low** ecological value due to its highly modified state, poor water quality, and lack of suitable aquatic habitat.

a) **b)**

Figure 10. a) Intermittent stream channel under poplar canopy, and b) soft-bottomed modified stream channel containing low flow in March 2023.

a)

b)

Figure 11. a) Downstream culvert facing towards Waterloo Creek, and b) the limited riparian vegetation downstream of the culvert, showing patches of gorse and planted native grasses and sedges.

5.2 Natural Inland Wetlands

Three natural inland wetlands were identified on the site as a part of an assessment previously undertaken within the site (Viridis 2023). These wetlands have not been assessed in detail in this EcIA as they are outside of the affected catchment.

Each of the three wetlands were located outside of the catchment where the works are proposed (Figure 9). All wetlands were fed by seepage, and dominated by exotic FACW species.

Viridis (2023) assessed the wetlands within the site as being of **low** ecological value, due to their small sizes, dominance of exotic species, stock damage and general lack of suitable aquatic habitat for indigenous fauna.

5.3 Summary of Ecological Values

The assessed ecological values are summarised in Table 3. The terrestrial ecological values of the site were low-moderate, with botanical values generally of low quality due to the presence of only common native species, and exotic and pest plant abundance. Moderate ecological values were attributed conservatively due to the possibility of At-Risk indigenous skink species presence and habitat for 'Threatened' long-tailed bats.

The freshwater features within the site consisted of one permanent stream, one intermittent stream, and three exotic seepage wetlands. Waterloo Creek is highly modified with poor water quality, low fish diversity, and degraded riparian vegetation. Moderate values were attributed conservatively due to the potential presence of At-Risk fish species. Its intermittent tributary was of low value, with limited aquatic habitat and a highly modified channel.

Table 3. Summary of the terrestrial and freshwater ecological values within the site.

Ecological Feature	Ecological Value
Mixed native-exotic vegetation	Moderate
Exotic tree stands	Low
Pasture	Negligible-low
Avifauna (Birds)	Low
Herpetofauna (Lizards)	Moderate
Chiroptera (Bats)	Moderate
Permanent stream (Waterloo Creek)	Moderate
Intermittent stream	Low
Freshwater fish	Moderate
Natural inland wetlands	Low

6 ASSESSMENT OF ECOLOGICAL EFFECTS

6.1 Project Overview

FHLD is seeking approval to authorise the construction and operation of a Wastewater Treatment Plant (WWTP) on Lysnar Road, Wainui. The key elements of the proposal include:

- Site compound;
- Wastewater Treatment Plant;
- Site Establishment;
- Ownership & Operation; and
- Duration & Disestablishment.

A full description of the project is provided in the application AEE.

Activities proposed that relate to ecology include bulk earthworks, earthworks within riparian yards, vegetation removal for ecological enhancement, and proposed revegetation planting. There are no proposed streamworks as a part of the works. The magnitude and level of effect that these activities have been assessed in the remainder of this section.

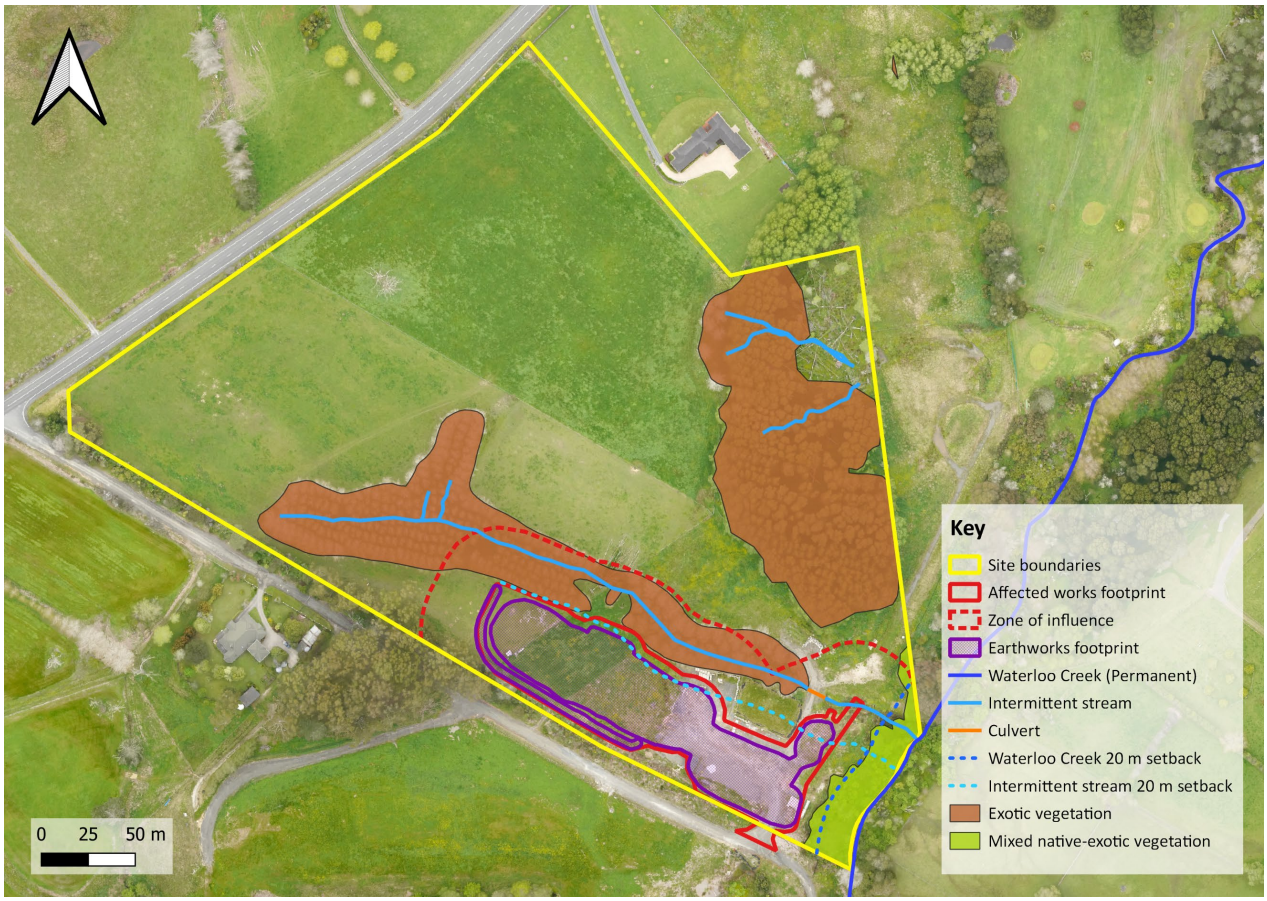

Figure 12. Proposed WWTP earthworks footprint, showing streams and key vegetation types, and the earthworks within the 20 m riparian yard of the intermittent stream.

