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PC2 Ecological Impact Assessment: 47 Golding and 50 Pukekohe East Roads

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Cover Illustration: 47 Golding Road & 50 Pukekohe East Road, Pukekohe (photo taken on 7 April 2021).

CONTENTS

1 INTRODUCTION

Bioresearches was engaged by OMAC Ltd. and Next Generation Properties Ltd. to undertake an ecological impact assessment (EcIA) of the properties at 47 Golding Road and 50 Pukekohe East Road, Pukekohe, to support a Private Plan Change (PPC) application. The PPC seeks to rezone approximately 27.2 ha of Future Urban Zone (FUZ) land to Residential – Mixed Housing Urban (MHU) zone and include a protected ecological area, parks and drainage reserves. The PPC area ('the site') is located in the Auckland suburb of Pukekohe between Pukekohe East Road and Golding Road, Valley Royal Way and the Auckland/Waikato regional boundary (Figure 1).

This report details the ecological value of existing terrestrial and freshwater features on the site and evaluates how the proposed PPC may impact the value of these features. A freshwater assessment identified the presence of permanent streams and associated natural wetlands around these streams. The terrestrial ecological assessment identified riparian margins surrounding these wetlands, along with scattered exotic and native vegetation present on the property.

This report addresses how the main ecological features on-site will be impacted and managed if the PPC is approved, and recommendations are provided to aid in the avoidance, minimisation, or remediation of adverse effects that could arise from the rezoning. It was concluded from the EcIA that the proposed zone change to an MHU zone would ensure adequate maintenance and enhancement of ecosystem services, indigenous biodiversity and vegetation cover while accommodating the appropriate subdivision, use and development of urban land.

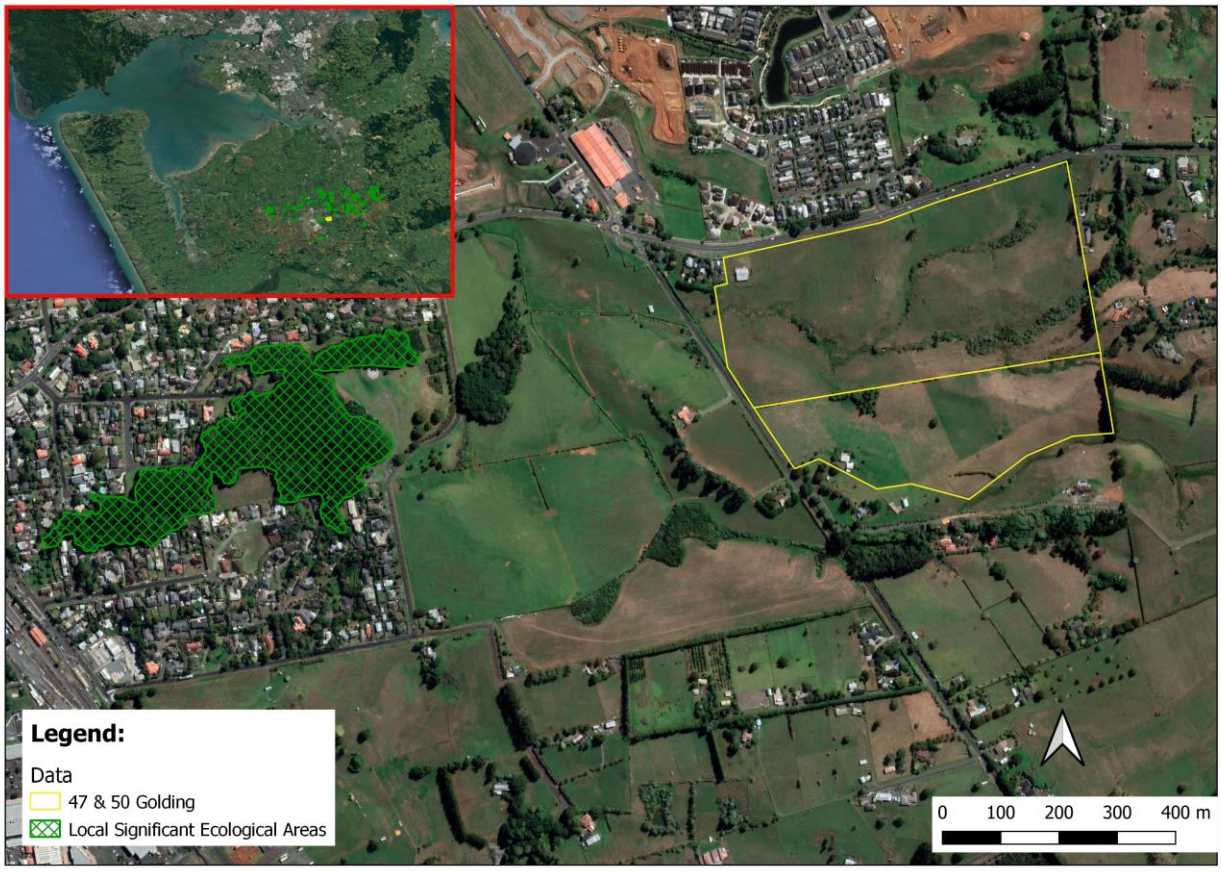


Figure 1. An aerial image of the site, the approximate boundaries of which are shown in yellow. Local SEAs are shown in green hatching.

