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Assessment of Ecological Effects: Campus 2 Project, Karaka Road, Drury

Fisher & Paykel Healthcare Properties Limited

May 2024

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1. INTRODUCTION

1.1 Background

Fisher & Paykel Healthcare Properties Limited (FPH) is proposing a Structure Plan (Structure Plan) and Private Plan Change (Plan Change) for land currently zoned Future Urban and Rural – Mixed Rural, under the Auckland Unitary Plan (AUP) Operative in part, located at 300, 328, 350, 370, & 458 Karaka Road, Drury (hereafter referred to as the 'site'). The land is bound by State Highway 22 to the north, Oiroa Creek to the west and the railway network of the North Island Main Trunk (NIMT) Line to the south.

This Structure Plan is proposed in replacement of the Drury-Opāheke Structure Plan (prepared by Auckland Council in 2019), for this part of Drury West. The Plan Change request involves rezoning the part of the site that is zoned Future Urban Zone, to Business – Light Industry. The area in the site currently zoned Rural-Mixed Rural will not be rezoned.

The purpose of the Structure Plan and Plan Change is to facilitate the future development of a research and development and manufacturing campus to support the growth and expansion of Fisher & Paykel Healthcare.

This report addresses the potential ecological effects to accompany the Plan Change application, by providing:

- An assessment of the ecological values of native flora and fauna and freshwater habitats within the site;
- An assessment of the ecological effects associated with the proposed Plan Change; and
- Recommendations to avoid, remedy or mitigate potential adverse effects and offset and/or compensate potential residual adverse effects.

1.2 Site description

The site is a 105 ha rural property and is currently utilised for pastoral and farming purposes (Figure 1). A single dwelling and other buildings (including two large green houses) are present on the property. The site is gently undulating, with gullies present within the site within the north western portion and within the south eastern portion, draining in a general northerly direction. Auckland Council GeoMaps shows multiple overland flow paths draining into these, and other smaller gullies (Figure 1).

The primary vegetation cover over the site is exotic pasture, which has been extensively grazed, with patches of native and exotic vegetation. Exotic trees form shelter belts and surround pond habitats, while native vegetation appears to have been planted around the dwelling as hedges, wind breaks or for amenity purposes.

1.3 Local Context

The site is located in Drury West and is accessed via State Highway 22 / Karaka Road. The site is located 3 km south west of the Drury Metropolitan Centre, 12 km north of Pukekohe, 16 km south of Manukau Metropolitan Centre and 40 km south of Auckland's City Centre. The site sits within the wider Drury – Opāheke area that is signalled as an area for urban expansion through the Auckland Unitary Plan. There are a number of emerging neighbourhoods in this area including the residential communities of Auranga, Paerātā Rise and Drury East, which are located 2.5 km north, 3.5 km west, and 3.5 km east of the site respectively. In addition, the industrial area of Drury South Crossing is under development and is located 4.5 km south-east of the site.

To the immediate south (south of the rail line), is a Special Purpose – School Zone, and land immediately north has been rezoned to a mixture of Mixed Housing Urban, Terraced Housing and Apartment Building, Neighbourhood Centre and Open Space Zones. Approximately 300 m east is the proposed Ngākōroa Railway Station.

The Supporting Growth Alliance (SGA) have announced a number of roading upgrades to support development in this area, most relevant to this site is the proposed upgrade to SH22.

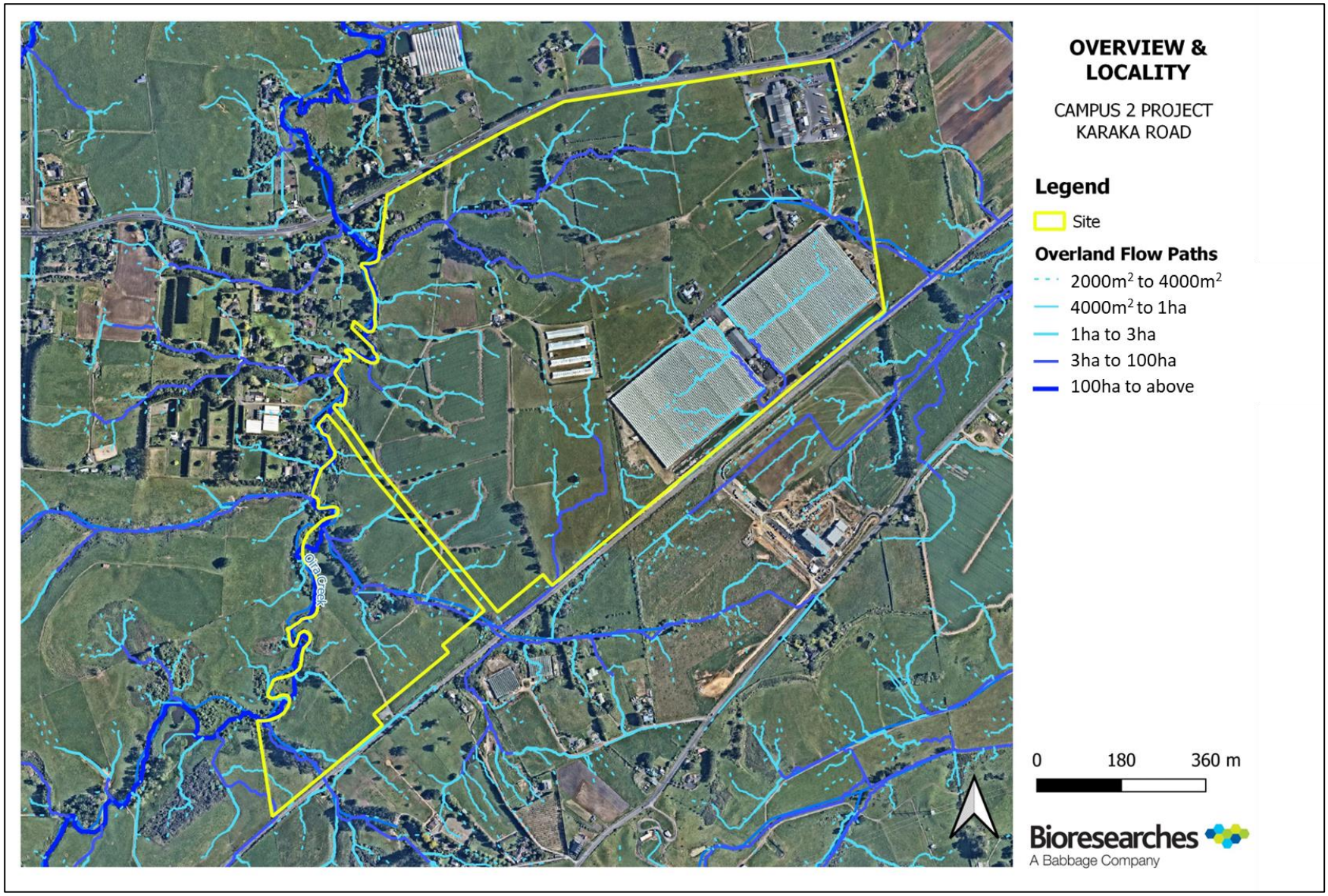

Figure 1. Overview of the site, presenting the overland flow paths as obtained from Auckland Council GeoMaps.

2. STATUTORY CONTEXT

The statutory and planning documents that provide the framework for this ecological effects assessment are detailed in the Section 32 Report. This section provides an overview of the legislation, policy, plans and strategies most relevant to the protection, conservation and enhancement of nature conservation interests associated with the site, but is not intended to provide an exhaustive list of all relevant statutory and non-statutory documents or provisions.

2.1 Legislation

2.1.2 Resource Management Act 1991 (RMA)

The purpose of the RMA is to promote the sustainable management of New Zealand's natural and physical resources. The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna is a matter of national importance under Section 6. Schedule 4 of the RMA sets out the requirements for effects assessments. Where a request is made for a private plan change, the request must describe the actual or potential environmental effects anticipated from the implementation of the change in accordance with clauses 6 and 7 of Schedule 4.

2.1.3 Wildlife Act 1953

The Wildlife Act (WA 1953) provides legal protection to listed species classed as wildlife. It controls how people interact with wildlife, including all native birds, bats, frogs and lizards and some invertebrates. Note it does not cover plants or freshwater fish.

2.1.4 National Environmental Standards for Freshwater (NES-F, 2020)

The National Environmental Standards for Freshwater 2020 (NES-F) set requirements for carrying out certain activities that pose risks to freshwater and freshwater ecosystems.

2.2 National Policy Statements

Issued under the RMA, National Policy Statements (NPS) provide national direction for matters of national significance relevant to sustainable management.

2.2.2 Freshwater

The National Policy Statement for Freshwater Management 2020 (NPS-FM) provides direction under the RMA to local authorities on managing activities that affect the health of freshwater, and provides protections to freshwater bodies, including natural inland wetlands, includes provisions for monitoring and reporting on freshwater quality and quantity, and for addressing the impacts of land use activities on freshwater resources. It contains national objectives for protecting ecosystems, indigenous species and the values of outstanding water bodies and wetlands. The main objective of the NPS-FM is to ensure the health and well-being of water bodies and freshwater ecosystems are prioritised. It is relevant to the proposal because several natural inland wetlands are present within the site.

2.2.3 Indigenous Biodiversity

The National Policy Statement for Indigenous Biodiversity (NPS-IB) provides direction to councils to protect, maintain and, where necessary, restore and enhance indigenous biodiversity in the terrestrial environment, requiring at least no further reduction nationally in biodiversity. It is relevant to the proposal because the site is within the terrestrial environment, and it contains indigenous biodiversity as defined in Section 1.6 (Interpretation) of the NPS-IB.

The site does not contain any areas identified in the Auckland Unitary Plan as Significant Natural Areas (SNAs). The NPS-IB requires that effects on indigenous biodiversity that is not protected by an SNA:

a. Is managed by applying the effects management hierarchy (avoid, minimise, remedy, offset, compensate), where those effects are significantly adverse; or
b. is managed to give effect to its Objective and Policies, where those effects are not significant (Section 3.16 (2)).

2.3 Regional Plans and Policies

The Auckland Unitary Plan (AUP) is the principal statutory planning document for Auckland. It was prepared by Auckland Council for the purpose of giving effect to the RMA as a regional council and as a territorial authority.

Chapter B of the AUP is the Regional Policy Statement for Auckland, which the Plan Change must give effect to. In particular, Chapter B7 relates to Natural Resources, and contains various objectives and policies relating to the protection and enhancement of indigenous biodiversity, and the management of freshwater systems.

2.4 Non-statutory documents

A number of non-statutory documents are also relevant, including:

c. The Auckland Plan 2050, which 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.

d. Auckland's Urban Ngahere (Forest) Strategy, which was formed to protect Auckland's Urban Ngahere in the face of a growing and urbanising population through supporting principles such as; preference for native vegetation, ensure urban forest diversity, protect mature healthy trees, create ecological corridors and connections and access for all residents.

3. ASSESSMENT APPROACH AND METHODOLOGY

3.1 EcIA Assessment

This Ecological Impact Assessment (EcIA) generally follows the EcIA Guidelines for use in New Zealand published by the Environmental Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay *et al.,* 2018). The EcIA Guidelines provide a standardised matrix framework that allows ecological effects assessments to be clear, transparent, and consistent. The EcIAG framework is generally used in Ecological Impact Assessments in New Zealand as good practice, and a detailed analysis of this methodology is presented in Appendix A.

Note that this report does not quantify any offset/compensation requirements (if applicable).

3.2 Tangata Whenua as Partners

The NPSIB recognises tangata whenua as kaitiaki of, and partners, in the management of indigenous biodiversity (NPSIB, Policy 2). At the time of preparation of this report, no acknowledged taonga species have been identified with respect to this project or are currently listed in the public domain.

Fisher and Paykel Healthcare has invited correspondence from 18 iwi groups. Te Ākitai Waiohua, Ngāti Te Ata Waiohua, and Ngāti Tamaoho have confirmed an interest in the proposal and participated in tours of the site. Cultural value assessments have subsequently been arranged for the proposed Structure Plan and associated Plan Change. The Cultural Values Assessment by Te Ākitai Waiohua (2024) did not identify specific taonga species. Further consultation and engagement are scheduled and will continue on an ongoing basis as the Plan Change progresses.

3.3 Desktop Review

A desktop review of various online GIS databases was undertaken to determine the extent of ecological protection overlays (e.g., covenants, conservation land, SEAs), 'ecosystem type' classifications, and visualise historical land-use using historical aerial images. The scheduling of SEAs and classification of ecosystems provides a means for Councils to protect and maintain indigenous biodiversity within Districts and Regions. The desktop review also included a search for fauna records from various information sources.

Specifically, the following databases were reviewed:

- Department of Conservation Bioweb records for herpetofauna and bats[1];
- Auckland Council herpetofauna records;
- iNaturalist records for herpetofauna and birds within approximately a 5 km radius from the site[2];
- New Zealand Bird Atlas eBird database[3]. Bird data is recorded in 10 km^2 grid squares. Grid square AE69 was accessed as this is positioned over the site[4];
- NIWA's New Zealand Freshwater Fish Database[5] records were accessed for affected stream catchments;
- Auckland Council Geomaps[6];
- Department of Conservation Threat Classification Series[7];
- Auckland Council conservation status reports for vascular plants (Simpkins *et al.*, 2022)[8], bats (Woolly *et al.*, 2023)[9], and reptiles (Melzer *et al.*, 2022)[10];
- Retrolens historic aerial imagery[11]; and
- Indigenous terrestrial and wetland ecosystems of Auckland (Singers *et al.*, 2017)[12].

3.4 Site Investigations

A site visit was undertaken on 21st of December 2022, with short follow-up site visits undertaken in January and March 2024. During the visits, additional information was gathered on terrestrial and freshwater habitats and native fauna presence within the site. The methodologies utilised for each of these assessments are listed below in the sections below.