6.2 Vegetation Removal and Enhancement Planting

The magnitude of effect of riparian vegetation removal within the site is considered to be low, and is expected to result in a **positive** effect when combined with the proposed revegetation and enhancement planting.

No tree removal is required to complete the bulk earthworks within the ZOI. Approximately half of the proposed works area consists of a gravel hard stand, and the remaining area is limited to pasture grasses only (Figure 12). The ZOI is not currently being grazed, however, the AUP-OP chapter J1 definition of 'vegetation alteration or removal' excludes "the alteration or removal of vegetation planted as a crop or pasture". The site is zoned has a rural land use, and grass within the site was originally planted as pasture and used for agricultural land uses. Thus, no vegetation alteration or removal as defined in the AUP-OP is proposed within the 20 m riparian margin to construct the WWTP.

However, to enhance the riparian vegetation along the Waterloo Creek within the site, the removal of exotic vegetation within the 20 m riparian margin is proposed. Along Waterloo Creek, the riparian margin consists of established native trees interspersed with exotic trees and a high abundance of pest plants, primarily Chinese privet. An arborist assessment identified 94 trees within this area that are scheduled for removal within the 20 m riparian margin, comprising 15 exotic trees, and 79 listed pest species (Arborlab 2024). All 129 identified native trees within the riparian margin will be retained.

The revegetation planting proposal also includes 1,166 m^2 of enhancement planting within at least 10 m on either side of the intermittent stream, downstream of the existing culvert, and along the edge of the existing bush (Appendix A). The intermittent stream within the site currently has little existing riparian vegetation within the area and is also proposed to be enhanced. Additionally, pest and exotic trees will be removed from the riparian margin of Waterloo Creek, followed by infill planting with enrichment species (as required across a 1,900 m^2 area) to enhance the existing established vegetation (Appendix A).

The planting plan includes species suited to site conditions and designed to allow for ecological succession, incorporating a mix of understorey, early successional, and canopy species. The proposed revegetation and enhancement planting will result in significant ecological benefits, increasing the extent of native and riparian vegetation, enhancing terrestrial biodiversity, improving habitat connectivity, and supporting freshwater ecosystems through shading and filtration.

6.3 Terrestrial Fauna

A draft Fauna Management Plan (FMP) has been prepared to provide an overview of the management of indigenous birds, lizards and bats for this project (refer Appendix B). This FMP will be refined and finalised as a condition of consent once the full details of the project are confirmed.

6.3.1 Birds (avifauna)

The magnitude of effect of the proposed works on birds is considered to be temporary and low, mitigated to **very low**.

Birds are highly mobile, unless they are nesting, or eggs or chicks in the nest. They can move over relatively large distances, depending on the species, to find suitable habitat as required. Clearance of trees during the bird breeding season has the potential to result in direct mortality of birds, eggs and chicks. It is recommended that removal of all tree/shrub vegetation occurs outside of the bird nesting season (October to February, inclusive). If clearance is unable to occur outside of breeding season, it is

recommended that a condition of consent requires an ecologist to inspect the affected vegetation within 24 hours of clearance. If active native bird nests are identified, a minimum 10 m buffer must be maintained around the nesting site until an ecologist deems it to be inactive (Appendix B).

The loss of, and disturbance to, habitat within the site is not expected to permanently displace the bird community. There is significant unaffected similar habitat along Waterloo Creek and in the immediate surrounds and wider landscape. It is expected any birds present within the site will move away from the disturbed habitat while works are occurring.

The proposed riparian revegetation and enhancement planting is anticipated to enhance its value for native birds by providing increased resources such as food, nesting opportunities, and shelter as the vegetation becomes established.

6.3.2 Lizards (herpetofauna)

The magnitude of effect on lizards is considered to be moderate and temporary, mitigated to **low**.

Works within the site have the potential to result in direct mortality and/or injury of any lizards present, through activities such as earthworks and the movement of machinery. The proposed bulk earthworks within the site will require the removal of rank pasture grasses. As lizards are not considered to be highly mobile, they have limited ability to move quickly to safety. Once established, the proposed native riparian revegetation planting is expected to provide good quality habitat for native skinks. Therefore, the effect on habitat is considered to be temporary.

As works in their habitat cannot be avoided during construction, it is recommended a lizard management plan (LMP) is prepared outlining how lizards will be managed during works (draft LMP in Appendix B). The LMP should include measures to capture native lizards from any suitable habitat within the site, and locations where they will be released. Additional information such as habitat enhancement at the release site and any ongoing monitoring should be provided as necessary.

6.3.3 Bats (chiroptera)

The magnitude of effects on bats is considered to be conservatively moderate, mitigated to **low**.

Tree felling when bats are utilising them for roosts or refugia has the potential to result in mortality and/or injury to any bats present. It is recommended that pre-clearance monitoring of potential roost trees as per DOC's Bat Roost Protocols (DOC 2024) is undertaken. This could be required through a resource consent condition requiring application of the DOC standards to be undertaken by a competent bat worker[2]. In summary, prior to felling, a suitably qualified and experienced ecologist should assess any tree greater than 15 cm diameter at breast height for potential bat roost habitat, and if there is potential roost habitat then further assessment (e.g., using ABMs) should be undertaken, following the protocols to ensure that there are no bats roosting in the tree. A draft Bat Management Plan (BMP) has been prepared, refer to Appendix B.