2 METHODS

An experienced ecologist undertook site assessments on 7 April and 10 August 2021 to assess the ecological values within the site. Before the field surveys occurred, a site map was created from Auckland Council Geomaps, which defined overland flow paths of watercourses, contours of the property and any ecological overlays. Assessments of freshwater habitats, vegetation and potential fauna habitats were noted during the site visit, and photographs of the site were taken. These notes and photographs were used to assess the ecological values of the terrestrial and freshwater ecosystems. A desktop analysis of relevant databases was also undertaken.

2.1 Terrestrial Ecology

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

Fauna habitats were assessed qualitatively, in conjunction with database reviews (e.g. Department of Conservation's ARDs, Bioweb, eBird, iNaturalist) and considered indigenous lizards, birds, and bats. Opportunistic fauna observations (birds seen or heard) were also recorded during the site visit.

No formal herpetofauna (reptile and amphibian) survey was undertaken on the site due to a lack of potential habitat. However, a review of historic lizard records from within 10 km of the project was undertaken, and an artificial cover object (ACO) survey was completed at the neighbouring site (19 Golding Road & 53 Birch Road) in March-April 2022 (refer Section 2.1.1).

2.1.1 Herpetofauna survey

Ten stations of four ACOs were scattered throughout the forest block at 19 Golding Road & 53 Birch Road. ACOs were installed at locations most likely to provide an opportunity for native lizard encounters. These areas supported dense leaf litter and edge vegetation that provide potential habitat for terrestrial lizards, especially skinks. ACOs were left in situ on 11 March 2022 to acclimatise for a minimum of four weeks, allowing time for potential resident lizards to habituate the ACOs. A minimum of three inspections of all ACOs were undertaken during fine, settled weather.

A nocturnal search was completed using powerful headlamps (LED Lenser™ H7), aided by Nikon Monarch™ 8 x 42 binoculars, to search for geckos on the ground, on tree branches and in foliage. The nocturnal search began after dusk, during settled and dry weather and targeted the edges of the forest block. The search for arboreal geckos was completed by slowly scanning potential habitats with a focused light beam, searching for the lizards' distinctive body shapes and reflective eyeshine (Whitaker, 1994).

2.1.2 Chiroptera survey

A desktop analysis using local chiroptera (bats) records from specific databases and a bat survey was executed. The bat survey comprised of five acoustic recording devices (ARDs), set throughout the sites, in locations that could provide edge fly-ways, facing trees that support bat roost characteristics (e.g. trees over 15 cm diameter at breast height, cavities, dense epiphytes) or along the watercourse. The survey covered the neighbouring site, 19 Golding Road & 53 Birch Road, Pukekohe and the current Site.

All ARDs were set 2-4 m above ground and clear of vegetation that may interfere with recording. The ARDs were set to begin recording 30 minutes before sunset and turn off 30 minutes after sunrise. They were left in situ for up to four weeks.

2.2 Freshwater Ecology

During the site assessment, the presence and extent of streams and wetlands within the site were noted, and the quality of any freshwater habitat was visually assessed.

Overland flow paths were ground-truthed and classified under the definitions in the Auckland Unitary Plan – Operative in Part (AUP OP) as to their permanent, intermittent or ephemeral status. Freshwater habitat was assessed, noting ecological aspects such as channel modification, hydrological heterogeneity, riparian vegetation extent, substrate type and any fish or macroinvertebrate habitat observed. Riparian and catchment information was also reviewed, and the NIWA New Zealand Freshwater Fish Database (NZFFD) was examined for fish species potentially present within the site.

Potential wetland areas were assessed following the Ministry for the Environment's (MfE) wetland delineation protocols[1], including vegetation assessments and wetland hydrology, to determine whether the areas meet the definition of a 'natural wetland' under the National Policy Statement for Freshwater Management 2020 (NPS-FM). Wetland assessments included identifying native and exotic vegetation species, examining the structural tiers within wetland areas, and assessing the quality and abundance of aquatic habitats. Signs of wetland degradation, such as pugging and grazing from stock access, structures such as culverts impeding hydrological function, and weed infestation were also noted.

Vegetation was assessed based on the dominance and prevalence of:

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

2.3 Ecological Impact Assessment

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

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

[1] Ministry for the Environment (2020). Wetland Delineation Protocols.

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

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

Determining factors	Value
Nationally threatened species, found in the ZOI[2] either permanently or seasonally	Very High
Species listed as 'At-Risk' – declining, found in the ZOI, either permanently or seasonally	High
Species listed as any other category of 'At-Risk' found in the ZOI either permanently or seasonally	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pests, species having recreational value	Negligible

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

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

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

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

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

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

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

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

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

3 EXISTING ENVIRONMENT

3.1 Background and Ecosystem Classification

The 27-ha site is situated within the Manukau Ecological District of the Auckland Region and is bordered by residential developments and large agricultural properties. Currently, the site consists of managed pasture, one dwelling and a mix of exotic and native vegetation (Figure 1).

The site is not recognised as a natural terrestrial ecosystem as classified under the AUP-OP: Biodiversity current extent GIS data set; however, it has unclassified (UC) ecosystems along the eastern boundary. The site is not subject to any Significant Ecological Areas (SEA) (Singers *et al.,* 2017).