3.4.1 Terrestrial Habitats

The vegetation within the site was assessed using a 'walk through' methodology. Botanic values recorded included native and exotic vascular vegetation, and notes were made on the quality and extent of vegetation present on site. Potential fauna habitats for indigenous lizards, bats and birds were assessed qualitatively. A call playback survey was undertaken for spotless crake (*Zapornia tabuensis*) in March. Spotless Crakes are known to be more vocal and responsive during the breeding season, which in New Zealand is typically from September to February. However, spotless crake still respond to call playback outside of the breeding season, especially if they are defending a territory.

[1] https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/
[2] https://inaturalist.nz/home
[3] https://ebird.org/home
[4] https://ebird.org/atlasnz/block/blkAE69
[5] https://nzffdms.niwa.co.nz/
[6] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html
[7] All Department of Conservation Threat Classification Documents are listed in the below webpage. When individual reports are referenced hereafter, they are referenced in-text.
https://www.doc.govt.nz/aboutus/science-publications/conservation-publications/nz-threat-classification-system/
[8] https://knowledgeauckland.org.nz/media/egzhyd1g/tr2022-19-conservation-status-of-vascular-plant-species-in-auckland.pdf
[9] https://knowledgeauckland.org.nz/media/2592/tr2023-04-conservation-status-of-bat-species-in-auckland.pdf
[10] https://knowledgeauckland.org.nz/media/2324/tr2022-03-conservation-status-reptile-species-auckland.pdf
[11] https://retrolens.co.nz/
[12] https://knowledgeauckland.org.nz/media/1399/indigenous-terrestrial-and-wetland-ecosystems-of-auckland-web-print-mar-2017.pdf

3.4.2 Freshwater habitats

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

3.4.2.1 Streams

During the site assessment, the presence and extent of water was noted, reference photos were taken, and freshwater habitats were marked using a handheld GPS unit. Watercourses were classified under the AUP to determine, in accordance with the definitions in these plans, the ephemeral, intermittent or permanent status of these watercourses (Table 1). In addition, these watercourses were assessed as to whether they were natural or artificial, in accordance with AUP definitions, using information from both the desktop review and site visit.

Table 1. AUP criteria for permanent, intermittent rivers and streams and ephemeral streams[13]

Criteria	Definition
Permanent Stream	
1	The continually flowing reaches of any river or stream, excluding ephemeral reaches
Intermittent or ephemeral stream*	
1	Evidence of natural pools
2	Well defined banks and bed
3	Retains surface water present more than 48 hours after a rain event
4	Rooted terrestrial vegetation not established across channel
5	Organic debris from flooding present on floodplain
6	Evidence of substrate sorting, including scour and deposition
***If three or more of the six assessment criteria can be met with confidence, the watercourse is considered intermittent. If at least three criteria cannot be met, the watercourse is considered ephemeral.**	

The quality of the aquatic 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.
The ecological value of the stream was then assigned based upon factors such as:

- The intactness of the riparian zone;
- Permanency of flow and complexity of habitat present within the stream;
- Observable water quality parameters; and
- Modifications to hydrology and catchment of the stream.

[13] Table reproduced from:
https://content.aucklanddesignmanual.co.nz/regulations/practice-notes/Documents/RC%203.3.17%20Stream%20Classification.pdf

Natural Inland Wetlands

Potential wetland areas were assessed following the Ministry for the Environment's (MfE) wetland delineation protocols (MfE, 2022)[14], to ascertain if the area presented with the physical characteristics to be considered a Natural Inland Wetland.

The definition of a Natural Inland Wetland (as per the NPS FM) is:

> *"a wetland (as defined in the [Resource Management] Act) that is not:*
> - *(a) in the coastal marine area; or*
> - *(b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or*
> - *(c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or*
> - *(d) a geothermal wetland; or*
> - *(e) a wetland that:*
>   - *(i) is within an area of pasture used for grazing; and*
>   - *(ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless*
>   - *(iii) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply."*

Consequently, the first step in delineating a Natural Inland Wetland is to ensure it meets the definition of a wetland under the Resource Management Act (RMA), referred to as 'the Act' in the above definition.

A wetland is defined by the RMA as:

> *'permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions'.*

If the potential wetland met the definition of an RMA wetland, then it was also checked to see if any of the exclusions in the Natural Inland Wetland Definition applied to the area. Finally, if the potential wetland did not meet any of the exclusions, the remainder of the MfE wetland delineation process was carried out to determine if the area was a natural inland wetland (Figure 2).

[14] Ministry for the Environment (2020). *Wetland Delineation Protocols.* Wellington: Ministry for the Environment.

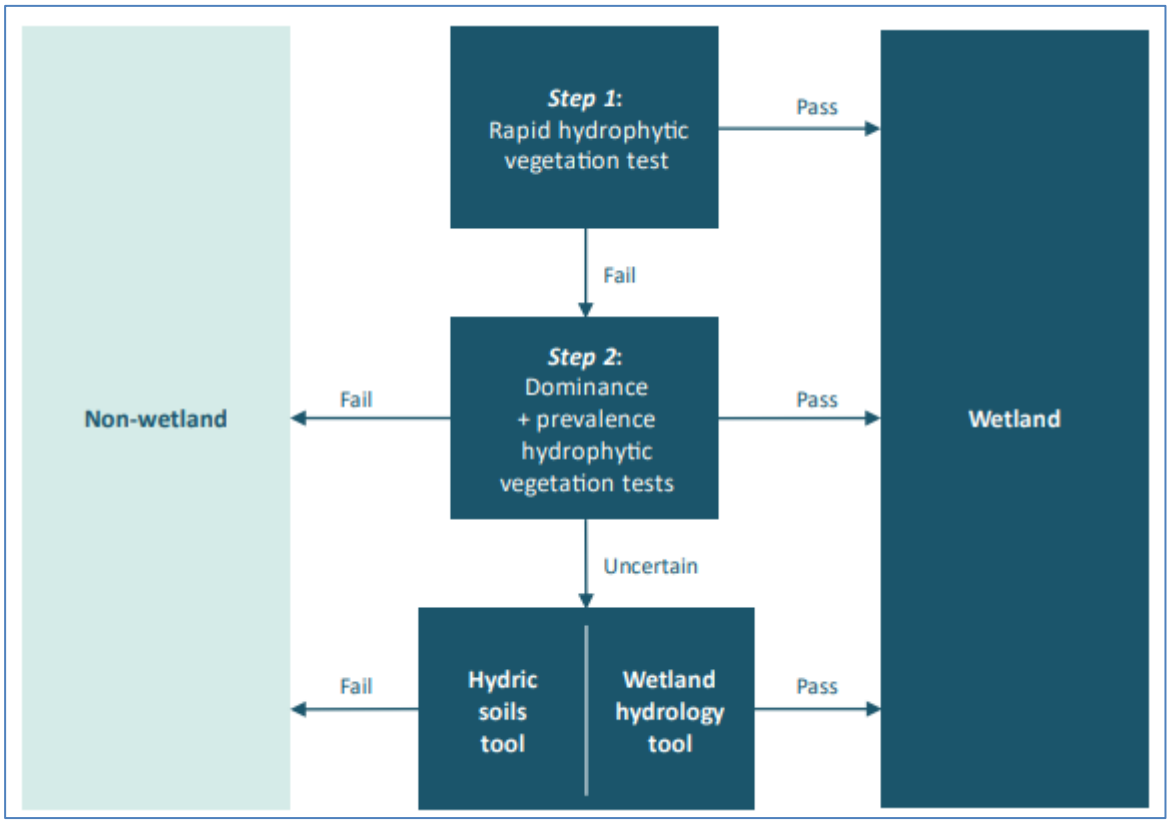

Figure 2. Simple flow chart of steps for delineating a Natural Inland Wetland using the hydrophytic vegetation, hydric soils and wetland hydrology tools. Reproduced from MfE (2022).

When following the MfE wetland delineation process, if the rapid test was not appropriate for determining if an area was an RMA wetland, vegetation assessment in accordance with Clarkson (2013)[15] was undertaken; based on the dominance and prevalence of plant species assigned the following 'wetland plant indicator ratings' within a vegetation plot:

- 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.

Where the dominance and/or prevalence tests applied to the vegetation plot results showed unclear results, hydric soils and hydrology tests were undertaken in accordance with the associated protocol (Ministry for the Environment, 2021[17]; Fraser *et al.,* 2021[16]).
All wetland assessments were carried out within the Auckland region's 'growing season'[17].

[15] Clarkson, B. (2013). *A vegetation tool for wetland delineation in New Zealand*. Prepared for Meridian Energy Limited. Hamilton: Manaaki Whenua Landcare Research.
[16] Fraser *et al*. (2018). *Hydric soils – field identification guide.* Report LC3223 prepared for Tasman District Council. Hamilton: Manaaki Whenua – Landcare Research.
[17] Ministry for the Environment (2021). *Wetland delineation hydrology tool for Aotearoa New Zealand*. Wellington: Ministry for the Environment.

3.4.3 Fauna

Opportunistic observations of fauna during the site visits were recorded. In addition, a hand-search method was used to identify any potentially present lizard fauna under woody debris and deadfall where available (Wildlife Authority 37605-FAU, 98006-FAU), and an informal assessment of the suitability of the terrestrial habitats to support bats was undertaken, by observing the structure and features of mature trees on site.

Targeted fauna surveys were also carried out in February 2023. For indigenous lizards, equipment was set out in potential habitat followed by three checks to determine if any native species were present. A bat survey was also undertaken in February 2023, and repeated in January to March 2024. This involved acoustic bat monitoring (ABM) equipment set out in an area of suitable habitat that may either provide roosting qualities or a potential flight path. The recordings were checked to determine if any bats had been picked up during the survey period.

4. EXISTING ENVIRONMENT

4.1 Vegetation

4.1.1 Desktop assessment

Historically (pre-1900's), the site would have been vegetated with forest ecosystem types such as WF8 (Kahikatea, pukatea forest) along the western boundary of the site, and WF9 (Taraire, tawa podocarp forest) for the remainder of the site (Singers *et al.,* 2017).

Since the 1940's the site and the surrounding land has undergone numerous changes and been highly modified, specifically transforming the site for agricultural land uses. As per Figure 3, in 1942 the site was devoid of native vegetation, obvious watercourses noted along the western boundary, the northern portion of the site, and in the southeastern corner of the site. The site is now primarily maintained as pasture grass, beyond occasional trees and shelter belts, and contains some patches of planted native vegetation. Small areas within the site have been classified as 'open water' (corresponding to artificial ponds) and 'unclassified' (small vegetation areas within the western portion of the site).

No SEAs are associated with the site, with the closest SEA's noted approximately 1.3 km north of the site (Figure 4). No other legal vegetation protections (e.g., DOC, QEII National Trust, Nature Heritage Fund Covenants, or Nga Whenua Rahu) were identified on or in the vicinity of the site.

Figure 3. Historic aerial image of the site (yellow outline) from 1942. Imagery sourced from Retrolens.

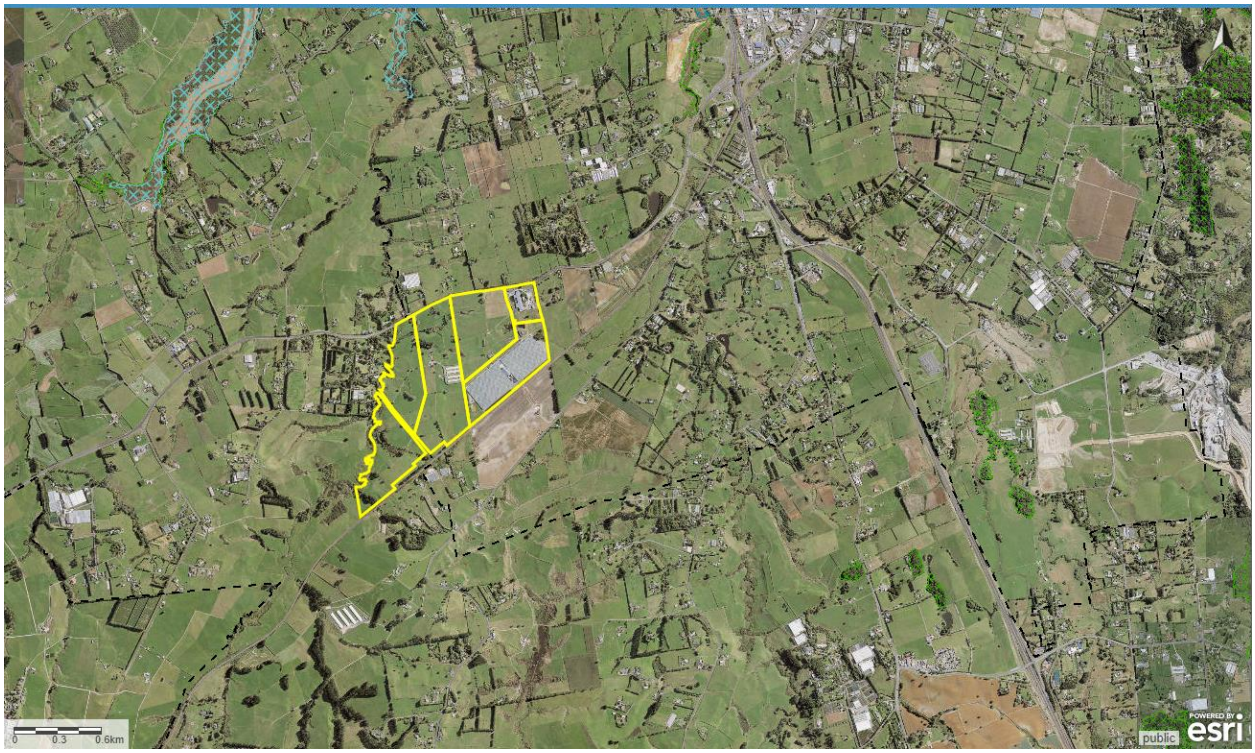

Figure 4. Wider landscape surrounded by intensive grazing and no SEA overlays. Image sourced from Auckland Council Geomaps GIS viewer.