Clearance of trees is not expected to result in any significant habitat loss or population displacement of a potential bat population. The wider area is not known to be a high use area for bats, which has been reflected in previous ABM survey data. The habitat available in the site is of low quality with poor connectivity, and is heavily influenced by human activities, including increased light levels and noise

[2]A 'competent bat worker' is a suitably qualified expert who holds the relevant DOC competencies required to undertake an activity relating to bat management.

disturbance. There is unaffected habitat in the immediate vicinity, and significant higher quality habitat in the wider area which will be unimpacted by the proposed works.

6.4 Earthworks

Bulk earthworks are proposed across most of the site to facilitate urban development. Woods & Partners Consultants Limited (Woods 2025) have specified that 7,500 m^2 of earthworks will be required over the course of one earthworks season. This will include a total of 175 m^2 of earthworks within the 20 m riparian margin of the intermittent stream (Woods 2025 Figure 12). No earthworks will occur within the riparian margin of Waterloo Creek.

Erosion and sedimentation

The magnitude of effect of fine sediment release on freshwater environments is considered to be moderate, mitigated to **low** providing control measures are implemented.

Elevated levels of suspended sediment can have detrimental effects on freshwater environments including reducing light penetration, smothering food and interstitial spaces, and clogging fish and invertebrate gills. However, aquatic organisms are adapted to periods of elevated sediment in the water, as they intermittently experience this during times of high river/stream flow.

It is expected earthworks and vegetation removal will generate the release of sediment. If not carefully managed, this could enter and detrimentally effect the freshwater environment. Woods (2025) have prepared a plan detailing erosion and sediment control (ESC) measures for the development in line with Auckland Council's GD05 guidelines. Primary ESC controls for the site will utilise two sediment retention ponds. Other proposed controls include super silt fences, a stabilised construction entrance, clean water cut off drains, and bunds for conveying dirty water. Following the completion of earthworks, the topsoil will be stabilised with hay mulch (and seed/fertiliser as required) or grass will be sewn.

6.5 Wastewater Discharge

The magnitude of effect of discharging treated wastewater to land is considered to be **low**, based on the proposed wastewater treatment design.

The proposed wastewater treatment system has been designed to minimise potential ecological effects on the receiving environment. The treatment plant will utilise a Hybrid Membrane Aerated Bioreactor with Ultrafiltration Membranes (MABR+MBR Hybrid), providing a high level of treatment before discharge. Key design features, including nutrient removal and flow balancing, will ensure that treated effluent meets appropriate discharge quality standards.

Treated wastewater will be discharged via a land contact infiltration device before reaching the intermittent watercourse. This system includes multiple filtration layers, such as a 300 mm topsoil layer, a 100 mm transition layer of clean gravel, and a 500 mm engineered bioretention media layer. These layers will facilitate nutrient uptake, sediment retention, and further treatment of the discharged effluent before it reaches the freshwater environment.

The surface of the infiltration device will be planted to provide additional nutrient uptake within the discharge area. The presence of structured drainage layers, including perforated novacoil with a filter sock and graded aggregate, ensures controlled percolation and reduces the risk of surface runoff. The treated wastewater will soak into the ground from the infiltration device within the Waterloo Creek catchment.

Based on an assessment of the treated wastewater discharge, Babbage (2025) concluded that the proposed development is unlikely to have significant effects on Waterloo Creek. Modelled water quality parameters are expected to remain unchanged, improve, or stay within the same attribute band under NPS-FM guidelines, with water temperature levels also remaining stable. Increased flow rates are not anticipated to significantly alter water levels, as Waterloo Creek has a large catchment and floodplain already subject to considerable natural fluctuations. To ensure ongoing environmental protection, Babbage (2025) has recommended quarterly surface water quality monitoring for 12 months prior to, and during the first two years of WWTP operation at design capacity, before transitioning to three-yearly monitoring. Additionally, their report recommended ecological monitoring, including fish and macroinvertebrate surveys, physical habitat assessments, and macrophyte and periphyton cover assessments, occurring annually during spring for the first two years, before shifting to a three-yearly schedule.

Given the highly modified and degraded nature of the receiving freshwater environment and its existing degraded water quality, the highly treated discharge is not anticipated to cause additional adverse effects, provided treatment and infiltration processes function as designed. The incorporation of planting and filtration media will further mitigate potential ecological impacts. Ongoing monitoring and maintenance of the infiltration device and surface water quality of the Waterloo Creek will be essential to ensure long-term performance and protection of downstream freshwater values.

6.6 Stormwater Discharge

If not appropriately designed and managed, changes to the site's stormwater regime could result in adverse effects on the freshwater environment. To mitigate these risks, stormwater flows will be managed through the construction of a dry basin, located to the east of the proposed wastewater treatment area (Woods 2025, drawing P24-189-3000-DR-WWTP). Contaminants from the wastewater treatment process will be isolated within the proposed buildings and not reach the stormwater system (Woods 2025).

The dry basin is proposed to meet the hydrology mitigation requirements for the hardstand and building areas. The basin will be planted in line with planting recommendations by Beca Limited (2024).

The basin will include an outlet with riprap for scour protection, with the final design to be confirmed at the detailed design stage. Additionally, stormwater pipes draining from around the wastewater treatment area ad from the dry basin will discharge to the intermittent stream. Stormwater outlet design will include riprap to prevent scouring (Woods 2025). However, detailed design specifications will be confirmed at the final design stage. It is recommended that all outlets be designed in accordance with TP10 standards to minimise scouring and erosion, thereby reducing potential adverse effects on the receiving freshwater environment.

To further stabilise the intermittent stream channel and enhance ecological outcomes, native riparian revegetation planting is proposed on both sides of the intermittent stream downstream of the existing culvert, as specified by Beca Limited (2024). The planting schedule includes a mix of early successional and canopy species.