Historically (pre-human era), the site would likely have been comprised of pūriri, taraire forest (WF7-2) (Singers *et al.,* 2017), as seen under Auckland Council Geomaps Ecosystems Potential Extent GIS Layer. The flora characteristics of the pūriri forest ecosystem would have likely included mixed broadleaved species, such as pūriri, karaka, kohekohe and locally, taraire and kohekohe. This ecosystem type would likely have supported a diverse range of invertebrates, amphibians, reptiles, birds, and bats. However, historical images indicate that the site and much of the surrounding landscape have been cleared for at least 80 years and managed for agricultural purposes (Figure 2).

Figure 2. Historical aerial image of 47 Golding Road and 50 Pukekohe East Road sites, dated 1942. The approximate site boundary is shown in yellow. Image sourced from Retrolens.

3.2 Terrestrial Ecology

The terrestrial ecological features of the site are comprised of riparian areas surrounding wetlands, amenity plantings and pasture. The ecological values of these features are linked to the terrestrial fauna that are expected to utilise these features.

3.2.1 Vegetation

The site's vegetation cover has been classified and mapped utilising site visit observations and aerial images (Figure 3). Figure 3 shows two main areas of vegetation which were differentiated based on the type of species observed in each area. The main terrestrial vegetation types are discussed below.

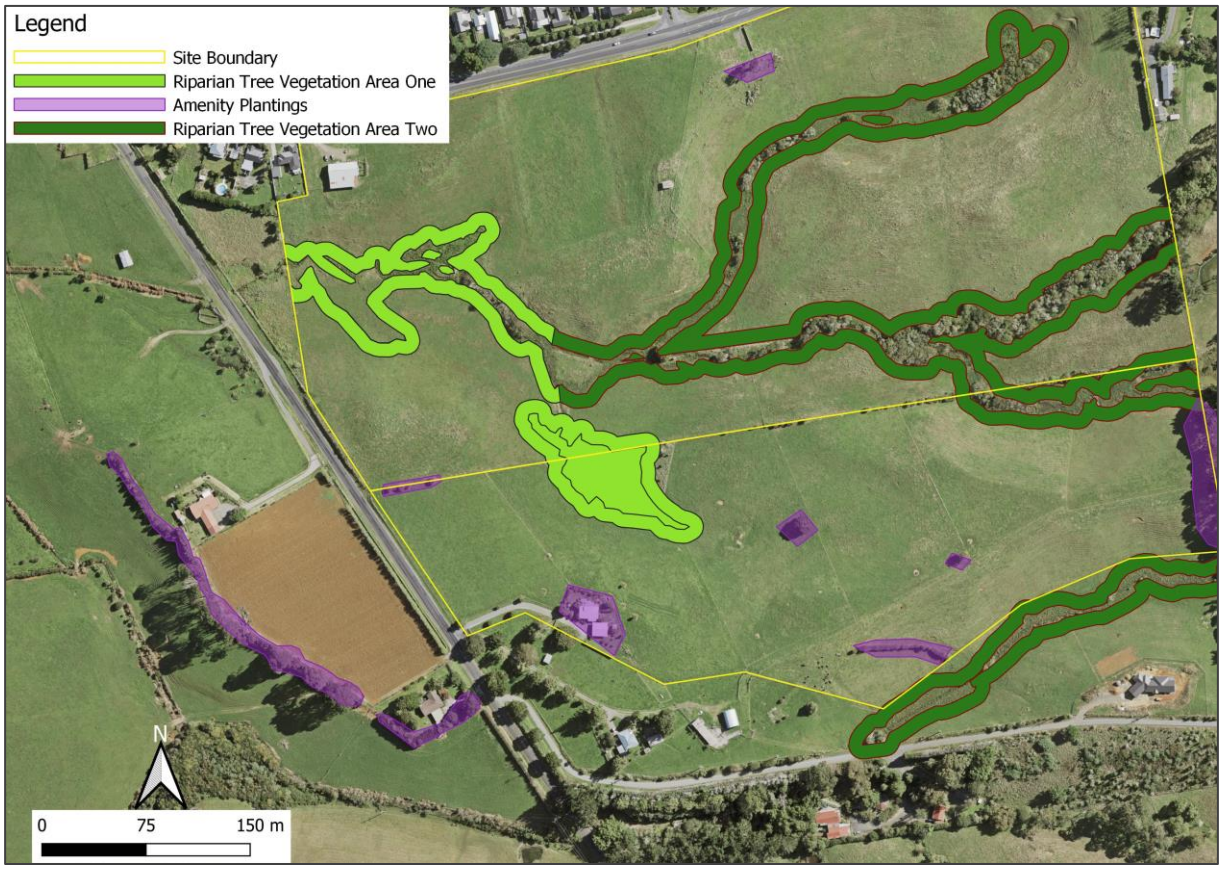


Figure 3. Key terrestrial features identified on site.

3.2.1.1 Riparian Tree Vegetation Area One

Riparian tree vegetation ran along the stream banks and was seen throughout the wetland areas. Native species identified in the north-western region of the site included lemonwood (*Pittosporum eugenioides*), kahikatea (*Dacrycarpus dacrydioides*), cabbage tree (*Cordyline australis*), ake ake (*Dodonaea viscosa*), and exotic/pest species included woolly nightshade (*Solanum mauritianum*), oak tree (*Quercus* sp.) and willow (*Salix* sp.). Due to the mix of common natives and exotic species within the riparian areas (Figure 4), this area was considered to have low ecological value.

3.2.1.2 Riparian Tree Vegetation Area Two

Riparian tree vegetation was observed adjacent to the stream, with willow trees being the dominant species (Figure 5). The occasional woolly nightshade and juvenile karamū (*Coprosma robusta*) were identified throughout the wetland, and the trees became denser towards the eastern side of the

wetland. Due to the dominance of exotic species within the riparian area, the ecological values of these features have been assessed as low.