4.1.2 Vegetation descriptions

The vegetation on site is highly modified and largely grazed pasture, and it is surrounded by an intensively grazed landscape. The vegetation within the site can be divided into these categories:

- Exotic vegetation, including pine tree land;
- Exotic riparian vegetation;
- Mixed native riparian vegetation; and
- Exotic, managed pasture, covering the majority of the site.

The exotic and native vegetation types are mapped in Figure 5 and discussed in the sections that follow.

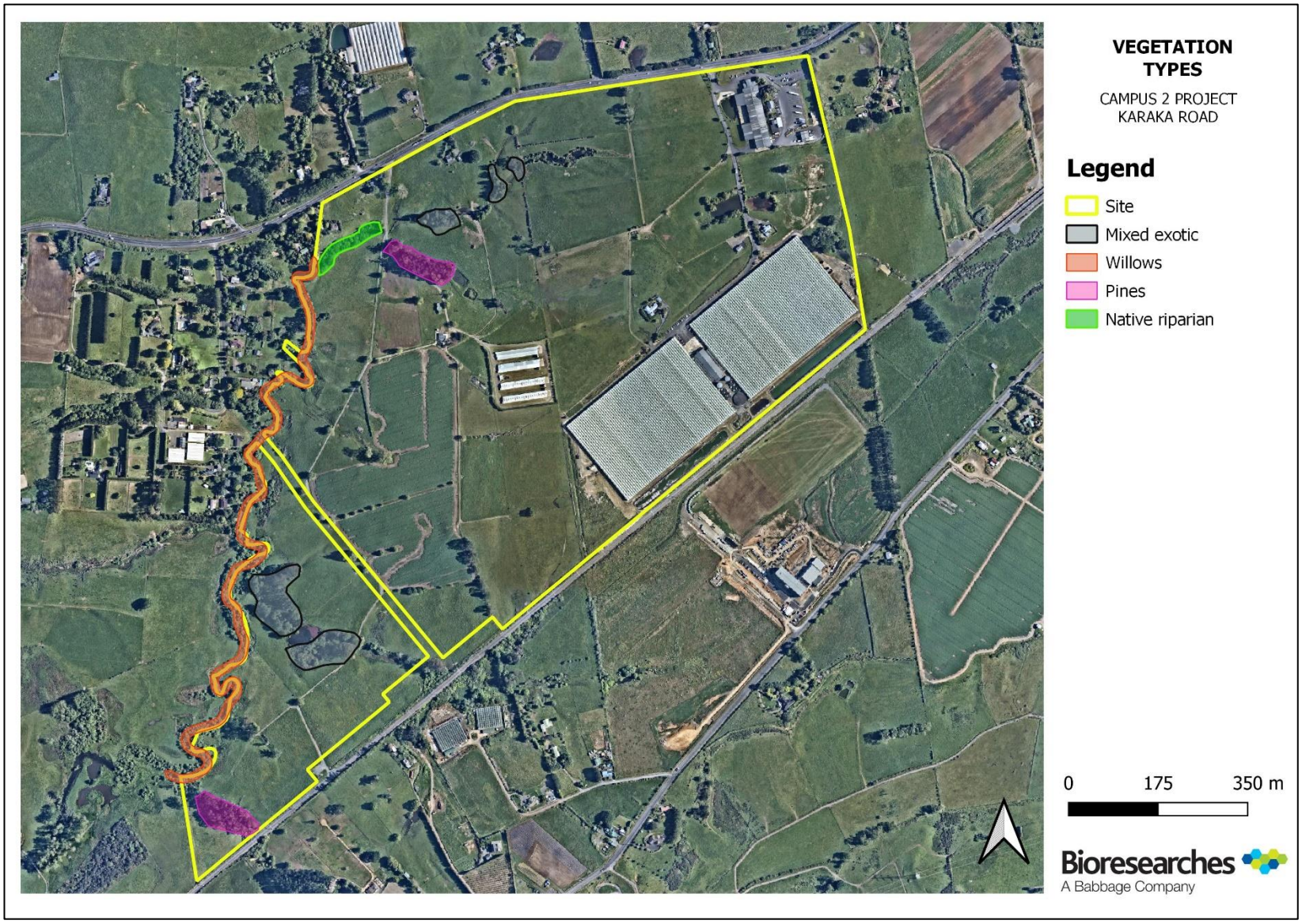

Figure 5. Vegetation map showing composition of larger vegetation stands on site.

4.1.2.1 Pine trees and mixed exotic vegetation

The mature trees that are on site are largely exotic species, including pine (*Pinus radiata*), London plane (*Platanus spp.*), several willow species (*Salix* spp.), cypress, Chinese privet (*Ligustrum sinense)*, river red gum (*Eucalyptus camaldulensis)*, black poplar (*Populus nigra),* woolly nightshade (*Solanum mauritianum)* and gorse *(Ulex europaeus*) (Figure 6). Two large stands of pines are located within the site (within the most southeastern corner and within the northwestern corner of the site), associated with intermittent streams. Others are either standalone or form partial shelterbelts across the site (see 'Pines', 'Mixed exotic', and "Standalone Large Exotics", Figure 5).

Considering the dominant presence of exotic vegetation species, the botanic value of this vegetation is **Very Low.**

Figure 6. Pine treeland and mixed exotic vegetation stands in the site.

4.1.2.2 Willow tree-dominated riparian vegetation.

Riparian vegetation associated with the Oiroa Creek is located along the eastern site boundary. The riparian yard consists mainly of willow (white and weeping) trees) (see 'Willows', Figure 5, Figure 7). Chinese privet and tree privet (*Ligustrum lucidum)* are also common within the riparian margin.

Although currently fenced, the historical lack of fencing and subsequent stock damage along the stream banks has reduced the integrity of the riparian vegetation. Along some sections of the stream, pasture extends up to the stream bank. Where riparian vegetation was present, it generally formed a thin (<5 m wide) buffer zone against the stream edge providing some canopy cover. Understory vegetation comprised mostly of exotic or mixed vegetation hosting a combination of woolly nightshade, arum lily (*Zantedeschia aethiopica*), and gorse.

As the riparian margin is narrow, it is consequently subject to intense edge effects, such as increased light and wind, which in turn increase temperature and decrease moisture levels. The edges also are subject to increased pressure from weed species (such as privet) as they encroach into the habitat. Considering these factors, the habitat was assigned a **low** botanical value.


Figure 7. Willow tree dominated riparian margin of the Oiroa Creek.

4.1.2.3 Mixed native riparian vegetation

The riparian yard surrounding a short permanent stream located in the northwestern portion of the site is fenced and densely vegetated with a mix of native species (Figure 8). The right bank comprises largely native vegetation with species such as *Coprosma lucida*, red matipo (*Myrsine australis)*, mānuka (*Leptospermum scoparium)*, lemonwood (*Pittosporum eugenioides)*, five finger (*Pseudopanax arboreus)*, tōtara (*Podocarpus totara)* and cabbage tree/ tī kōuka (*Cordyline australis)*. However, weed species of privet, Taiwan cherry (*Prunus campanulata)*, woolly nightshade, gorse and blackberry (*Rubus fruticosus* agg.) is present on the left bank.

Similar to the Oiroa Creek riparian margin, due to the presence of exotic vegetation species, the habitat was assigned a **low** botanical value.


Figure 8. Fenced native riparian vegetation associated with a permanent stream (tributary of the Oiroa Creek).

4.1.2.4 Exotic managed pasture

Areas of exotic, managed/grazed pasture within the site consisted primarily of kikuyu (*Cenchrus clandestinus*) and paspalum (*Paspalum dilatatum*) (Figure 9). Other introduced grasses and pasture species such as ryegrass (*Lolium perenne*), white clover (*Trifolium repens*), and dock (*Rumex sp*.) were present throughout. Given the absence of native plant species and the lack of representation of a naturally occurring habitat type, this area was assessed to have **Negligible botanic value**.

Figure 9. Exotic pasture comprising a variety of predominantly exotic grass species.

4.2 Avifauna

Table 2 lists the native avifauna recorded from desktop databases. Sea birds (due to a lack of any marine or coastal habitat within the site) and non-native species were excluded.

The likelihood of the presence for species recorded was considered with respect to the habitat value to those species, as assessed on-site.

Table 2. Native avifauna identified during the desktop study, with corresponding conservation status (Robertson et al., 2021).

Conservation status	Common name	Scientific name	Record source
Threatened - Nationally Increasing	New Zealand dabchick	*Poliocephalus rufopectus*	New Zealand Bird Atlas
Declining	Spotless crake / Pūweto	*Porzana tabuensis*	New Zealand Bird Atlas
At Risk - Naturally Uncommon	Pīhoihoi / New Zealand Pipit	*Anthus novaeseelandiae*	New Zealand Bird Atlas
Not Threatened	Masked lapwing / spur-winged plover	*Vanellus miles*	New Zealand Bird Atlas, iNaturalist
	kererū / New Zealand pigeon	*Hemiphaga novaeseelandiae*	iNaturalist, New Zealand Bird Atlas
	Kāhu / swamp harrier	*Circus approximans*	New Zealand Bird Atlas, iNaturalist
	pīpīwharauroa / shining cuckoo	*Chrysococcyx lucidus lucidus*	New Zealand Bird Atlas, iNaturalist

Conservation status	Common name	Scientific name	Record source
	pīwakawaka / North Island fantail	*Rhipidura fuliginosa placabilis*	New Zealand Bird Atlas, iNaturalist
	Pied Stilt / poaka	*Himantopus himantopus*	New Zealand Bird Atlas
	pūkeko	*Porphyrio melanotus melanotus*	New Zealand Bird Atlas
	pūtangitangi / Paradise Shelduck	*Tadorna variegata*	iNaturalist, New Zealand Bird Atlas
	rironiro / grey warbler	*Gerygone igata*	New Zealand Bird Atlas
	Kōtare / sacred kingfisher	*Todiramphus sanctus vagans*	New Zealand Bird Atlas, iNaturalist
	Makatu moana / white-faced heron	*Egretta novaehollandiae*	New Zealand Bird Atlas
	tauhou / silvereye	*Zosterops lateralis lateralis*	New Zealand Bird Atlas, iNaturalist
	welcome swallow	*Hirundo neoxena neoxena*	New Zealand Bird Atlas, iNaturalist
	Tui	*Prosthemadera novaeseelandiae*	New Zealand Bird Atlas, iNaturalist
	Ruru / morepork	*Ninox novaeseelandiae*	New Zealand Bird Atlas
	Australasian shoveler / Kuruwhengi	*Anas rhynchotis*	New Zealand Bird Atlas

Table 3 lists the bird species identified opportunistically on site during the site visit.

Table 3. Avifauna observed on-site and corresponding NZ conservation status (Robertson et al., 2021).

	Common name	Species name	NZ Conservation status
Indigenous	pūkeko	*Porphyrio melanotus melanotus*	Not Threatened
	New Zealand dabchick (Discussed in Section 4.2.1)	*Poliocephalus rufopectus*	Threatened
	Masked lapwing / spur-winged plover	*Vanellus miles*	Not Threatened
	Tui	*Prosthemadera novaeseelandiae*	Not Threatened
	welcome swallow	*Hirundo neoxena neoxena*	Not Threatened
	Grey Teal / Tete-moroiti	*Anas gracilis*	Not Threatened
Introduced	mallard duck	*Anas platyrhynchos*	Introduced and Naturalised
	ring-necked pheasant	Phasianus colchicus	Introduced and Naturalised

Three bird species with a threat status of 'At-Risk' or higher (NZ dabchick, spotless crake, and NZ pipit) were recorded within 5 km of the site. These species are discussed below.

4.2.1 New Zealand Dabchick

The New Zealand dabchick (*Poliocephalus rufopectus* – Threatened – Nationally Increasing) is often recorded using amenity and stormwater ponds around the Auckland Region, particularly where those ponds provide dense edge and overhanging vegetation or other cover where they can shelter 'floating' nests during the breeding season. A desktop and database review identified two dabchicks, reported twice (2016, 2022) on the narrow ponds at the southern boundary of the site with the railway. These constructed ponds are plastic-

lined (Figure 10, Figure 12) and have no associated vegetation or structure (e.g. undercut banks) that would be considered sufficient to support suitable habitat in the long term (e.g. nesting and food resources would be marginal if at all).

Figure 10. Lined pond between green house and railway supporting dabchicks (six observed in total).

A site visit in December 2022 identified a single dabchick on one of the artificial ponds, adjacent to the Oiroa Creek. This pond supports riparian vegetation, including raupō within and around it (Figure 11) and it supports abundant potential nesting sites.

Figure 11. Amenity pond supporting New Zealand dabchick.

Dabchicks construct nests on floating platforms on ponds and lakes, where sufficient cover is available. Such habitat is often limited in modified landscapes; however, this pond provides very good such resources (Figure 11, identified as 'dabchick habitat' in Figure 14). Dabchicks are typically very territorial during the breeding season (from June to March) and it is likely that this pond supports a breeding pair, given the available habitat that it supports. A subsequent visit in April 2024 also identified six dabchicks using one of two narrow ponds

at the southern boundary between the greenhouses and railway line (e.g. Figure 12), as previously recorded from eBird observations. These narrow greenhouse ponds do not support suitable breeding habitat; however, it is possible that they are used by juvenile dabchicks dispersing from natal ponds nearby. This observation suggests that there are breeding pairs in the surrounding landscape.

Figure 12. Two dabchicks on a lined pond at the southern boundary of the site.

Several other artificial ponds are also present within the site, some of which support suitable potential roosting or breeding habitat for dabchicks (e.g. Figure 13). Note that as a highly mobile species (appendix II NPS-IB), this assessment does not preclude dabchicks from using any of these other ponds at a later date (e.g. Figure 14). During a site visit undertaken on 29 April 2024, no dabchicks were observed on any of the ponds. Dabchicks are a threatened species and as such, they have a **very high species value.**

Figure 13: Ponds within the site within which dabchick potentially breed.