6.7 Natural Wetlands

The three natural inland wetlands identified within the site are all outside of the ZOI and affected catchment. None of the proposed water discharges will reach the wetlands, thus the proposal does not require consent under the NES-F provisions.

6.8 Summary of Ecological Effects

The overall level of effect for the proposed works is generated using Table 1, taking the ecological value and expected magnitude of the effect on that value. Expected levels of effect for the proposal are given in Table 4. Generally, mitigation is only required when the level of effect is expected to be moderate or higher. However, in line with best practice, a number of mitigation measures are recommended to ensure the level of effect of the proposal remains low.

Table 4. Overall level of effect of the project on ecological values.

Effect	Ecological value	Magnitude of effect before mitigation	Magnitude of effect after mitigation	Level of effect
Effect on botanical and habitat values	Low	Low	Low	Positive – following riparian planting
Effect on birds	Low	Low	Low	Low
Effect on lizards	Moderate	Moderate	Low	Low
Effect on bats	Moderate	Low	Low	Low
Effects of erosion and sedimentation	Low	Moderate	Low	Low
Effect on streams	Low	High	Low	Positive – following riparian planting

7 SUMMARY AND RECOMMENDATIONS

Viridis was engaged by FHLD to undertake an EcIA within Lot 4 DP 353309 at Lysnar Road, Wainui, which is proposed for development under the FTAA. Resource consent is required for the construction and operation of a WWTP involving earthworks, wastewater and stormwater discharges and riparian vegetation removal. Riparian enhancement planting will be undertaken to significantly improve the terrestrial and freshwater values within the ZOI.

The following measures are recommended to avoid and minimise ecological impacts during earthworks and development:

- Site management should include ensuring that no rubbish, fuel, solvents, concrete wash-down material or other related materials enter the freshwater environment;
- If tree clearance is unable to occur outside of breeding season, it is recommended that a condition of consent requires an ecologist to inspect the affected vegetation within 24 hours of clearance. If active native bird nests are identified, a minimum 10 m buffer must be maintained around the nesting site until an ecologist deems it to be inactive (draft avifauna management plan in Appendix B);
- A LMP is required as a condition of consent and is prepared and implemented by a suitably qualified and experienced herpetologist to minimise adverse effects on indigenous lizards (draft LMP provided in Appendix B);
- A consent condition to minimise adverse effects on bats that requires a resource consent condition requiring application of the DOC standards to be undertaken by a qualified competent bat worker, or the preparation of a BMP (draft BMP in Appendix B);
- ESC measures are implemented according to Auckland Council's GD05 guidelines and strictly adhered to;
- The wastewater treatment system is strictly maintained and monitored to minimise adverse effects on the downstream receiving environment; and
- Discharge outlets are designed in accordance with Auckland Council's TP10 guidance document to minimise erosion and scour.

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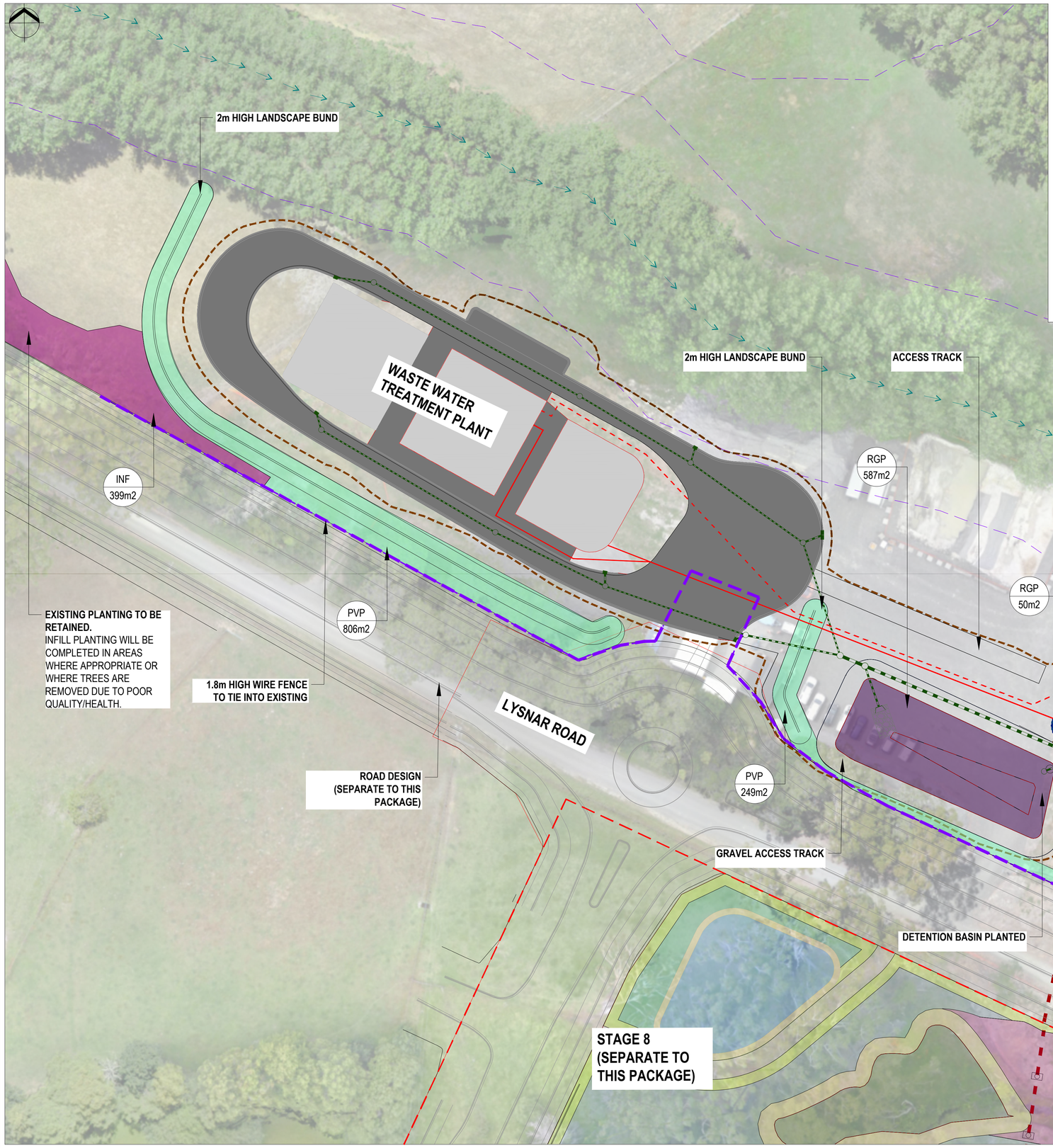
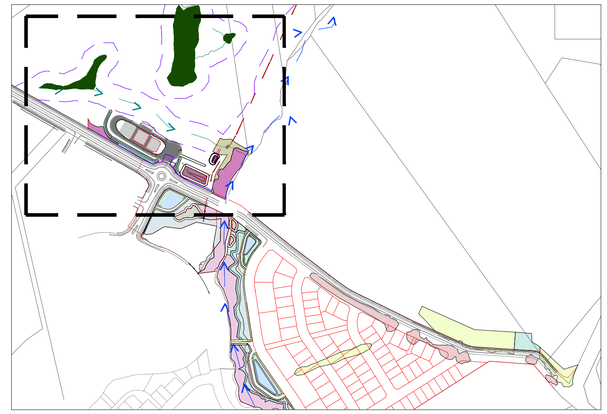
Appendix A
Landscape Planting Layout Plan – Beca Limited 2024