3.2.1.3 Other Vegetation

On the remainder of the site, a few sparse young trees and shrubs were present as hedges, pasture and amenity plantings (Figure 6 and Figure 7). These included cabbage trees, tōtara (*Podocarpus totara*), various pine species (*Pinus* sp.) and barberry (*Berberis glaucocarpa*).

A mix of mature native trees and exotic trees surrounded the residential dwelling on site. These included tōtara, karaka (*Corynocarpus laevigatus*), cabbage trees, oak trees and various pine species. Due to the mix of common natives and exotic species and lack of ecological connectivity, the ecological and botanical values of these areas have been assessed as negligible.

Figure 4. A mix of native and exotic species in riparian tree area one.

Figure 5. A dominance of willow trees within riparian tree area two.

Figure 6. Trees present around a dwelling.

Figure 7. Amenity plantings on site.

3.2.2 Connectivity and Ecological Function

Connectivity between areas of vegetation is essential to facilitate ecological function. The riparian vegetation areas were observed to be disjointed, narrow and heavily influenced by increased exposure to light, drying winds and competitive weeds, known as the edge effect. Patch fragmentation increases this effect and impairs reproductive function for both flora and fauna. Due to the narrow width of the vegetation and its lack of connectivity to other habitats, the areas were considered to have low ecological connectivity and function. The remaining areas of vegetation (amenity plantings and pasture) were considered to have negligible ecological connectivity and function.

3.2.3 Pest Animals

No formal pest animal surveys were undertaken. It is reasonable to assume that the typical density of rats, mice, feral cats, mustelids and hedgehogs are present within the site due to the surrounding urban land use.

3.2.4 Fauna

3.2.4.1 Herpetofauna

Herpetofauna comprise a significant component of New Zealand's terrestrial fauna. Currently, 104 endemic herpetofauna taxa are recognised in New Zealand (Hitchmough, et al., 2016), 80% of which are considered '*Threatened*' or '*At Risk*'. All indigenous reptiles and amphibians are legally protected under the Wildlife Act 1953, and vegetation and landscape features that provide significant habitat for native herpetofauna are protected by the Resource Management Act 1991. Statutory obligations require the management of resident reptile and amphibian populations if they are threatened by a disturbance, i.e., land development.

The site was assessed for the viability of potential herpetofauna habitat and the requirement for a survey. Due to dominance of low-grade pasture, saturated wetland habitat, and stock access to most site areas, no appropriate habitat for herpetofauna was identified. Therefore, no survey was conducted on site. However, an ACO survey was undertaken on the neighbouring site, 19 Golding Road & 53 Birch Road, Pukekohe, in March-April 2022 (Figure 8).

A review of historic lizard records from within 10 km of the project area was undertaken on the neighbouring site, 19 Golding Road & 53 Birch Road, Pukekohe, in April 2022. The review indicated that ornate skink (*Oligosoma ornatum*) was the only indigenous lizard species that has been recorded in the wider landscape (DOC BIOWEB Herpetofauna database; accessed September 2021;

Table 6).

Table 6. Herpetofauna of the Auckland Region (mainland taxa only), including conservation threat status (Hitchmough, et al., 2016) and potential occurrence in the project area.

	Common name	Species name	NZ threat status	Distance to nearest record	Habitat potential within Projects
Indigenous	*Mokopirirakau granulatus*	Forest gecko	At Risk – Declining	-	✓
	Naultinus elegans	Elegant gecko	At Risk – Declining	-	✓
	Dactylocnemis pacificus	Pacific gecko	At Risk – Relict	-	✓
	Woodworthia aff. maculata	Muriwai gecko	Threatened - Nationally Vulnerable	-	x
	Oligosoma ornatum	Ornate skink	At Risk – Declining	<2.5 km	✓
	Oligosoma aff. smithi	Tatahi skink	At Risk – Declining	-	x
	Oligosoma moco	Moko skink	At Risk – Relict	-	✓
	Oligosoma smithi	Shore skink	At Risk – Naturally Uncommon	-	x
	Oligosoma striatum	Striped skink	At Risk – Declining	-	x
	Oligosoma aenuem	Copper skink	At Risk – Declining	-	✓
Exotic	*Lampropholis delicata*	Plague skink	Introduced & Naturalised	-	✓
	Ranoidea aurea	Green and golden bell frog	Introduced & Naturalised	<2.5 km	✓
	Ranoidea raniformis	Southern bell frog	Introduced & Naturalised	-	✓

Forest gecko, elegant gecko and pacific gecko are typically arboreal (tree dwelling) and normally associated with regenerating scrubland and forests. Pacific and forest geckos will also inhabit clay banks and rock walls within and around such forests or scrubland. For populations of these species to persist, vegetated areas with good connectivity need to be relatively stable over time. Additionally, geckos prefer dense foliage typical of early seral vegetation communities. Little to no habitat of this description was seen on the site. For this reason, the site vegetation was considered to provide negligible habitat for these species.

Copper skink and ornate skink are generally found in dense ground cover or under logs or other debris around forest edge habitats. While copper skink are widespread, ornate skinks tend to be patchily distributed. Moko skink are relatively common on offshore islands, however mainland populations are rare. No suitable habitats were seen on the site, with amenity plantings providing little ground cover and debris. As such, the site vegetation was considered to be of poor habitat quality for these herpetofauna species.