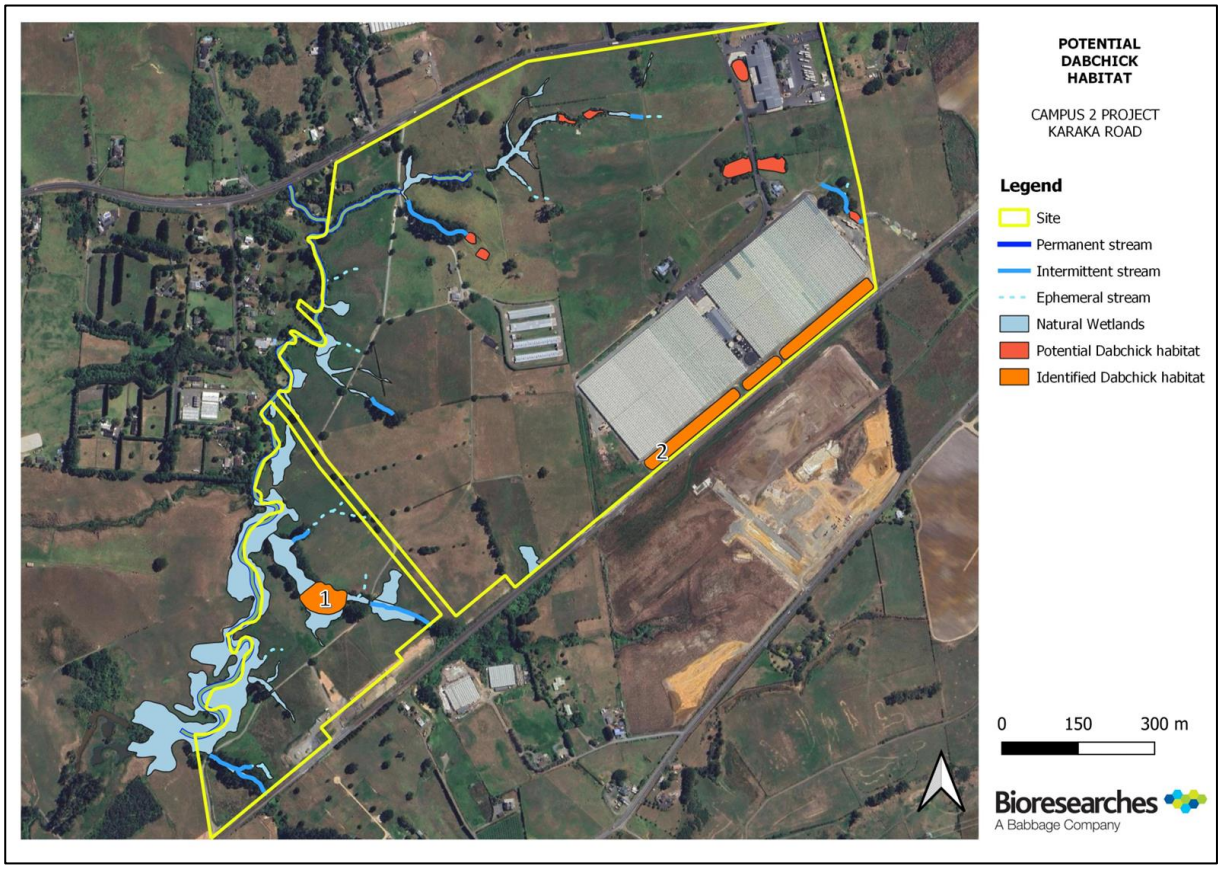

Figure 14. Artificial ponds within the Karaka Road Structure Plan, identified as supporting or having potential to support New Zealand dabchicks. (Basemap edited from Barkers & Associates)

4.2.2 Spotless Crake / Pūweto

Spotless crake (*Zapornia tabuensis* - At Risk) inhabit wetland areas dominated by dense emergent vegetation, such as raupō. New Zealand eBird identifies spotless crake records in the surrounding landscape, with the closest being approximately 6.5 km north and south, both in highly modified environments. To the north, two records were identified from the southern edge of the Pahurehure Inlet at Karaka Harbourside, residential environment. To the south, a dead specimen was identified from an office carpark in central Pukekohe.

Some small patches of raupō are present surrounding the western pond and sections of the Oiroa Creek riparian margin, and dense weedy growth occurs along the length of Oiroa Creek and connects with one of the ponds (Figure 13). These environments are degraded, relatively small and isolated from larger areas that may support spotless crake populations.

Spotless crake call-playback did not elicit any responses. As a highly mobile species (appendix II NPSIB), this assessment does not preclude spotless crake from using any of the potential habitats (Oiroa Creek riparian and densely vegetated adjacent ponds) at a later date. Spotless crake are considered unlikely to be present on any regular basis and the value of the site to spotless crake is considered **low**.

4.2.3 New Zealand Pipit

The New Zealand pipit (*Anthus novaeseelandiae* – At Risk – Naturally Uncommon) has been recorded within 5 km of the site. This species is widespread in rough, open habitats such as rough pasture, similar to those currently maintained within the site. Pipits are considered to have probably benefitted from forest clearance and have been recorded throughout the north Auckland area where similar, highly modified (rough, open pastures) are common. New Zealand pipit have not been recorded at the site; however, such open parts of the site have some potential to be used intermittently for foraging. Pipit nesting habitat is ground based, typically under grass or tussock clumps, within ferns where they are fully covered by vegetation. The ponds and wetlands located at the southern end of the site have rough edge vegetation that could potentially support nesting habitat. However, the stability of such environments may be affected by managed pasture, and changes to grazing practices could impact the availability of suitable nesting habitat in these areas. The habitat value of site to pipits is considered to be **moderate**.

4.2.4 Non-threatened native birds

The habitat value to native avifauna is limited, largely due to a lack of tree cover. Some large trees, both native and exotic, may provide intermittent foraging or nesting for common native birds such as tūī, kererū and silvereye from surrounding areas. Denser areas of riparian vegetation may also support common native birds for nesting and foraging.

Open pasture areas provide suitable foraging habitat for common native birds, including herons, pied stilt shelducks and harrier hawks, which may also breed within the site where isolated trees or current land-use (grazing) provides undisturbed ground cover.

However, these areas are highly modified environments and, while supporting generally exotic and common native species, are considered to be **low ecological value.**

4.3 Herpetofauna

The indigenous herpetofauna of the Auckland Region includes 18 terrestrial taxa, of which 12 occur on the region's mainland (c.f. islands). A further four introduced species are also known to occur in the region (van Winkel *et al*., 2018). These species are listed in Table 4, which also lists the species recorded within 5 km of the site during the literature search. This includes a copper skink, plague skink and two exotic frog species. The records also indicate that three unidentified skinks and a *Litoria* spp. frog species was identified.

Table 4. Terrestrial herpetofauna of the Auckland region, corresponding NZ conservation statuses and reported occurrence within 5 km of the site.

	Common name	Species name	NZ threat status*	Reported within 5 km of the site
Indigenous	***Woodworthia "Muriwai"***	Muriwai gecko	Nationally Critical	
	Mokopirirakau granulatus	Forest gecko	At Risk – Declining	
	Naultinus elegans	Elegant gecko	At Risk – Declining	
	Dactylocnemis pacificus	Pacific gecko	At Risk – Relict	
	Woodworthia maculata	Raukawa gecko	Not Threatened	
	Oligosoma ornatum	Ornate skink	At Risk – Declining	
	Oligosoma striatum	Striped skink	At Risk – Declining	
	Oligosoma moco	Moko skink	At Risk – Relict	
	Oligosoma smithi	Shore skink	At Risk – Naturally Uncommon	

	Common name	Species name	NZ threat status*	Reported within 5 km of the site
	Oligosoma aff. smithi	Tatahi skink	At Risk – Naturally Uncommon	
	Oligosoma aeneum	Copper skink	At Risk – Declining	✓
	Leiopelma hochstetteri	Hochstetter's frog	At Risk – Declining	
Introduced	***Lampropholis delicata***	Plague skink	Introduced & Naturalised	✓
Introduced	***Ranoidea aurea***	Green and golden bell frog	Introduced & Naturalised	✓
Introduced	***Ranoidea raniformis***	Southern bell frog	Introduced & Naturalised	✓
Introduced	***Litoria ewingii***	Whistling tree frog	Introduced & Naturalised	

* Hitchmough *et al*., 2021; Burns *et al*., 2018

4.3.1 Field assessment

A lizard survey undertaken in February 2023. The survey was done through an ACO (artificial cover object) survey of 15 stations across the site (Figure 17). Each station consisted of three ACOs, totalling 45. The survey targeted potential habitat for native skinks, specifically copper skinks, in edge vegetation along the riparian vegetation and shelterbelts (Figure 15). Initial checks found only plague skinks (*Lampropholis delicata*) on-site. Native skinks are behaviourally very cryptic, and it is not uncommon for them to be discovered during precautionary management where surveys have not detected them. Therefore, while not detected in the current surveys, native skinks may still be locally present at the site, however it is unlikely that any such occurrences are of a high abundance.

The plague skink is an 'Unwanted Organism' (Biosecurity Act 1993) that has the potential to compete with indigenous skinks. However, the impacts of this species on indigenous lizards are not clearly understood and therefore, its presence does not add or detract from the site's ecological values. As this species is exotic, it is not considered further.

Figure 15. An ACO station (red arrow) at the edge of shelterbelt vegetation and grazed pasture, targeting copper skinks.

4.3.2 Habitat assessment for native herpetofauna

Skinks, such as the copper and ornate, in the Auckland Region generally require dense ground cover, particularly along the edges of taller vegetation. They may also be found under log and debris piles. Geckos typically require contiguous areas of vegetation with dense foliage, cavities (such as cracks, flaky bark and hollows) and / or epiphytes (suitable for forest gecko, pacific gecko and elegant gecko (foliage-dwelling)).

Areas of managed pasture, and most associated shelterbelts are considered to be of **low value**, however localised areas of more densely vegetated mixed scrub (Figure 16) are conservatively assessed as of **moderate value**.

Figure 16: Examples of scrub and overgrown groundcover beneath vegetated margins, that may provide skink habitat

The site, being almost entirely cleared of native vegetation historically, is of **negligible value** to native geckos. Geckos require dense arboreal vegetation, although can persist in fragmented, highly modified environments provided there is connectivity to nearby suitable habitat. No gecko habitat connectivity exists throughout the site, additionally with no geckos recorded within 5 km of the site. No gecko habitat has remained within the site, with native vegetation being planted following clearance.

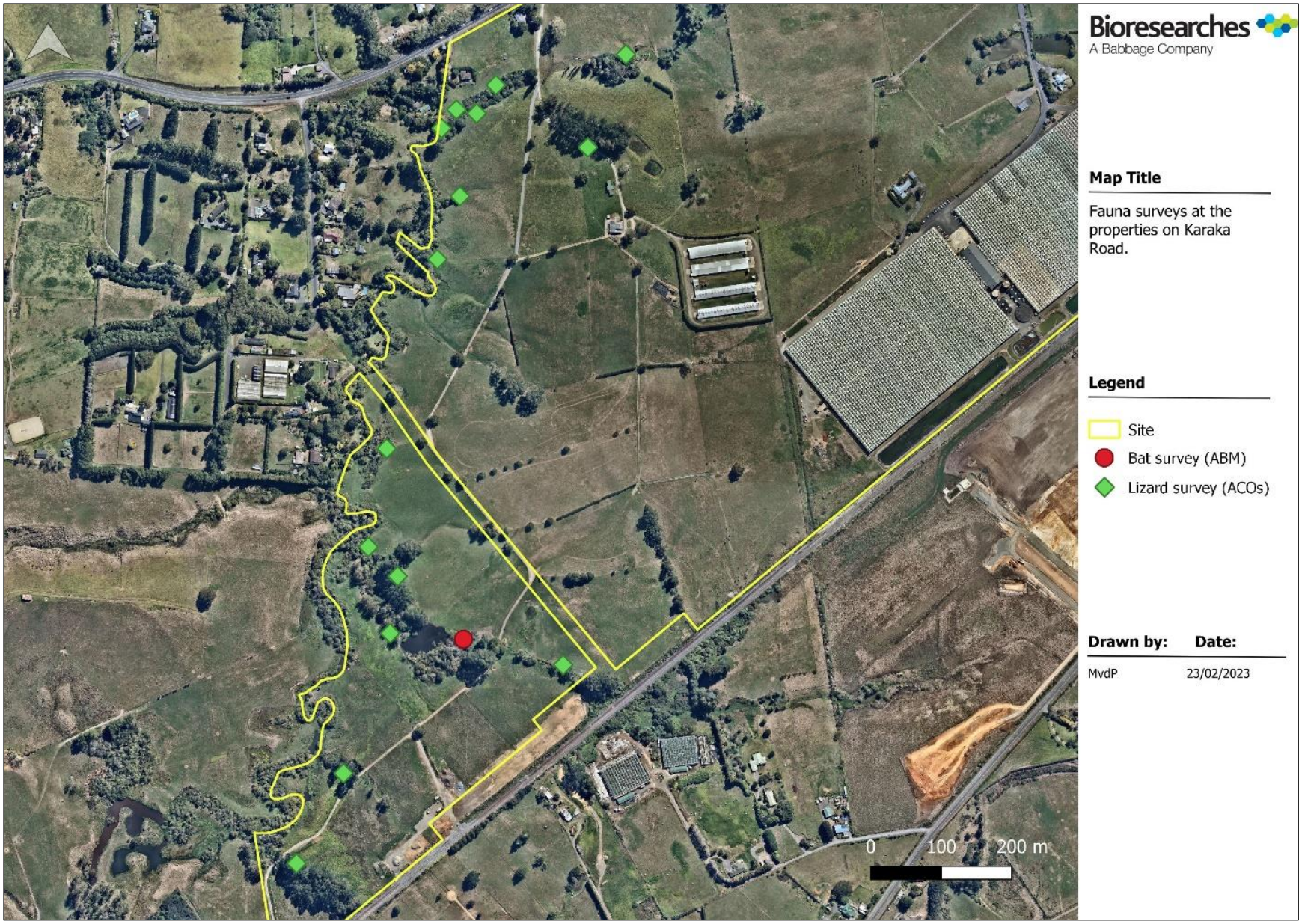

Figure 17.Native skink and bat surveys at the site, targeting potential fauna habitat (refer to Section 4.4 for more information regarding the bat survey).