Drawing Plotted: 17 Dec 2024 10:05 am





CONTEXT PLAN

LEGEND

ESP - ENHANCING STREAM PLANTING

INF - EXISTING PLANTING TO BE RETAINED WITH ADDED ENRICHMENT PLANTING

PVP - PROPOSED VISUAL SCREEN PLANTING

RGP - RAIN GARDEN PLANTING

FOR PLANT AREAS AND SPECIES, REFER TO PLANT SCHEDULE, DRAWING 4672100-AL-S9-3000

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ORIGINAL DRAWING IN COLOUR

FOR INFORMATION
NOT FOR CONSTRUCTION

No.	Revision	By	Chk	Appd	Date
A	FOR INFORMATION	DD	JC	JC	16.12.24

Original Scale (A1) 1:400 @ A1	Design	J. COOKE	04.12.24
	Drawn	D. DAY	16.12.24
Reduced Scale (A3) 1:800 @ A3	Dsg Verifier	J. COOKE	16.12.24
	Drg Check	J. COOKE	16.12.24

Approved For Construction* Date

* Refer to Revision 1 for Original Signature

Beca

Client: FULTON HOGAN LAND DEVELOPMENT

Project: MILLDALE WASTEWATER TREATMENT PLAN LANDSCAPE LAYOUT PLAN

Title: PLANTING PLAN SHEET 1 OF 2

Discipline: LANDSCAPE

Drawing No.: 4672100-AL-S9-1000

Rev.: A

Document No. 4672100-AL-S9-1000.DWG

DO NOT SCALE FOR SET OUT DIMENSIONS

Appendix B
DRAFT Fauna Management Plan

1 AVIFAUNA MANAGEMENT

Clearing of vegetation has the potential to negatively impact on birds, particularly if birds are nesting in vegetation at the time it is cleared. Native avifauna are legally protected by the Wildlife Act 1953 (WA) and significant habitats for indigenous fauna are protected under the Resource Management Act 1991 (RMA).

Wildlife Act (1953) Authority

Most indigenous birds are legally protected under the Wildlife Act (and subsequent amendments). A Wildlife Act Authority (WAA) is required to capture, handle, and relocate native wildlife.

Resource Management Act 1991

Landscape features that provide significant habitat for indigenous species, including birds, are protected under the RMA (Section 6(c)). This includes ostensibly low value exotic vegetation that can support populations of native birds.

1.1 Potential Adverse Effects on Birds

The project requires earthworks and vegetation clearance. If indigenous birds are present within the affected area, potential adverse effects on birds may include:

Direct effects:

- Adult and chick mortality during physical clearance/construction works
- Injury during physical clearance/construction works

Indirect effects:

- Temporary loss of habitat
- Temporary noise and dust disturbance
- Disruption to nesting and breeding behaviour

Site development cannot be achieved without vegetation removal, and therefore potential adverse effects on native birds cannot be avoided. Adult birds are highly mobile and expected to move to nearby unaffected habitat once disturbance commences. Nesting birds and chicks that have not fledged are unable to move away. Therefore, managing effects on birds requires mitigation through monitoring for signs of nesting activity and displays of breeding behaviour.

To mitigate the effects of direct mortality and indirect disturbance on breeding and nesting birds, the following protocol will be followed for all vegetation that will be cleared.

1.2 Bird Survey and Management

1.2.1 Timing

In the first instance, vegetation clearance between 1 September and 28 (29) February should be avoided where practicable.

If vegetation clearance must occur within this time frame, the nesting bird survey protocols will be adopted, as detailed below.

1.2.2 Nesting bird survey

- A survey will be undertaken to identify if and/or where native bird nesting behaviour (including courtship, nest building, and active nesting) is occurring.
- The survey will be completed by an appropriately qualified ecologist.
- The survey will include inspections for tree cavities, tree nests and ground nesting species such as pūkeko.
- Where no nesting behaviour or activity is observed, the vegetation may be cleared within 24 hours of the survey being completed. If clearance does not occur within 24 hours, the area must be surveyed again to verify the absence of nesting behaviour prior to clearance.
- If nesting behaviour, or an active nest is located, an exclusion area with a diameter of 10 m will be demarcated around the tree (or nest if it is a ground nest) and works shall not occur within this cordon until it has been confirmed by the appropriately qualified ecologist that all nestlings have fledged. Once the appropriately qualified ecologist has confirmed this, the vegetation may be cleared.