Overall, due to the lack of suitable herpetofauna habitat and a lack of remnant vegetation identified on site, the herpetofauna habitat value of the site was considered negligible.

3.2.4.2 Chiroptera

A desktop analysis of chiroptera was undertaken using local records of bats from specific databases, in addition to a bat survey executed at the neighbouring site, 19 Golding Road & 53 Birch Road, Pukekohe and the current site (Figure 8). No bat activity was recorded during the survey, which was completed in late summer 2022. The survey covered 23-28 valid survey nights, with four nights discounted from analysis due to rainfall and the full moon phase. Nightly temperatures remained above 10°C (Table 7).

Figure 8. Fauna survey locations undertaken at 19 Golding Road & 53 Birch Road, Pukekohe, during March-April 2022.

Table 7. Bat survey results for 19 Golding Road & 53 Birch Road, Pukekohe.

ARD	Start date	End date	Total nights	Full moon nights	Rainfall	Useable nights	Passes
D	16/03/2022	8/04/2022	23	3	1	19	0
M	16/03/2022	8/04/2022	23	3	1	19	0
N	16/03/2022	8/04/2022	23	3	1	19	0
ABM4	11/03/2022	8/04/2022	28	3	1	24	0
ABM5	11/03/2022	8/04/2022	28	3	1	24	0

3.2.4.3 Avifauna

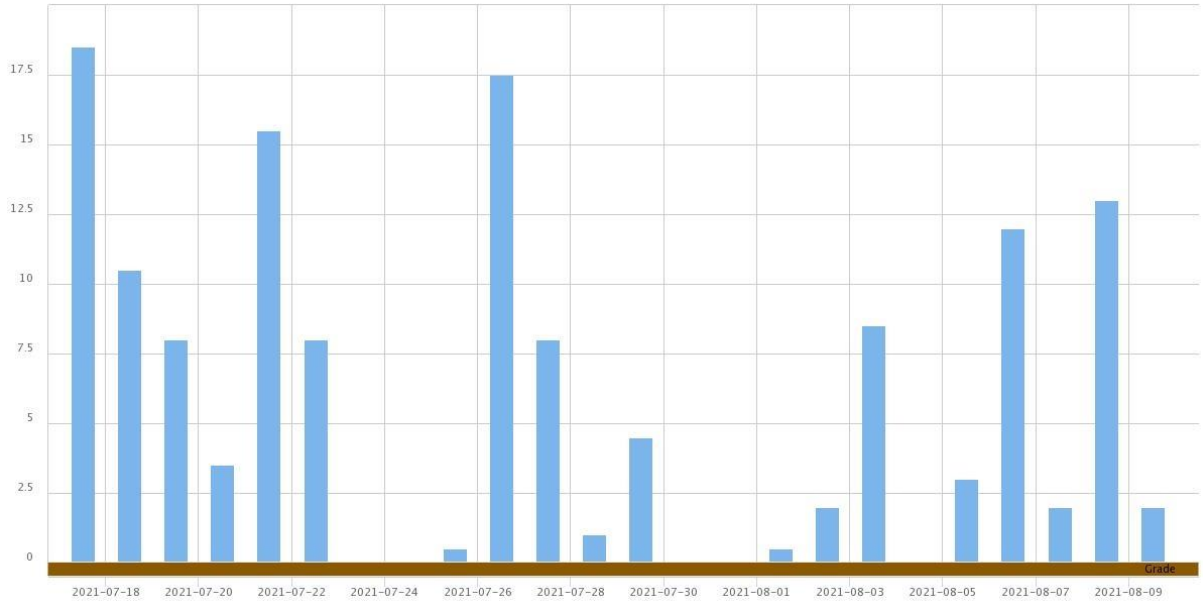
During the site visit, the indigenous avifauna heard or observed was limited to pūkeko (*Porphyrio melanotus*). No *'At Risk'* or *'Threatened'* species were recorded, and are not expected to be present on site, even on an intermittent basis. Due to the lack of suitable habitat for native avifauna, the avifauna habitat value within the site was considered low.

3.3 Freshwater Ecology

Aerial images obtained for the site indicated the presence of multiple watercourses on the property. These were ground-truthed and classified as permanent or intermittent streams, ephemeral flow paths, natural wetlands, or constructed features (Figure 9).

Before the site assessment, three weeks of sustained, moderate rainfall occurred (Graph 1). The catchments on-site were expected to be saturated during the site visit, allowing any intermittent streams to flow.

Figure 9. Freshwater features identified at 47 Golding Road and 50 Pukekohe East Road, including streams and natural wetlands.



Graph 1. Daily rainfall recorded between 17/07/2021 - 10/08/2021 at the Ngākōroa at Donovans weather station.

3.3.1 Streams

A well-defined stream and wetland network system was identified on site (Figure 9), and a permanent stream with well-defined banks flowed in a westerly direction through the 50 Pukekohe Road site towards the west. The stream has been modified by stock access which has resulted in pugging, erosion, sediment deposition and grazing (Figures 10 -12). Due to this degradation and a lack of a well-established native vegetation buffer, the ecological value of the stream was deemed to be low.

Figure 10. A permanent stream tributary on site.

Figure 11. Pugging surrounding Wetland One.

Figure 12.Pugging surrounding Wetland Two.