4.4 Bats (pekapeka)

Two endemic species of bats (pekapeka) are found in New Zealand, including the long-tailed bat (LTB; *Chalinolobus tuberculatus*) and short-tailed bat (STB; *Mystacina tuberculata*); the latter is represented by three subspecies (O'Donnell *et al.,* 2023). Both species are listed as 'Threatened' or 'At Risk' under the New Zealand threat classification system (i.e., LTB - 'Nationally Critical' and Southern STB – 'At Risk – Recovering') (Townsend *et al*., 2008; O'Donnell *et al*., 2023). Their threat statuses reflect the chronic decline in populations across much of New Zealand, due to the loss and fragmentation of habitats and adverse impacts of pest mammals (e.g., rodents, cats), with some population recovery from conservation management apparent in Southern STB populations.

4.4.1 Desktop assessment

Department of Conservation bat records were accessed within the vicinity of the site (Figure 18). The closest record was for a LTB, 2.8 km to the north of the site close to the Pahurehure inlet. Other LTB records were also recorded within 3 km to the southwest of the site. Other surveys have been completed nearer to the site which have not detected bats.

These records also indicate that bats use areas to the Auckland Region's south, including Pukekohe, Drury and Karaka- all locations well beyond recognised regional strongholds (e.g. Hunua Ranges) for this species.

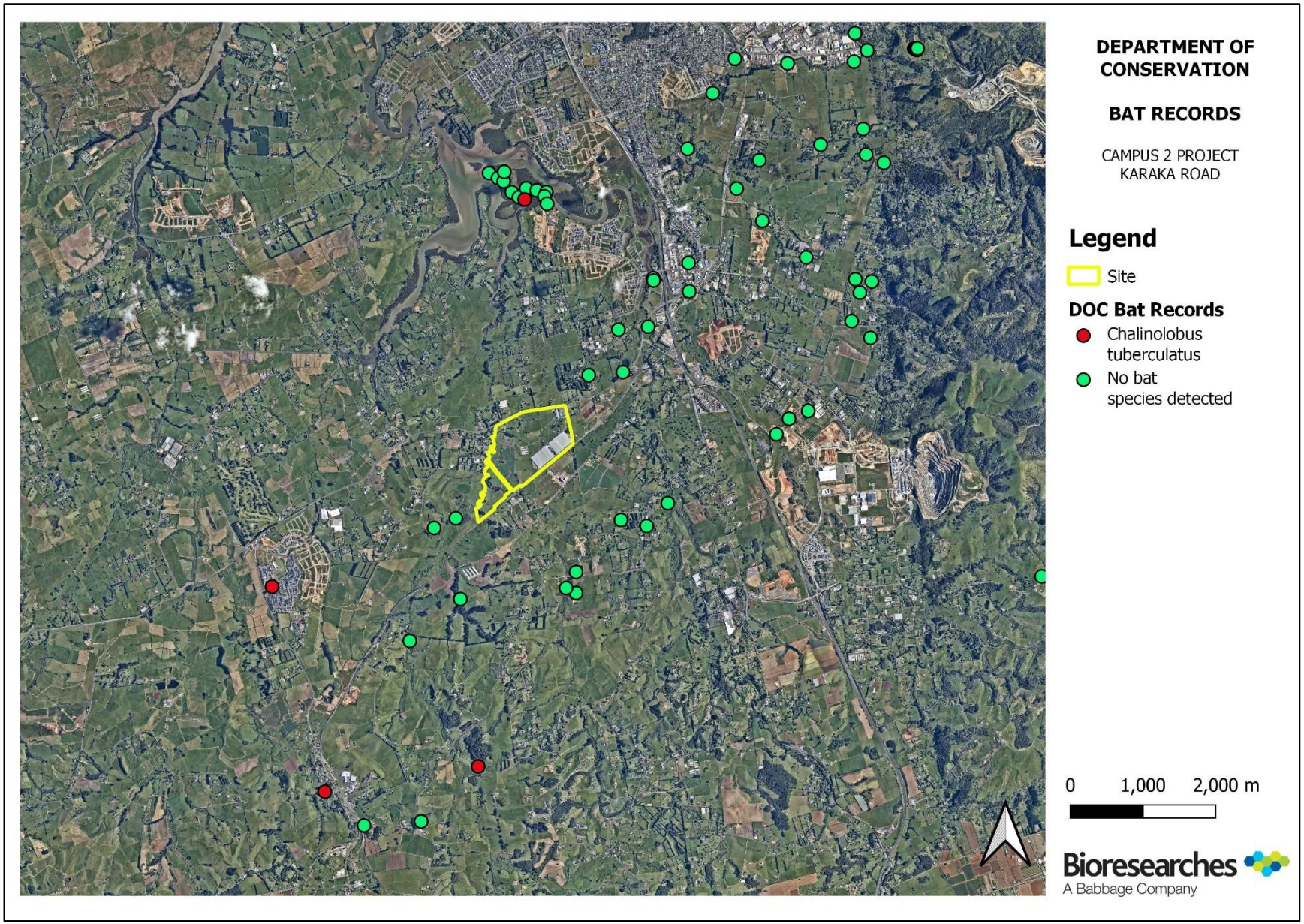

Figure 18. Bat records within the vicinity of the site.

4.4.2 On-Site Bat Survey

Survey 1 (January – March 2024)

One acoustic bat monitor (ABM) was placed on site in a pine tree within a wetland in the southwestern part of the site (Figure 17, Figure 19). No bats were recorded during this survey, however bad weather conditions were prevalent through the February 2023 survey. From January 2024 to early March 2024, an ABM was reset in the same position, which recorded two LTB passes from 51 valid survey nights. These records indicate that bats are utilising the site during the mid-season survey period. The recordings were noted on 10/02/2024, at 3:55 a.m., and 23/02/2024, at 10:21 p.m. As these times are outside dawn and dusk (roost entry and exit times), it is unknown if the bats are passing through the available corridors, or using available habitat for roosting.

Figure 19. ABM situated in a pine tree adjacent to a wetland and open pond.

Survey 2 (21st March – 28th April 2024)

A second survey was undertaken from the 21st March to the 28th April 2024. This survey included ten ABMs throughout the site, to gain a greater understanding of bat activity and use of the site.

Five of the ten locations detected bat activity, mostly 1-2 passes at each location, from7-23 valid survey nights (Figure 20).

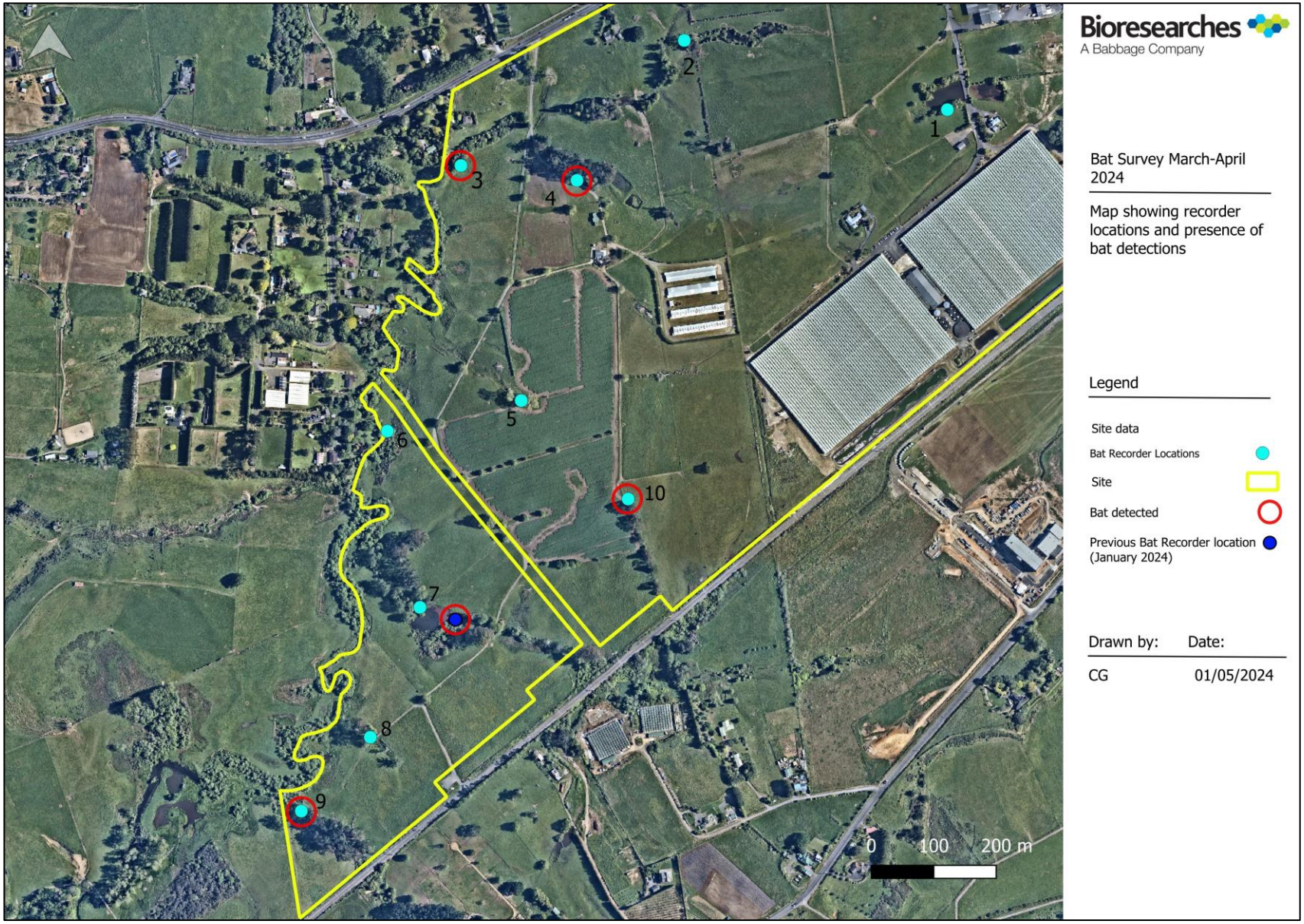

Figure 20: Map showing locations of 2024 bat recorders, and location of bat detection

Table 5: Recorder locations in the March-April 2024 survey, including total number of valid nights, and survey results

Recorder	Recording Dates	Bat Passes	No. Valid Nights	Valid nights with passes	Total Passes	% valid nights with passes
1	21/03/24 – 18/04/24	0	17	0	0	0
2	21/03/24 – 22/04/24	0	21	0	0	0
3	21/03/24 – 15/04/24	04/04/24 8:15 pm	15	1	1	6.5
4	21/03/24 – 13/04/24	4/04/24 – 8:20 p.m. 6/04/24 – 9:21 p.m.	15	2	2	13
5	21/03/24 – 28/04/24	0	23	0	0	0
6	21/03/24 – 18/04/24	0	18	0	0	0
7	21/03/24 – 28/04/24	0	23	0	0	0
8	21/03/24 – 08/04/24	0	8	0	0	0
9	05/04/24 – 16/04/24	8/04 – 4:37 a.m. 16/04 – 7:43 p.m. x2; 7:44 p.m. x2; 7:45 p.m.	7	2	6	40
10	21/03/24 – 17/04/24	2/04/24 - 7:54 p.m. 4/04/24 - 7.29 p.m.	16	2	2	12.5
	Site-wide		**163**		**11**	

Recorders 3, 4, and 10 all detected 1-2 passes across the survey period, with six passes detected at Recorder 9. Activity was mostly detected in the early evening (from around 7:30 p.m.).

Sixteen nights from 38 were excluded from the data (temperatures > 10°C within the first four hours after sunset. Full weather data can be found in Appendix B.

Further bat surveys are anticipated (October to December) to provide a further understanding of bat activity at the site.

4.4.3 Habitat Assessment

LTBs utilise habitat features such as vegetated stream corridors for foraging and flight paths, and mature trees (both native and exotic) with habitat features such as loose bark, cracks or rot holes as roosts. Many of these features occur at the site, with numerous large, old mature trees. Several ponds are also present on-site with large surrounding trees and adjoining riparian flight corridors. Bats are known to use ponds and large open water bodies for feeding.

LTBs are a **very high value species**, and low-level activity has been recorded in association with the southern end of the site. Further survey results will inform level of activity beyond these areas.

Figure 21: Example of bat habitat on-site (this pond is specifically referred to as 'Identified Dabchick Habitat' on Figure 14), with a large body of water for feeding, and old pine which may provide roosting habitat.

4.5 Freshwater and Wetland Habitats

The site hosts several watercourses (Figure 22 to Figure 24); comprising of the Oiroa permanent and intermittent streams, as well as natural inland wetlands. Artificial ponds are also located within the site boundaries. The sections that follow provide a description of each of the freshwater ecosystem habitats identified.