1.3 Inadvertent Bird Injury or Death

If a native bird is found injured or dead during vegetation clearance, the following steps will be taken:

- Injured native birds will be placed in an appropriate carrying box/cloth bag and immediately transported to a veterinarian for assessment.
- If the species has a conservation status of At Risk or Threatened (Robertson et al. 2017), the local Department of Conservation (DoC) office will be contacted as soon as practicable, but within 24 hours.
- All deceased birds (including those found dead on site, or any that are ultimately euthanised by a veterinarian) will be transported to the local DoC office as soon as practicable.
- All injuries or mortalities will be accurately recorded and reported to DoC on request.

Native bird management is required in all areas where vegetation clearance will occur, including the grassed paddocks on the flat portion of the site.

1.4 Management of Dotterels

The site does not currently provide habitat for NZ dotterels (*Charadrius obscurus aquilonius*; Threatened – Nationally Increasing). In Auckland they tend to favour open areas and bare ground. They are known from the wider Milldale and Silverdale area, with eBird.org records showing them in various urban areas, though mostly around the fringe. As works progress, it is expected the open areas will be generated by earthworks and clearance of the pasture within the site. It is possible that they may utilise these open areas as they become available. Dotterels are known to establish nests on construction sites where habitat conditions are suitable.

1.4.1 Deterrence

From July onwards, dotterels begin looking for breeding territory. Weekly inspections of the works area should occur to determine if dotterels are present. Breeding dotterels are territorial and will show defensive behaviour to anything that they think is a threat (including people). Defensive behaviour includes alarm calls, running in front of potential threats to distract and lure them away (‘rat run’), and

pretending to be injured ('broken wing'). It is this behaviour that should be looked for during weekly site inspections.

The easiest method to manage dotterels on a site is to deter them from establishing nests in the first place. From early July onwards, one or more of the methods in Table 2 should be employed to discourage dotterel presence within the site.

Table 1. Deterrence options (adapted from NZTA, 2012[1]).

Method	Description	Likelihood of success	Comments
Long grass	Allow grass to grow long so not considered by dotterels to be a good place to lay eggs.	High	Leave grass to grow from at least April to ensure it is long
Machinery*	Park large machinery close to where dotterels are showing an interest. Start the engine from time to time.	Moderate	Machinery cannot be left for long periods or the birds may get used to it.
Silt fences	Erect shade cloth at knee height. Place in rows. Space at 5– 10 m.	High	These fences obscure dotterel vision from nesting sites as they actively seek areas with good sight lines
Metallic or reflective tape	Streamers attached to posts that flutter when there is wind	Moderate	Works for a short time (up to three weeks) and then birds habituate

* to be used in early to mid-July only. If nests establish, movement of machinery increases the risk of nest damage.

The likelihood of success column used in Table 2 has been developed based on known dotterel behaviours. However, they are known to become used to activities, such as machinery, if it is left stationary for any period of time, and reflective tape can become ineffective within a few weeks. Actions that alter the site to make it less attractive for nesting are considered to be the most effective options over a long period of time.

1.4.2 Eggs found within the construction zone

If, despite deterrence options being in place, eggs are still found within the construction zone, the following measures should be followed.

- If eggs are found on the ground within the construction zone activities within 50 metres of the nest are to stop immediately and people are to leave the area.
- Contact the project ecologist.
- If the nest needs to be marked in order for the project ecologist, or others, to find it the markers should be at least 10 m away from the nest. Use two on either side of the nest if necessary as long as they are at least 10 m away.
- The project ecologist will monitor the nest on a weekly basis to confirm when chicks have fledged (usually 6-7 weeks after hatching). Once this has occurred, the ecologist will confirm when works in the area can re-commence.

[1] NZTA. 2012. Guidance in Relation to New Zealand Dotterels on NZTA Land. NZ Transport Agency, Wellington.

2 HERPETOFAUNA MANAGEMENT

2.1 Management of Potential Adverse Effects on Lizards

2.1.1 Statutory protections and management of lizards

Wildlife Act (1953) Authority

All indigenous lizards are legally protected under the Wildlife Act (and subsequent amendments). A WAA is required to capture, handle, and relocate native wildlife.

Resource Management Act 1991

Landscape features that provide significant habitat for indigenous species are protected under the RMA (Section 6(c)). This includes ostensibly low value exotic vegetation that can support populations of native lizards.

2.1.2 Potential adverse effects on lizards

The project requires earthworks and vegetation clearance. If indigenous lizards are present within the affected area, potential adverse effects on lizards may include:

Direct effects:

- Lizard mortality during physical clearance/construction works
- Injury during physical clearance/construction works

Indirect effects:

- Temporary loss of habitat
- Temporary noise and dust disturbance

Site development cannot be achieved without vegetation removal, and therefore potential adverse effects on indigenous herpetofauna cannot be avoided. Managing the effects on lizards requires mitigation through a salvage and relocation programme and potential release site habitat enhancement.

2.1.3 Project herpetologist

A suitably qualified herpetologist or ecologist ('project herpetologist') is required to implement all herpetofauna management, and a WAA to capture and relocate indigenous lizards is required.

2.2 Lizard Search and Capture Methodology

Lizard capture and relocation will be associated with consented vegetation clearance activities through the methods outlined in this section.

2.2.1 Timing of activities

Vegetation clearance should occur between October and April (inclusive); lizard salvage activities are confined to warmer months when lizards are the most active and likely to be detected if present.

All lizard management activities are required to be undertaken during fine, calm, and dry weather.

2.2.2 Destructive searches

Destructive searches will be undertaken by the project herpetologist prior to vegetation removal, in coordination with the appropriate contractor undertaking the clearance works. This will involve

systematic manual searches of suitable habitat (e.g. log piles, tree bark) and destruction of habitat where practicable. Leaf litter, ground cover vegetation and small debris may be hand-raked, and larger debris overturned to search for refuging lizards.

2.2.3 Felled trees searches

Destructive searches involve searching through branches and foliage of felled vegetation. The crowns of large trees shall be felled intact as far as practicable. All branches and foliage of felled vegetation will be thoroughly searched. Where practicable, the crowns of any larger trees that cannot be fully searched after felling should be left in any areas of vegetation to remain on site, to allow any undetected lizards to disperse naturally.