3.3.2 Natural wetlands

Multiple freshwater features of interest on site were assessed in respect to the NPS-FM and the AUP-OP (Figure 9). In particular, clause 3.21 was considered in relation to the definition of a natural wetland:

A natural wetland means a wetland (as defined in the Act) that is not:

> *(a) a wetland constructed by artificial means (unless it was constructed to offset impacts on or restore an existing or former natural wetland); or*
> *(b) a geothermal wetland; or*
> *(c) any area of improved pasture that, at the commencement date, is dominated by more than 50% of exotic pasture species and is subject to temporary rain-derived water pooling.*

Several areas of degraded riparian margins within the site met the definition of a natural wetland. Based on historical aerial imagery and topography, the general environment of the site has not changed significantly over the last 80 years (Figures 13-15).

Figure 16 shows two distinct wetlands. Wetland One was approximately 6339m^2 and Wetland Two was approximately 14,346m^2. Both wetlands were within the site's stream floodplain and both passed the rapid vegetation assessment, as per the Wetland Delineation Protocols. As the rapid assessment conditions were met, no further assessments were required. Both wetlands were contained within the contours of the stream gully with distinct hydrological features including pooling and saturated soils,

and there was a clear boundary between where hydrophytic species dominated and where upland species dominated.

Figure 13. 1945 historical imagery of the site.

Figure 14. 2003-2004 historical imagery of the site.

Figure 15. 2010 historical imagery of the site.

Figure 16. Wetland One and Wetland Two locations at 47 Golding Road and 50 Pukekohe East Road, Pukekohe.

3.3.2.1 Wetland One

Wetland One is connected to wetland two by a distinct drainage channel. This channel is likely the main water flow path into the wetland, with other water coming from surface runoff. There is a distinct demarcation in hydrology between wetland species and non-wetland species. Primary hydrological indicators were present, with saturated soils present throughout the wetland. Pugging and grazing were also seen surrounding the connecting drainage channel and wetland area (Figure 11).

The vegetation within wetland one was made up of a mix of exotic species and was dominated by hydrophytic species including soft rush (*Juncus effusus* - FACW*)*, water purslane (*Ludwigia palustris* - OBL), water celery (*Helosciadium nodiflorum* – OBL), and mercer grass (*Paspalum distichum* – FACW), buttercup (*Ranunculus repens* - FAC), and Yorkshire fog (*Holcus lanatus* - FAC). Japanese honeysuckle (*Lonicera japonica*), dock (*Rumex* sp.), harakeke (*Phormium tenax*), gorse (*Ulex europaeus* - FACU), Chinese privet (*Ligustrum sinense*) and barberry (*Berberis glaucocarpa*) were also present (Figures 17-20).

As discussed, trees within wetland one were scattered within the herb and shrub stratum. The trees identified were species such as lemonwood, kahikatea, cabbage trees, woolly nightshade, ake ake and willows. Due to the domination of exotic species, grazing, erosion and pugging of the wetland caused by stock access, and lack of established buffer vegetation, wetland one was considered to have low ecological value (Figures 17-20).

Figure 17. Wetland One overview.

Figure 18. Vegetation in Wetland One.

Figure 19. Origin of Wetland One.

Figure 20. Vegetation in Wetland One.

3.3.2.2 Wetland Two

Wetland two has a dominance of the herb and shrub layers, delineating it from wetland one. Common species such as mercer grass (*Paspalum distichum*), buttercup, and lotus *(Lotus pedunculatus*) make up the majority of the herb layer. Within the shrub layer, there is a significant amount of soft rush, knotweed (*Persicaria* sp.), water purslane, and gorse, along with small patches of Kiokio (*Blechnum novae-zelandiae*) and Māori sedge (*Carex maorica*) (Figures 21-24).

Trees become denser towards the eastern side of the wetland, with Willow trees (*Salix*) being the dominant species. The occasional woolly nightshade and young karamū were seen throughout the wetland (Figures 21-24).

Three crossings were present within Wetland Two, and stock access has caused pugging throughout the wetland area (Figure 12). The ecological value of wetland two was considered to be low; despite some presence of common native wetland species, the area has been damaged by stock access and is dominated by exotic species (Figures 21-24).

Figure 21. Vegetation in Wetland Two- shrub dominant area

Figure 22. Figure 24 Vegetation in Wetland Two - dense willows at eastern border

Figure 23. Vegetation in Wetland Two- mixed native and exotic species

Figure 24. Vegetation in Wetland Two- willow dominance

3.4 Summary of Ecological Values

The terrestrial ecological value of the site is predominately linked to the presence of riparian tree vegetation adjacent to and throughout the streams. The remainder of the site comprises low-ecological value pasture, which has experienced pugging and deterioration. The freshwater values of the site are linked to the presence of wetland habitats identified on site. The values of the site are summarised in Table 8.

The riparian tree vegetation has low value as it predominantly consists of exotic trees and has low connectivity values. The wetlands currently have low value as they are dominated by exotic species and influenced by stock grazing. The effects of the works, including excavation within 10m of a wetland, are expected to be very low following standard mitigation. Several other recommendations are provided in Section 5 to ensure effects remain low.

Table 8. Summary of the terrestrial and freshwater ecological values on site.

Ecological Feature	Assigned Ecological Value
Riparian Tree Vegetation	Low
Other vegetation (amenity plantings and pasture)	Negligible
Permanent stream	Low
Wetland One	Low
Wetland Two	Low

4 ASSESSMENT OF ECOLOGICAL EFFECTS

The proposed PPC seeks to rezone approximately 27.2 ha of land from FUZ to MHU under the Auckland Unitary Plan. All Auckland-wide and MHU zone provisions of the AUP will apply to the rezoned land and will enable Auckland Council to regulate and manage future subdivision development. No additional provisions are provided as part of this private plan change.