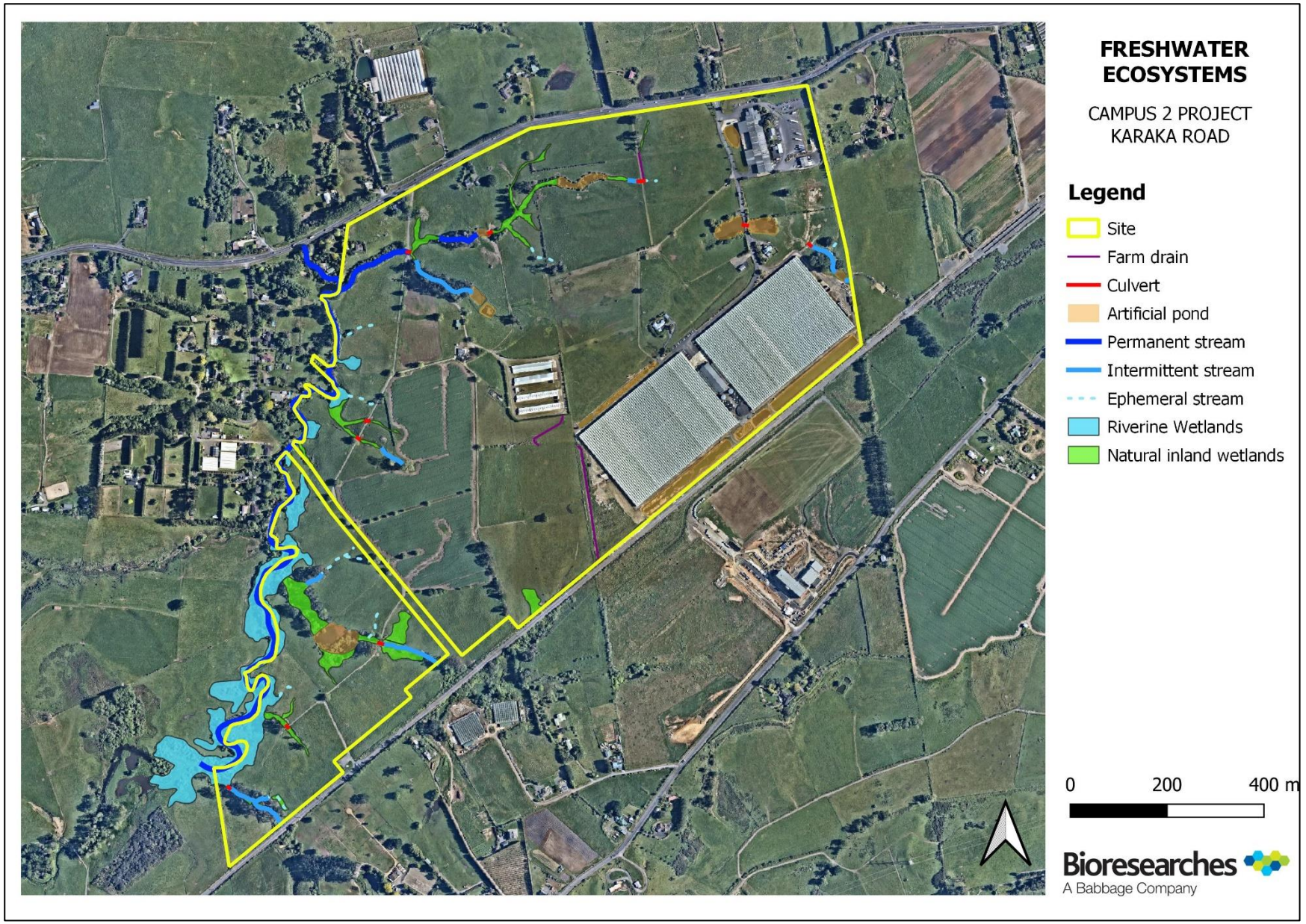

Figure 22. Overview of the freshwater habitats identified within the site.

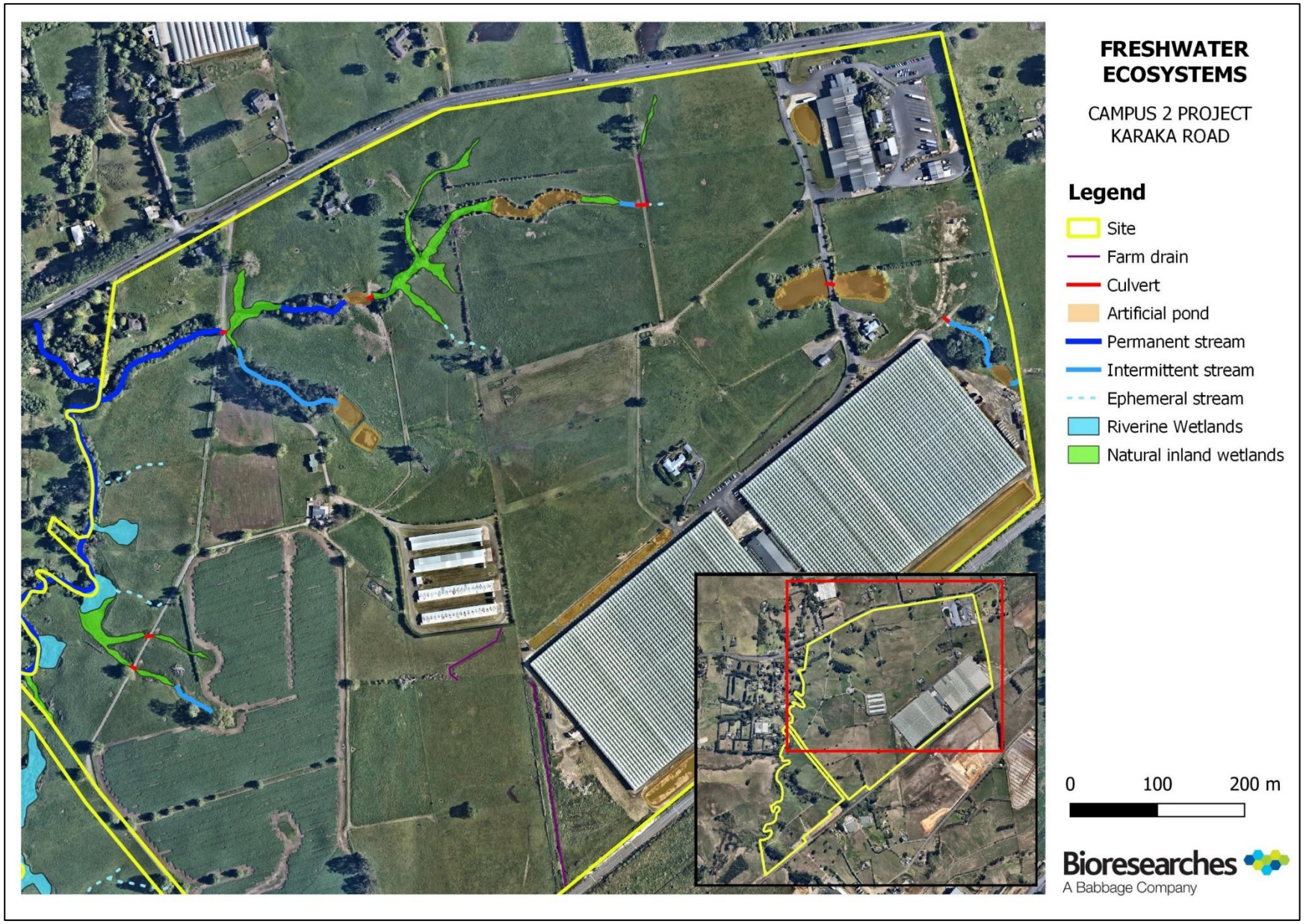

Figure 23. Focused overview of the freshwater habitats identified within the north eastern portion of the site.

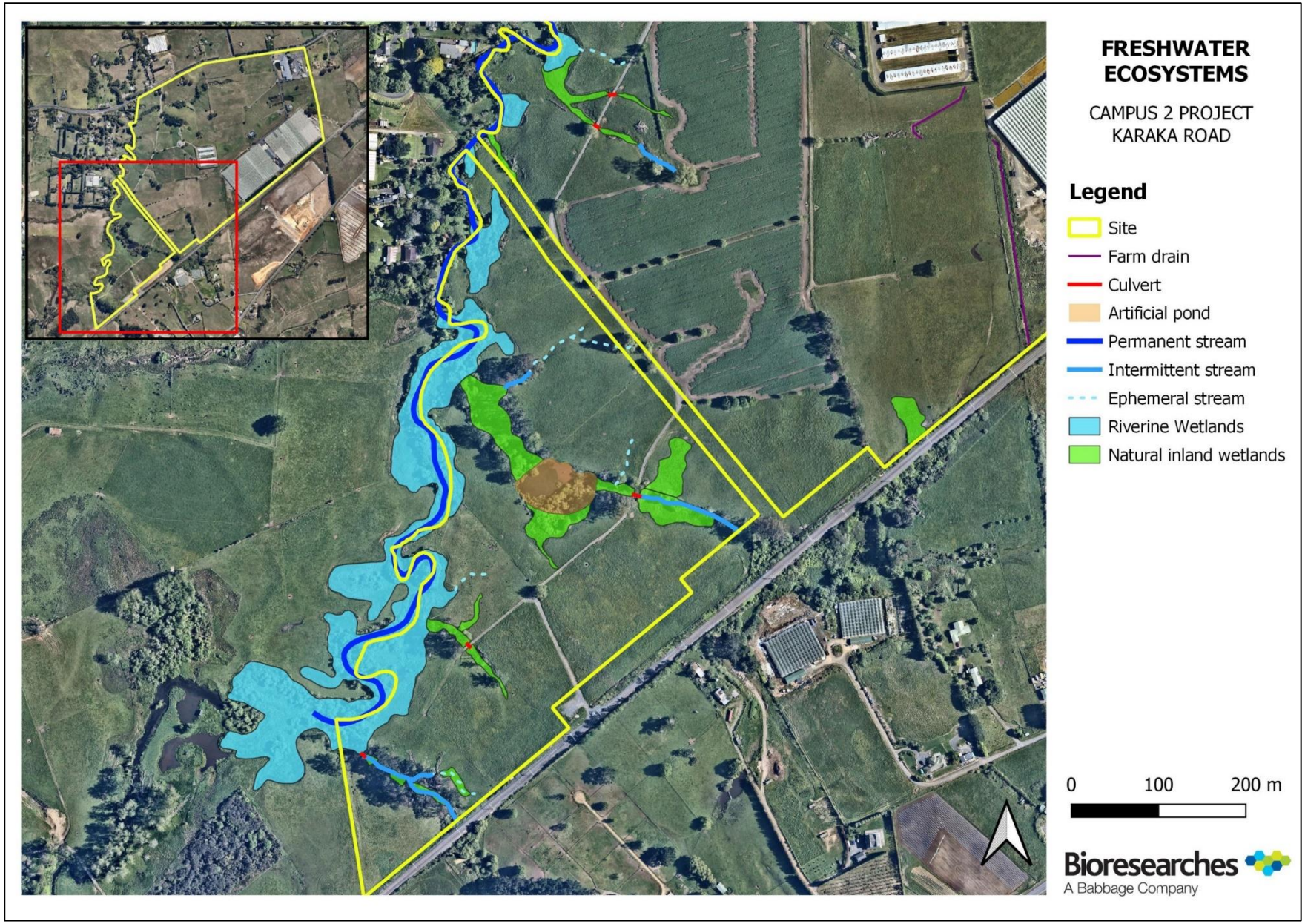

Figure 24. Focused overview of the freshwater habitats identified within the south western portion of the site.

4.5.1 Streams

4.5.1.1 Oiroa Creek (Permanent stream) and associated tributary.

The Oiroa Creek, a permanent stream is located along the western boundary of the site (Figure 22). A tributary of the Oiroa Creek, located within the northwestern portion of the site was classified as the only other permanent stream (Figure 25). Stream characteristics were reflective of the current agricultural nature of the catchment and the site, with a lack of, or poor-quality riparian vegetation.

The streams are classified as soft-bottomed streams. The Oiroa Creek channel in the site averaged between 1.5 to 3 m wide, with variable depth, ranging from 0.3 to approximately 0.7 m deep. Runs were the dominant habitat type, which were periodically interupted by pools. Some backwaters were present in the riverine wetland sections of the Oiroa Creek (refer to Section 4.5.2.1) where oxbow lakes had formed as meanders became cut off from the mainstream. Banks of some stream sections were incised, and active erosion on the banks was observed.

The riparian vegetation and stream banks (where steep) provide effective shading to the stream. It is expected that the riparian vegetation would provide filtration functions and bank stability, however this is limited where banks are only vegetated with grasses due to historical effects from grazing.

Figure 25. Representative photographs of the Oiroa Creek.

Figure 26. Representative photographs a tributary (permanent stream) of the Oiroa Creek.

A desktop search for native fish records, using the New Zealand Freshwater Fish Database (NZFFDB), was undertaken within the Oiroa Creek catchment. Only two native fish species have been recorded (Table 6). Given the proximity to the coast, habitat characteristics of the stream, including suitable habitat for native fish species, it is likely that these fish species are present in the Oiroa Creek and its tributary and that other common species usually present in permanent, lowland, mainly soft bottomed Auckland streams are also present, including longfin eel (*Anguilla dieffenbachii*) and bullies (*Gobiomorphus cotidianus, G. huttoni*). No barriers to fish passage were observed in the assessed reach of the Oiroa Creek. Fish migration may be limited between the upstream and downstream reaches of the tributary, as a small culvert crossing is present.

Table 6. Native fish recorded within 5km of the site.

Common name	Scientific name	Threat classification*
shortfin eel	*Anguilla australis*	Not threatened
banded kōkopu	*Galaxias fasciatus*	Not threatened

* = Freshwater fish threat classifications from Dunn *et al.* (2017); freshwater invertebrate threat classifications from Grainger *et al.* (2018).

The stream is likely to provide moderate habitat for macroinvertebrates and fish, as good habitat with the undercut banks and woody debris were observed, and it is highly likely that native eels (at a minimum) are present in the reaches on site. Therefore, the Oiroa Creek and tributary is considered of **moderate ecological value**.

4.5.1.2 Intermittent streams

Several intermittent streams were identified within the site (Figure 23 and Figure 24). The intermittent streams contained defined banks, surface water and lacked rooted terrestrial vegetation throughout the assessed reaches (Figure 27). The hydrological heterogeneity was considered to be low, with the streams consisting of single runs with shallow water, very slow water flow, and were assessed as being likely to have ceased to flow during the later stages of summer. Considering this, and the small culvert crossings in these streams, it is likely that only shortfin eel could be present within these streams.

Riparian vegetation of the intermittent streams varied between a combination of pasture grasses to a small buffer of trees (exotic and native). In most cases, the riparian yard provided moderate shading functions to the streams due to the canopy cover. Nonetheless, in other reaches where short, grazed bankside grasses were observed, shading and filtration function was determined to be very low.