2.2.4 Construction (machinery) assisted searches

Suitable ground cover will be searched during machine-assisted clearance. The machine will be fitted with a toothed scraping bucket (or similar) during vegetation clearance to lift habitat such as non-woody vegetation, logs, and debris piles.

Machine-assisted searches will continue until all habitat for lizards has been removed and there is no suitable habitat for native lizards remaining within the affected area, as assessed by the project herpetologist.

2.2.5 Post-clearance search

At the conclusion of the machine-assisted searches and vegetation clearance, the suitably qualified ecologist would undertake a final site walk over to detect any remaining lizards.

2.2.6 Lizard handling and containment

All indigenous lizards found during the destructive searches, machine-assisted searches and post-clearance search, will only be captured and handled by, or under supervision of, the DoC-authorised suitably qualified ecologist. Hands should be sterilised before and after handling lizards, along with all field equipment that indigenous lizards may encounter.

All captured lizards would be placed in a holding container(s) with adequate ventilation and kept at ambient temperature. Vegetation, soil and leaf litter from the capture site will be placed in the box to provide shelter and protection during containment/transport. Lizards would only be held temporarily for the period of the active searches or trap inspections, before being released at the approved relocation site (refer Section 4.4).

It is not anticipated that lizard taxa with conservation statuses higher than ‘At Risk’ would be encountered on-site. However, if ‘Threatened’ lizard species were encountered, the individual(s) would be captured and temporarily contained, and the local DoC office contacted for further instruction.

2.3 Inadvertent Lizard Injury or Death

The following steps will be implemented should any injured or dead indigenous lizards be found during the vegetation clearance activities:

- The project herpetologist would notify DoC at soon as possible (within 24 hours);
- Any lizard death of ‘Threatened’, ‘At Risk’ or ‘Data Deficient’ species shall be sent to Massey University Wildlife post-mortem service for necropsy. The body should be chilled if it can be delivered within 24 hours, or frozen if delivery will take longer than 24 hours;

- Where appropriate, measures shall be undertaken to minimise further lizard deaths;
- Injured lizards found during salvage will be taken to a suitably qualified vet as soon as possible for assessment and treatment. Injured lizards will be kept in an appropriate portable enclosure (i.e., a clean, well-ventilated (plastic container) under the direction of the project herpetologist to ensure the lizard is handled appropriately until it can be treated;
- Lizards assessed by the vet or alternative specialist as uninjured, or otherwise in suitable condition for release, would be transported to the relocation site in the portable enclosure and released; and
- Euthanasia of an injured lizard is only to be undertaken under direction from DOC.

2.4 Release Site

All salvaged indigenous lizards are required to be released into an approved release site. Factors that should be considered when selecting a release site include ecological appropriateness, long-term security, habitat suitability, and protection from predators and future human disturbance (DOC Lizard Technical Advisory Group, 2019). Key considerations include, but are not limited to, the following:

- It is important that the release site is an appropriate distance from the project footprint to prevent the lizards from re-entering the works area. However, the release site should be located as close as possible to the salvage site to help retain similar microhabitats and environmental conditions.
- The habitat within the release site should be representative to, or of higher ecological value than the salvage site.
- Areas with long-term protection should be favoured, such as reserves managed by DoC or Council, vegetation covenants or areas protected by Auckland Unitary Plan provisions (e.g., SEA overlay, riparian habitat).
- Potential existing species composition and density at the release site should be considered as far as practicable, to limit potential adverse effects of intra- and inter-species competition at the release site.

2.4.1 Proposed release site

It is generally preferred that lizards are relocated within or adjacent to the project footprint as far as practicable, to maintain local biodiversity and reduce the risk of adverse effects that may occur with longer distance relocations. A key consideration of relocation is ensuring the habitat suitability (quantity and quality) is present to support relocated lizards.

[Details within this section will be included in the final Fauna Management Plan, and will recommend release sites within the site, and/or within the surrounding environment. Figure showing potential release sites will be included.]

2.4.2 Habitat enhancement

Refuge structures (e.g., felled logs, rocks, branches) should be recovered prior to vegetation clearance by the project herpetologist and relocated into the release sites. In addition, if five or more indigenous lizards are captured for relocation, the implementation of supplementary refugia is also recommended prior to lizard release. The provision of permanent refuges, including but not limited to log piles, natural debris (e.g. decaying vegetation), artificial cover objects (i.e., Onduline sheets) and rock piles should be

installed to supplement the natural refuges already present. Salvaged skinks would be released beneath these refuge structures to provide immediate protection.

2.5 Capture Trigger

If more than 20 native lizards are captured, then contact should be made with DoC immediately to discuss the next steps. These may include continuation with the current programme, additional habitat enhancement and/or protection, or the requirement of additional permits.

2.6 Completion Reporting

A completion report or Amphibian/Reptile Distribution Scheme (ARDS) Card will be prepared by the project herpetologist and submitted to Auckland Council within 30 days of the completion of all vegetation removal. The information provided should detail the number of lizards captured and the locations they were captured from, and whether any post-release monitoring (and timing) is recommended based on the number of lizards salvaged.

3 BAT MANAGEMENT

All vegetation removal should occur under the following protocols. The protocols are required to minimise the likelihood of adverse effects on potentially occupied bat roosts as vegetation is cleared. They have been adopted from the *Protocols for minimising the risk of felling bat roosts* prepared by the New Zealand Bat Recovery Group[2]. If no bats were detected during the pre-vegetation clearance survey, felling can occur without implementation of the protocols.

3.1 Identification of Potential Roost Habitat

All trees to be removed within the site should be visually assessed prior to vegetation clearance by an appropriately qualified ecologist with Competency 3.3[3]. Each tree should be classified as either high risk, or low risk, with regard to bat roost habitat.

Low risk trees have a diameter at breast height (DBH) of ≤ 150 mm.