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

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

4.1 Terrestrial Ecology

Due to the low ecological values associated with the Riparian Tree Vegetation and Other Vegetation (amenity plantings and pasture), there is little significant ecological value on site. The site is not subject to an SEA overlay (AUP-OP). The closest SEA is located approximately 524m to the west of the site.

Due to engineering constraints and road layouts, the proposed rezoning and subsequent subdivision are not expected to result in a loss of valuable vegetation, as vegetation removal will not occur within 10m of the wetlands.

The PPC provides the opportunity to further enhance the terrestrial ecological values through the planting and protection of the 10m riparian margins. Any subsequent subdivision is expected to trigger requirements under the Resource Management Act 1991 (RMA) and AUP-OP as a mechanism to protect riparian margins where appropriate. The remaining vegetation within the site is of low ecological value and has been impacted by the current agricultural land use. The rezoning and subsequent subdivision will likely increase the ecological quality and functioning of the existing vegetation within the site and the planting of new vegetation.

Accordingly, it is considered that the proposed rezoning of the site will result in low adverse effects on the existing vegetation. In fact, the rezoning will result in preservation of native vegetation, which under alternative circumstances could not be guaranteed.

4.2 Pest Animals and Terrestrial Fauna

The rezoning of the Site from FUZ to MHU is expected to increase the human population density within the area. Human population density often increases rat, mice and domestic cat abundance. However, the current site does not have pest control measures, and most pests are likely at carrying capacity. Pest control will likely be implemented on site once the number of residents increases. Additionally, the proposed native vegetation protection and enhancement will likely require pest control. Overall, it is considered that there may be a low increase in rat and mice abundance. Due to the surrounding residential and commercial properties to the west and south, roaming domestic cats would likely be present within the site, resulting in no significant impact due to cats being expected.

Overall, it is considered that the rezoning of the site will result in a negligible increase in pest animal effects. It is not expected that possum, mustelid, hedgehog and rabbit abundance would increase due to the rezoning, in fact there will likely be a decrease due to the reduction in agricultural land. The

rezoning will likely result in an increase in terrestrial habitat value due to the proposed vegetation enhancement.

Any potential direct adverse effects on native terrestrial fauna as a result of subsequent development works (e.g. earthworks) would be assessed at the resource consenting phase and can be appropriately mitigated through the implementation of fauna management plans. It should be noted that any subsequent site works resulting from any rezoning of the FUZ will result in the same or similar potential adverse effects on native fauna.

4.3 Freshwater Ecology

All streams within the site are considered of low current ecological value due to the impact of farming on the streams. The proposed rezoning will not affect stream protection measures required by the AUP's objectives, policies and rules. No further stream works are proposed; however, it is proposed that the remaining 10m riparian margins around both wetlands are protected and enhanced. There will likely be an enhancement of freshwater values by planting the riparian margins. As such, it is considered that the proposed rezoning will not result in any significant adverse effects on the site's freshwater values.

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

• The potential increase in impervious surfaces as a result of subsequent development.

• The potential increase in pollutant runoff as a result of subsequent development.

However, it should be noted that any residential rezoning of the FUZ will likely result in potential adverse stormwater effects.

4.3.1 Stormwater

The proposed zone change will likely increase impervious surfaces. This increase can amplify the adverse stormwater effects on the receiving environment by resulting in scouring, erosion or high levels of contaminant input. Catchment neutrality can likely be designed into the stormwater management system and consequently have no effect on the wetland hydrology.

The main considerations when designing the potential stormwater system/discharges are:

- All stormwater outlets can be designed with suitable erosion and scour protection in accordance with Auckland Council requirements. Stormwater can be attenuated to achieve neutrality before it is discharged within the stream catchment.
- Stormwater quality treatment of road and accessway runoff is needed in compliance with the requirements of schedule 4 of the Network Discharge Consent.
- Stormwater quantity treatment is necessary for all impervious areas. The urban-zoned areas in close proximity of the site should fall within a Stormwater Management Area Control – Flow (SMAF).

If catchment neutrality can be designed into the stormwater management system, any adverse stormwater effects can be appropriately managed to prevent impacting ecological values on site.

4.4 Policy Documents/ Provisions

4.4.1 National Policy Statement for Freshwater Management 2020

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

4.4.2 Auckland Unitary Plan

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

4.4.2.1 B2 – Urban Growth and Form

Consistent with B2, through the proposed vegetation protection and enhancement, the PPC will provide ample opportunity to maintain and enhance the quality of the natural environment, including those scheduled in the AUP, while promoting quality compact urban form.

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

4.4.2.2 B7 – Natural Resources

Consistent with B7, areas of significant indigenous biodiversity value in and freshwater environments have been identified within the site. All freshwater habitat would be protected from the adverse effects of subdivision use and development. It is considered that the rezoning will result in less than minor adverse effect on terrestrial habitat and will likely result in an increase in terrestrial habitat value due to the proposed vegetation protection and enhancement.

Additionally, the PPC will provide further opportunities to maintain indigenous biodiversity through the protection, restoration and enhancement of areas where ecological values are degraded and where development occurs, namely through planting and protecting the riparian margin.