Aquatic habitat and abundance were considered to be low, with available habitat for indigenous fish severely limited by the very shallow depth of these streams, additionally, some culvert crossings partially limit fish movement between upstream and downstream reaches. Limited undercut banks, macrophytes or other forms of fish cover were observed within the channels.

Given these conditions, the intermittent streams are considered to hold **low ecological value**.


Figure 27. Photographs of intermittent streams observed on site. Note that these streams have mostly surface water and comprise of single runs confined to a channel.

4.5.1.3 Ephemeral flow paths

Multiple other ephemeral watercourses were identified, which correspond to the overland flow paths identified by Auckland Council's Geomaps (Figure 1). Upon ground-truthing, these overland flow paths were located within grass swales and did not have defined banks, standing water or pools, and rooted terrestrial vegetation was established throughout the flow paths (Figure 28). Additionally, these flow paths drain relatively small localised catchments within the site, and as such, most of the flow paths were considered to be ephemeral watercourses.

The flow paths generally consisted of a shallow swale with common pasture species such as kikuyu (*Cenchrus clandestinus*), broad-leaved dock (*Rumex obtusifolius*) and buttercup (*Ranunculus repens*) (Figure 28).

Figure 28. Typical ephemeral watercourse identified within the site.

4.5.2 Wetlands

4.5.2.1 Riverine wetlands (Natural inland wetlands)

The Oiroa Creek is associated with riverine wetlands which have formed in low lying areas near the banks and historical meandering points (Figure 23). These wetlands are hydrologically driven by the stream and frequent overbank flooding from rain events raising the water level in the stream. Surface runoff from the areas surrounding the wetlands also contributes to the hydrological regime. During the site visit in December 2022, most of these wetlands had shallow surface water.

The highly invasive exotic reed sweetgrass (*Glyceria maxima*), which has a wetland indicator status rating of 'Obligate'[18],dominated the large wetlands associated with the southern reach of the Oiroa Creek. Wetland areas not dominated by reed sweetgrass comprised a mixture of exotic sedges, rushes and pastural weeds dominated by Mercer grass (*Paspalum distichum* - FACW), soft rush (*Juncus effusus* - FACW), water pepper (*Persicaria hydropiper* - FACW), with Yorkshire fog (*Holcus lanatus* - FAC), buttercup (*Ranunculus repens* - FAC), lotus (*Lotus pedunculatus* - FAC) and some FACU pasture species also present. These wetlands passed the 'Rapid Test'[19] and were classified as 'natural inland wetlands' under the NPS-FM, and therefore no further tests (i.e., soil or hydrology) were undertaken.

The hydrologic variation and habitat diversity within these wetlands were assessed as low, comprising shallow surface water within the lower lying areas of the wetland areas closest to the stream bank. However, the shading provided by the Oiroa Creek riparian margin would provide moderate value habitat for native freshwater fauna both within the stream and the wetlands. The exception would be the areas of the invasive reed sweet grass. Reed sweet grass is a bio-modifier and outcompetes native wetland vegetation, other exotic vegetation, forming a dense monoculture with root mats unsuited to our native fauna. However, while the ecological values of these wetlands are limited and dominated by exotic weed species, these wetlands are extensive, serve important hydrological functions, and are as such considered of **moderate ecological value**.

Figure 29. Riverine wetlands identified along the Oiroa Creek, noting the presence of the invasive reed sweetgrass.

[18] Clarkson BR, Champion PD, Johnson PN, Bodmin KA, Forester l, Gerbeaux P, Reeves PN 2013. Wetland indicator status ratings for New Zealand species. Landcare Research, Hamilton.
[19] Ministry for the Environment. 2020. Wetland delineation protocols. Wellington: Ministry for the Environment.

4.5.2.2 Other natural inland wetlands

Several wetlands were identified throughout the site, predominantly draining into the Oiroa Creek (Figure 23). These wetlands can best be described as exotic wetlands, due to the dominance of exotic vegetation species such as soft rush (FACW), jointed rush (*Juncus articulatus* - FACW) and water pepper (FACW), amongst the same species noted in the riverine wetlands (Figure 30). These wetlands passed the 'Rapid Test' and were classified as 'natural inland wetlands' under the NPS-FM, and therefore no further tests (i.e., soil or hydrology) were undertaken.

Due to the current land use (pastural farming) these wetlands have been grazed and, in some cases, pugged. Predicted floodplain data from Auckland Council geomaps indicated these areas contain the hydrology to support natural wetlands. While some of the wetlands had shallow water during the site visit, it is probable that they most become saturated only intermittently. As a result, the wetlands offer limited habitat for native fish species, although it is possible it may provide habitat for shortfin eels (*Anguilla australis*; Not Threatened) when water levels are high. In addition, the presence of narrow and obstructed culvert crossings would act as at least partial barriers to fish movement.

As these wetlands are dominated by exotic vegetation species, with limited habitat for native faunal species, the overall **ecological value is considered low**.

Figure 30. Natural inland wetland identified within the site, predominantly dominated by a variety of facultative wetland grasses and sedges.

4.5.3 Artificial ponds

Several artificial ponds were identified at the site (Figure 22). Most of these ponds are instream ponds, likely constructed for agricultural purposes. Other constructed ponds on site were constructed as part of the facilities for the hothouses on site (Figure 13, Figure 31).

Considering the surrounding land use, and the observation of the surface water of the ponds, water quality is expected to be low. Although, these ponds can provide some potential habitat for native freshwater fauna, such as shortfin eels and potentially native birds (refer 0), the overall ecological value of these ponds is considered to be **low**.


Figure 31. Artificial ponds identified within the site.

5. ECOLOGICAL VALUE

Table 7 combines the fauna and habitat information presented in Section 4 to assign an ecological value for each habitat present within the site.

Table 7. Summary of ecological values of habitats and species within and surrounding the site. The ecological value is assigned by considering the information discussed in Section 5 on the structure and condition of the habitats combined with their potential to support native fauna.

Habitat		Botanic value	Species which habitat may support				Ecological value of habitat
			Avifauna	Herpetofauna	Bats	Fish	
Terrestrial Habitats	Pine treeland and mixed exotic vegetation (Figure 5)	Very Low	Low Unlikely to support any more than common, Not Threatened species.	Low Unlikely to support native herpetofauna	High Conservative value: Exotic vegetation may support bat roosting habitat.	N/A	**High** (results from further bat surveys in proposed in October to December 2024 may reduce this value)
	Willow tree dominated riparian vegetation (Figure 5)	Low	Low Unlikely to support any more than common, Not Threatened species.	Low Unlikely to support native herpetofauna	High Conservative value: riparian vegetation may support a flight corridor and roosting habitat.	N/A	**High** (results from further bat surveys may reduce this value)
	Mixed native riparian vegetation (Figure 5)	Low	Low Unlikely to support any more than common, Not Threatened species.	Moderate May support native skinks where edges are overgrown and groundcover present	High Mature trees could provide roosting habitat, although highly unlikely to be important habitat or frequently visited.	N/A	**High** (results from further bat surveys may reduce this value)
	Exotic Managed Pasture	Negligible	Moderate May support 'At Risk – Declining' pipit throughout some of its life stages/ habitat requirements	Low Unlikely to support native herpetofauna	Moderate Bats may commute or forage over open spaces	N/A	**Moderate**

Habitat		Botanic value	Species which habitat may support				Ecological value of habitat
			Avifauna	Herpetofauna	Bats	Fish	
Freshwater habitats	Oiroa Creek and tributary (Figure 22)	N/A	N/A	N/A	N/A	Likely limited number of common native fish present but not likely to be high-value habitat.	**Moderate**
	Intermittent streams (Figure 22)	N/A	Unlikely to support any more than common, Not Threatened species.	N/A	N/A	Highly unlikely to contain native fish	**Low**
	Riverine wetlands (Figure 22)	N/A	Unlikely to support any more than common, Not Threatened species	N/A	N/A	Could be utilised by native fish during high-flow periods, however does not provide high-value habitat.	**Low**
	Natural inland wetlands (Figure 22)	N/A	Unlikely to support any more than common, Not Threatened species	N/A	N/A	Highly unlikely to contain native fish.	**Low**
	Artificial Ponds (Figure 22)	N/A	No threatened or at-risk species recorded	N/A	N/A	Could be utilised by native fish such as shortfin eels, however does not provide high-value habitat.	**Low**
	Artificial pond at south-western corner of site, referred to as 'Identified Dabchick habitat' 1 (Figure 14)	N/A	Very High Pond likely to be used for breeding by threatened New Zealand dabchicks	N/A	N/A	Could be utilised by native fish such as shortfin eels	**Very High**
	Artificial pond at south-eastern boundary between green house and railway, referred to as 'Identified Dabchick habitat' 2 (Figure 14)	N/A	High Six threatened dabchicks recorded using this pond, though habitat quality apparently low.	N/A	N/A	Highly unlikely to contain native fish	**Moderate**

6. ASSESSMENT OF ECOLOGICAL EFFECTS

The proposed Plan Change seeks to rezone land from Future Urban Zone (FUZ) to Business – Light Industry Zone (under the AUP). The current FUZ is applied to greenfield land that has been identified by Council as suitable for urbanisation (AUP, H18.1).

The site sits within the wider Drury – Opāheke area that is signalled as an area for urban expansion through the Drury-Opāheke Structure Plan (prepared by Auckland Council in 2019). Future development of the site would be subject to resource consenting and therefore more detailed effects assessments.

Existing waterways and wetlands lead to development and connectivity constraints whilst also presenting an opportunity to support onsite amenity and enhanced ecological functions. Site planning considerations and opportunities include:

1. Riparian setbacks from waterways and wetlands (all identified natural inland wetlands) planted with eco-sourced native plants;
2. Management and enhancement of all identified natural inland wetlands;
3. Open spaces that also provide for the treatment, drainage and in some cases retention of stormwater;
4. A connected green network within the Site including a safe pedestrian and cycle network to assist with movement around the campus.

Ecological input has informed development of the proposed structure plan concept, providing recognition of important ecological values, particularly existing vegetated - areas and potential ecological corridors associated with Oiroa Creek along the eastern boundary, and associated riparian corridors and wetlands.

6.1 Terrestrial Ecology

6.1.1 Terrestrial Ecology

Terrestrial ecology values within the site are largely associated with potential fauna habitats within or connected with the Oiroa Creek riparian vegetation. These values, include native lizards (not detected but potentially present in low abundance or localised areas); wetland birds (spotless crake and dabchick may be intermittent visitors to these areas) and long-tailed bats (activity recorded, follow up survey results to provide greater detail). Further, threatened dabchicks were recorded on narrow, artificial ponds situated between the rail line and green houses at the southern boundary. Notably, the dabchicks were not recorded using other ponds that would otherwise be considered to have much higher potential value to this species, based on other artificial pond habitats, including within urban environments, that this species has been recorded on.

Native lizards, particularly copper and ornate skinks, are widespread in the Auckland Region, including urban environments such as riparian vegetation, parks, reserves and private gardens. The potential presence of these high value fauna would be expected to be protected through the implementation of a native lizard management plan, where those environments are subject to a resource consent.

At least six New Zealand dabchick were recorded using the narrow artificial ponds between the rail line and green houses at the southern boundary. This species is regularly recorded using artificial ponds, including

stormwater infrastructure, for all life stages, including breeding, foraging, roosting (e.g. Albany Lakes Civic Park, Kopupaka Playground). The site plans indicate protection and enhancement of these higher value ponds, where they are contiguous with the Oiroa Creek riparian margin.

Long tailed bat activity was detected in the vicinity of one of the ponds contiguous with Oiroa Creek. The Oiroa Creek ecological corridor and contiguous wetlands and ponds are features that are typically associated with bat habitat and these features may be of high value to bats at the site (subject to further surveys proposed within the bat survey season, to commence in October to December 2024). It remains unknown, exactly how much urbanisation long-tailed bats can tolerate before they are excluded from an area. Long-tailed bats are generally absent from most urban areas in New Zealand. The most important considerations for managing adverse effects of urbanisation on bats are associated with noise, light and pest animals (such as domestic cats). Opportunities to manage these effects include:

- provision of open space setbacks around ecological corridors to provide buffering from noise, lighting, and protection of these areas where they may be used for commuting, foraging or roosting.
- removing, reducing or modifying artificial lighting in areas adjacent to ecological corridors to:
    - avoid light spill (lights close to ground, directional and shielded);
    - minimise intensity;
    - provide adaptive controls to manage light timing; and
    - avoid blue violet and ultra-violet wavelengths.
- Provision of additional planting to buffer noise and light disturbance.
- Require infrastructure, such as buildings to use dark-coloured, non-reflective coloured surfaces.

6.1.2 Freshwater Ecology

The current Freshwater Ecology values, including wetland and pond ecosystems within the Site are generally assessed as low to moderate value, having potential to support common native fish, but not providing high quality habitat for such fauna. Note that one pond ('Identified Dabchick habitat' 1, Figure 14) is of very high value due to the likelihood of it being used by threatened dabchicks for breeding). Values of these systems to other fauna (particularly bats) may elevate their values with further information.

Two moderate value environments identified include Oiroa Creek and tributary, which is likely to support common native fish, and a set of narrow, artificial ponds at the southern boundary between the green houses and railway, on which six threatened dabchicks were recorded. These narrow ponds may support dispersing juvenile dabchicks on an intermittent basis.

The proposal should apply the effects management hierarchy under the National Policy Statement for Freshwater Management 2020 (NPS-FM), where:

a) adverse effects on wetlands and streams are first avoided, where practicable; and
b) where adverse effects cannot be avoided, they are minimised where practicable; and
c) where adverse effects cannot be minimised, they are remedied, where practicable; and
d) where more than minor residual adverse effects cannot be avoided, minimised or remedied, aquatic offsetting is provided where possible; and
e) if aquatic offsetting of more than minor residual adverse effects is not possible, aquatic compensation is provided; and
f) if aquatic compensation is no appropriate, the activity itself is avoided.