High risk trees have a DBH of ≥ 150mm and have one or more of the following features:

- Holes, cavities, crevices, cracks and/or fractured limbs that could potentially support roosting bat/s
- Hollow trunks and/or branches
- Loose, flaking bark, or deep incised bark crevices that could potentially support bat/s
- Deadwood (including debris caught in tree forks) or epiphyte communities in the canopy or in the trunk that could potentially support bat roosts
- Evidence of bat droppings, grease marks and/or urine staining around cavities

All low-risk trees can be felled at any time, subject to requirements of other management measures (e.g. for birds). The only exception is where low risk trees have evidence of bat droppings, grease marks and/or urine staining around cavities, in which case they will be treated as high-risk trees.

High risk trees, including adjacent groupings of high-risk trees will be subject to a pre-felling assessment. Pre-felling assessments will be undertaken by an appropriately qualified ecologist.

3.2 Pre-felling Procedures

High risk vegetation should only be cleared between 1 October and 30 April to align with the season when bats are active. A Competent Bat Worker[3] (CBW) will be present to supervise the clearance of all high-risk vegetation and they must be available at all times during the vegetation removal stages in order to respond immediately to any incidental discoveries of bats within the site.

The following procedure must be adhered to:

- All high-risk vegetation will be clearly identified by a CBW prior to clearance commencing.
- All high-risk vegetation will be acoustically monitored using ABMs for two consecutive nights (with optimal weather conditions[2]; Table 3) immediately prior to vegetation removal. Results will be

[2] DoC 2024. Protocols for minimising the risk of felling occupied bat roosts (Bat Roost Protocols). Dated October 2024.

[3] A person who has been certified as 'Competent' in a particular skill by the NZ Bat Recovery Group.

analysed the following morning, as early as possible. If vegetation removal does not take place the day after monitoring, monitoring will continue until it does.

- Where a night does not meet optimum conditions[2] (Table 3), monitoring must continue to take place until a total of two consecutive nights of optimum conditions have been monitored.
- If no bats are recorded:
    - The ecologist will notify the site manager immediately after data is reviewed, and permission will be given to clear the monitored vegetation within 24 hours.
- If bats are recorded:
    - If bat activity recorded on the ABM/s suggest bats may be roosting in the vicinity of the ABM, or if a bat roost is observed, the site manager shall be notified immediately after reviewing the data and the affected vegetation cannot be cleared until additional investigations have been completed.
    - The ABM survey must continue until no bat activity has been recorded for two consecutive nights; OR
    - If safe to do so, the suspected roost/s will be visually assessed by an arborist trained to identify bat roosts. The arborist will take photos of any roosts or roost evidence found. If necessary, an endoscope and handheld bet detector will be used to examine potential features.
- If bat roosts are confirmed:
    - The tree/s will not be removed until further acoustic monitoring (for seven nights) confirms the bats have abandoned the roost.
    - The tree/s will be clearly marked and a 10 m radius exclusion zone established around the site. The zone will be identified with fencing or other appropriate materials. All relevant people (e.g. site manager, vegetation contractors) will be notified the area must be left as is.
    - Representatives from DoC and Auckland Council will be informed via email, of the relevant information, including photos if available. The CBW, DoC and Council will agree on options for next steps in the event roosting continues after seven nights.
    - If bats are still roosting in the tree/s after seven nights, a meeting will be held between the CBW, site manager, DoC and Council to determine an appropriate way forward. The meeting must occur within three days of the end of the seven day monitoring period.
    - Immediately following clearance of high-risk vegetation, trees will be inspected for bats and evidence of bat roosts by the CBW.

Table 2. Optimal weather conditions required for bat surveys[2] (derived from DoC 2024).

Component	Conditions
Timing	Begin one hour before sunset and end one hour after official sunrise
Temperature	Temperatures of 8°C or higher for the first four hours after official sunset
Wind	Little to no wind of ≤ 20 km/hour for the first four hours after official sunset
Precipitation	Little to no precipitation (≤ 2.5mm) in the first four hours after official sunset

3.3 Managing and Reporting Injury or Mortality

If any living bat/s are found during or after vegetation clearance that are not able to fly away, they will be taken immediately to a veterinarian for assessment. Bats will be placed in a clean, dark, cotton bag by the CBW, and then in a carrier to ensure safe transportation. The site manager, and relevant representatives from DoC and Council will be notified as soon as practicable, but within 24 hours of the bat being found. Any bat found dead or subsequently euthanised by a veterinarian will be returned to DoC.

Bats assessed by the veterinarian as uninjured will be transported back to site in the cotton bag and placed in an open, temporary artificial roost box suspended within a tree outside of the site but as close as possible to the site the animal was found. The roost box will be open to allow the animal to come and go as it chooses and will be placed within the tree prior to dusk on the same day the bat is found.

3.4 Bat Mitigation

If bats are detected on site during the pre-vegetation clearance survey, mitigation in the form of habitat enhancement will be required if vegetation to be cleared is identified as suitable for bat nesting/roosting.

To replace roosting habitat following vegetation clearance, artificial bat roost boxes will be installed in area suitable for roosting, as directed by the CBW. Emphasis should be placed on the established riparian bush areas or SEAs in the immediate surrounding environment, as they will be largely protected from future vegetation clearance.

The number of roost boxes will be installed at a rate of one per every 10 high risk bat roost tree/s removed. The boxes should be installed at a minimum height of four metres from the ground, with no clutter within 2 m of the box opening. ‘Possum bands’ will be wrapped around each tree where a box is installed to deter mammalian predators. Any bat box installed must be checked annually to remove any nesting materials that have been brought in by birds.

In recent years, several bat box designs have been installed at sites in New Zealand:

- A timber ‘Kent’ bat box design (Auckland Council);
- A timber ‘Microbat box’ design (Auckland Council);
- A bespoke timber design similar to the ‘Kent’ (Waikato Regional Council); and
- Four Schwegler ‘woodcrete’ designs (models 2F, 2FN, 1FF and 1FD; DoC, South Canterbury).

Any of these designs are considered suitable for use within the site, as needed.

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