4.4.2.3 E1 – Water Quality and Integrated Management

Consistent with E1, it has been demonstrated that the PPC can appropriately manage discharges, subdivisions and development that affect freshwater systems to maintain or enhance water quality, flows, stream channels and their margins.

4.4.2.4 Lakes, Rivers, Streams and Wetlands

Consistent with E3, all potential streams, rivers and wetlands have been identified within the site. Additionally, reclamation and significant residual adverse effects can be avoided and the PPC provides opportunities to protect and enhance the freshwater systems.

4.4.2.5 E15 – Vegetation Management and Biodiversity

Consistent with E15, the vegetation and biodiversity values of the site have been identified. The PPC provides opportunities to maintain and enhance ecosystem services and indigenous biodiversity values, particularly in sensitive environments and areas of contiguous indigenous vegetation cover, while providing for appropriate subdivision, use and development.

4.4.2.6 Appendix 1 – Structure Plan Guidelines

Consistent with the Structure Plan Guidelines, it has been demonstrated that the PPC provides opportunities and mechanisms to protect, maintain or enhance natural resources, particularly those that have been scheduled in the AUP and integrate green networks, namely through the protection and enhancement of the riparian vegetation.

4.4.3 Auckland Plan 2050

The Auckland Plan 2050, states that Auckland's natural environment is inextricably connected to Aucklanders' sense of identity and place. Auckland's natural environment not only supports its people, but it is home to many special local ecosystems and is essential for the survival of both indigenous wildlife and species from across the world. However, many of Auckland's treasured natural environments, ecosystems, and indigenous species are already under significant pressure from human activity, and some are in decline. To reverse this decline, Auckland must ensure that development is sustainable and has minimal negative impacts on the natural environment.

Consistent with the Auckland Plan 2050, the PPC provides opportunity to restore degraded ecosystems where appropriate, while providing for appropriate development.

4.4.4 Auckland 's Urban Ngahere (Forest) Strategy

This Strategy was formed to protect what Auckland's urban ngahere in the face of a growing and urbanising population through supporting principles such as; preference for natives, ensure urban forest diversity, protect mature, healthy trees, create ecological corridors and connections and access for all residents.

The PPC is consistent with the Urban Ngahere Strategy, as it has identified the ngahere of the site and provides opportunities for enhancement of ecological corridors, connections and diversity through the proposed planting of native riparian vegetation and maintaining existing vegetation where practicable, while also providing for public access.

4.4.5 Pukekohe-Paerata Structure Plan 2019

While the Pukekohe-Paerata Structure Plan 2019 arguably has no statutory weight, the structure plan was prepared to form the basis of future Auckland Council-initiated plan changes under the RMA. The vision of the structure plan is to; enhance Pukekohe as a focal point and place to further support the surrounding rural economy, offer a range of housing choice and employment opportunities for people at all stages of life to be connected to the wider Auckland and Waikato regions, protect and enhance the natural, physical and cultural values that contribute to Pukekohe's unique character and identity.

Regarding ecology specifically, the structure plan seeks to protect and enhance the ecological and landscape features. This includes differing levels of protection and enhancement. Some values may have high levels of protection (e.g. SEAs) and others will rely on the provisions of the Auckland Unitary Plan. One key issue that has been highlighted within the structure plan is stream bank erosion accelerated by urbanisation. Existing mitigation methods include the use of riparian buffers, detention of stormwater flows and stormwater retention. Riparian buffers also provide opportunities for stream protection and ecological linkages. The Pukekohe-Paerata Structure Plan takes a precautionary approach seeks a 20m riparian buffer for permanent and intermittent streams.

The PPC proposes a minimum 10m buffer, on both sides of all permanent and intermittent streams, from all proposed MHU zoned land and roading networks. There is further scope to increase this buffer to ≥20m, in certain areas within the proposed drainage reserve.

The Auckland Regional Council published two documents in relation to riparian widths and their functioning; TP350 (Parkyn et al. 2000) and TP148 (Auckland Regional Council 2001). While both documents consider urban riparian buffers greater than 10m are beneficial, they both conclude that 10m urban riparian buffers would appropriately support sustainable indigenous riparian vegetation, allow for natural succession, control weeds and meet desired aquatic functions. As such in our view, the PPC allows the opportunity to; protect streams, create ecological linkages and effectively mitigate stream bank erosion through the allocation of the drainage reserve which allows for a minimum 10m riparian buffer.

5 SUMMARY AND RECOMMENDATIONS

Bioresearches have assessed the proposed private plan change for the site. The impact of rezoning from FUZ to MHU has been considered in relation to the terrestrial and freshwater values present on site. It is considered that the PPC is appropriate for the site. Future subdivision and development in accordance with the zoning and precinct plan are anticipated to result in the appropriate protection and enhancement of the site's indigenous terrestrial and freshwater biodiversity values. It is recognised that the AUP-OP and the NES-FW provide a framework that manages any proposed future development at the resource consenting phase to ensure development aligns with the appropriate policies and regulations.

Ecological values on site are linked to the wetlands and the stream present on site. The adverse effects of the PPC on these natural features can be appropriately and effectively managed through existing planning provisions and policy framework within the AUP and the proposed SEA classification and precinct plan provisions. Additionally, the PPC provides opportunities to protect and enhance the terrestrial and freshwater values of the site. Appropriate stormwater management, pest control, maintenance programmes and biodiversity enhancement are expected to be implemented during the site's development.

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

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