Under the National Environmental Standards for Freshwater 2020 (NES-F), any earthworks within wetlands that result in drainage is prohibited, unless the earthworks are for an activity that meets the criteria for status such as specified infrastructure or urban development. In regards to works within and/or near streams and wetlands, the proposal should consider the objectives and policies in the NPS-FM and AUP, the regulations within the NES-F and the rules within E3 and E15 of the AUP.

The current proposal considers enhancement opportunities for the Oiroa Creek and tributaries, an area of natural inland wetland and artificial pond towards the southern end of the site. Implementation of these initiatives would have a positive effect on freshwater values, and potentially improve habitat values for other fauna species (wetland birds, bats and lizards).

The Auckland Council guidance document for Riparian Zone Management (Technical Publication 148), recommends at 10m minimum buffer as a general guideline but also states that narrower or wider options being considered appropriate as indicated by site constraints or opportunities. Robust buffers along Oiroa Creek and associated tributaries, wetlands and artificial pond, could offer substantial ecological benefits for fauna values, particularly whereby compensation may be required for ponds currently used by threatened dabchicks.

6.2 Policy assessment

We consider that any potential adverse effects on terrestrial or freshwater ecology due to the proposed rezoning and associated land use change within the Site can be effectively addressed through:

1. the existing provisions of the Auckland Unitary Plan;
2. the provisions developed for the Precinct, which adopt the recommendations in this report; and
3. subsequent resource consent processes, in which effects management measures will be enacted through consent conditions and associated management plans, in accordance with those provisions.

A more detailed analysis of the policy framework is provided in the Section 32 Report, however we consider that the proposed Precinct provisions (insofar as they relate to ecological matters) are consistent with standards and objectives of the following legislative, policy statement and regional plan documents. In particular they:

1. Give effect to the NPS-FM as:
    a. all freshwater ecosystems have been identified within the site;
    b. no wetland/stream reclamation or works are proposed; and
    c. any potential significant adverse effects identified will be appropriately avoided, minimised, remedied or offset under the effects management hierarchy;
    d. enhancement opportunities for the Oiroa Creek and tributaries will be provided.

2. Give effect to the NPS-IB as:
    a. there are no identified SNAs within the Site;
    b. significant adverse effects on indigenous biodiversity are not anticipated;
    c. the existing indigenous biodiversity of the Site will be protected and maintained; and
    d. opportunities for enhancement of habitat values for dabchick and other fauna species (wetland birds, bats and lizards) will be provided.

3. Give effect to the regional policy statement, and Chapters B2 and B7 in particular as:
    a. through vegetation protection and enhancement, they will provide ample opportunity to enhance the quality of the natural environment;
    b. potential significant adverse effects on receiving waters will be avoided/minimised.
    c. areas of significant indigenous biodiversity value and freshwater environments have been identified within and surrounding the Site will not be adversely affected;
    d. development of the site in future will provide opportunities for freshwater habitats to be protected from significant adverse effects of use and development, as well as provide further opportunities to maintain indigenous biodiversity through the protection, restoration and enhancement of areas where ecological values are degraded and where development is occurring, namely through planting and protection of riparian margins.

4. Are consistent with the regional plan, including in particular the objectives and policies of Chapters E1, E3, and E15 and the Structure Plan Guidelines as:
    a. Consistent with E1, the Plan Change will avoid adverse effects on freshwater systems as minimal physical works are proposed on streams or wetlands, and it is anticipated future development can appropriately manage discharges and development that affect freshwater systems to maintain or enhance water quality, flows, stream channels and their margins.
    b. Consistent with E3, upon field investigation of the site, streams and wetlands have been identified and their constraints will be included in the proposed development. Reclamation and adverse effects will be avoided or minimised, and the proposed Business Light Industry development within the site provides opportunities to protect and enhance the freshwater systems.
    c. Consistent with E15, the vegetation and biodiversity values of the site have been identified. The proposed Structure Plan avoids significant adverse effects on vegetation and biodiversity values (through the application of relevant management plans) within the site and receiving environments.
    d. Subsequent urban rezoning in future is expected to provide opportunities to maintain and enhance ecosystem services and indigenous biodiversity values, particularly in sensitive environments, while providing for appropriate use and development.
    e. Consistent with the Structure Plan Guidelines (section 1.4.2), the Plan Change provides opportunities and mechanisms to protect, maintain, and enhance natural resources.

The Plan Change is also consistent with:

5. The Auckland Plan 2050, as it provides opportunities to restore degraded ecosystems where appropriate, while providing for appropriate development.
6. The Urban Ngahere Strategy, as it will create opportunities for enhancement of ecological corridors, connections and diversity through the planting of native riparian vegetation and maintaining existing vegetation where practicable, while also providing for public access.

7. SUMMARY AND RECOMMENDATIONS

The Structure Plan and Plan Change aims to address ecological effects as far as practicable by avoiding and enhancing the highest ecological values on-site. If the recommendations below are adopted, it is not anticipated that the adverse ecological effects of the proposed Fisher and Paykel Healthcare campus would result in the loss of or unacceptable disturbance to indigenous species, ecosystems, or critical ecosystem functions on-site, nor within the context of the wider landscape, provided that key ecological features around Oiroa Creek and associated tributaries are protected and enhanced. It is noted that long-tailed bats may require a sufficient greenspace buffer alongside these corridors, where further activity indicates very-high value habitat. A greenspace network of up to 100 m along-side Oiroa Creek is available within the site, and this would be consistent with current expectations for provision of bat corridors. Other identified and potential habitat values, including those for threatened dabchicks and potentially present native lizards and (less likely) spotless crake, are generally aligned with those environments that would be protected and enhanced through retention, protection and enhancement of these corridors

7.1 Management of sensitive ecological environments

- Oiroa Stream, the permanent tributary stream and intermittent streams, should be protected by a minimum of 10 m buffer, but potentially up to 100 m (and as further bat survey information provides).
- A buffer is recommended to be planted with native species, in accordance with a site-specific Planting and Pest Management Plan, to create an ecological buffer zone for these habitats. The objectives of the management plan should include:
    - provision of open space setbacks around ecological corridors to provide buffering from noise, lighting, and protection of these areas where they may be used for commuting, foraging or roosting for native birds and bats.
    - removing, reducing or modifying artificial lighting in areas adjacent to ecological corridors to:
        - avoid light spill (lights close to ground, directional and shielded);
        - minimise intensity;
        - provide adaptive controls to manage light timing; and
        - avoid blue violet and ultra-violet wavelengths.
- Planting of indigenous trees, as indicated in the Open Space area (Figure 8, Karaka Road Plan Change Landscape Report (B&A)) and where planting may soften the boundary, buffer noise and reduce light spill between buildings and associated lighting and the Open Space Area..
- Require infrastructure, such as buildings to use dark-coloured, non-reflective coloured surfaces alongside the Oiroa Stream Corridor (and as informed by further bat survey information).

7.2 Management of freshwater environments

- Implement a site-specific erosion and sediment control plan (ESCP) as compiled by an appropriately qualified person/s at the earthworks consent stage.
- If works are carried out in aquatic habitats that have the potential for native fish to be present, a Native Fish Recovery and Relocation Plan should be prepared by a suitably qualified freshwater

ecologist and submitted to Auckland Council for approval prior to any works in aquatic habitats commencing. This would prevent negative effects to native fish species.

8. REFERENCES

Burns, R.J., Bell, B.D., Haigh, A., Bishop, P., Easton, L., Wren, S., Germano, J., Hitchmough, R.A., Rolfe, J.R., Makan, T. (2018). *Conservation status of New Zealand amphibians, 2017*. New Zealand Threat Classification Series 25. Department of Conservation, Wellington. 7 p.

Clarkson, B. (2014). *A vegetative tool for wetland delineation in New Zealand*. Landcare Research New Zealand Ltd 2014.

Clarkson, B., Champion, P., Forester, L. & Rance, B. (2021). *New Zealand Wetland Plant List 2021, Prepared for Hawke's Bay Regional Council*. Lincoln: Manaaki Whenua Landcare Research.

de Lange, P.J., Rolfe, J.R., Barkla, J.W., Courtney, S.P., Champion, P.D., Perrie, L.R., Beadel, S.M., Ford, K.A., Breitwieser, I., Schonberger, I., Hindmarsh-Walls, R., Heenan, P.B., Ladley, K. (2018). *Conservation status of New Zealand indigenous vascular plants, 2017*. New Zealand Threat Classification Series 22. Department of Conservation, Wellington. 82 p.

Department of Conservation (2021). Protocols for minimising the risk of felling bat roosts. Version 2: October 2021. Available from https://ftp.doc.govt.nz/public/folder/J8y-HgKTuEmoYMZtafa6nA/bat-recovery/doc-bat-roost-protocol-v2-oct-2021.pdf

Dunn, N.R., Allibone, R.M., Closs, G.P., Crow, S.K., David, B.O., Goodman, J.M., Griffiths, M., Jack, D.C., Ling, N., Waters, J.M., Rolfe, J.R. (2018). Conservation status of New Zealand freshwater fishes, 2017. New Zealand Threat Classification Series 24. Department of Conservation, Wellington. 11 p.

Fraser, S. Singleton, P & Clarkson, B. (2018). *Hydric soils – field identification guide*. Report LC3223 prepared for Tasman District Council. Hamilton: Manaaki Whenua – Landcare Research.

Grainger, N., Harding, J., Drinan, T., Collier, K., Smith, B., Death, R., Makan, T., Rolfe, J. (2018). *Conservation status of New Zealand freshwater invertebrates, 2018.* New Zealand Threat Classification Series 28. Department of Conservation, Wellington. 25 p.

Greif, S., & Siemers, B. M. (2010). Innate recognition of water bodies in echolocating bats. Nature communications, 1(1), 107.

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson, G.B., Reardon, J.T., van Winkel, D., Rolfe, J., Michel, P. (2021). *Conservation status of New Zealand reptiles, 2021*. New Zealand Threat Classification Series 35. Department of Conservation, Wellington. 15 p.

Melzer, S., R. Hitchmough, D. van Winkel, C. Wedding, S. Chapman, M. Rixon (2022). *Conservation status of reptile species in Tāmaki Makaurau / Auckland*. Auckland Council technical report, TR2022/3

Ministry for the Environment (2020). *Wetland Delineation Protocols*. Wellington: Ministry for the Environment.

Ministry for the Environment (2021a). *Defining 'natural wetlands' and 'natural inland wetlands'*. Wellington: Ministry for the Environment.

Ministry for the Environment (2021b). *Wetland delineation hydrology tool for Aotearoa New Zealand*. Wellington: Ministry for the Environment.

O'Donnell, C.F.J., Borkin, K.M., Christie, J., Davidson-Watts, I., Dennis, G., Pryde, M., Michel, P. (2023). *Conservation status of bats in Aotearoa New Zealand, 2022*. New Zealand Threat Classification Series 41. Department of Conservation, Wellington. 18 p.

Powlesland, R.G. (2013) [updated 2022]. *North Island robin | toutouwai.* In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz

Robertson, H.A., Baird, K.A., Elliott, G.P., Hitchmough, R.A., McArthur, N.J., Makan, T.D., Miskelly, C.M., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A., Michel, P. (2021). *Conservation status of birds in Aotearoa New Zealand, 2021*. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 p.

Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. (2018). *Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems*. 2nd edition. EIANZ, Melbourne.

Simpkins, E., J. Woolly, P. de Lange, C. Kilgour, E. Cameron, S. Melzer (2022). *Conservation status of vascular plant species in Tāmaki Makaurau / Auckland*. Auckland Council technical report, TR2022/19.

Singers, N., Osborne, B., Lovegrove, T., Jamieson, A., Boow, J., Sawyer, J., Hill, K., Andrews, J., Hill, S., Webb, C. (2017). *Indigenous terrestrial and wetland ecosystems of Auckland.* Auckland: Auckland Council.

Townsend, A.J., de Lange, P.J., Duffy, C.A.J., Miskelly, C.M., Molloy, J., Norton, D.A. (2008). *New Zealand Threat Classification System manual.* Department of Conservation, Wellington. 35 pp.

Te Ākitai Waiohua. (2024) Cultural Values Assessment for Fisher & Paykel Healthcare. Karaka Road Drury Plan Change Project.

van Winkel, D, Baling, B, Hitchmough, RA (2018). *Reptiles and amphibians of New Zealand: A field guide.* Auckland University Press, Auckland, New Zealand. 376 pp.

Woolly, J., Paris, B., Borkin, K., Davidson-Watts, I., Clarke, D., Davies, F., Burton, C. & Melzer, S. (2023). *Conservation status of bat species in Tāmaki Makaurau / Auckland*. Auckland Council technical report, TR2023/4.

9. APPENDICES

Appendix A – Ecological Impact Assessment Methodology

The assessments were undertaken in general accordance with Ecological Impact Assessment guidelines, published by the Environment Institute of Australia and New Zealand (EIANZ; Roper-Lindsay *et al*. 2018). The Guidelines provide criteria for assigning value to habitat for assessment purposes. Values are assigned (High, Moderate, Low, Very Low, Table 8) based on the following four assessment matters (as described in Roper Lyndsay et al. 2018):

1. Representativeness
2. Rarity / Distinctiveness
3. Diversity / Pattern
4. Ecological Context

The level of effect is then determined by determining the magnitude (Table 9) and combining the value of the ecological feature/attribute with the score or rating for magnitude of effect to create a criterion for describing the level of effects (Table 10). The cells in Table 3 italics in represent a 'significant' effect under the EIANZ 2018 guidelines.

Cells with low or very low levels of effect represent low risk to ecological values rather than low ecological values *per se*. A moderate level of effect requires careful assessment and analysis of the individual case. For moderate levels of effects or above, measures are expected to be introduced to avoid through design, or appropriate mitigation needs to be addressed (Roper-Lindsay *et al*. 2018).

Table 8. Criteria for assigning value to habitat/species for assessment.

Value	Determining Factors
Very High	Nationally Threatened species found in the 'zone of influence' (ZOI) either permanently or seasonally. 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	Species listed as At Risk – Declining found in the ZOI either permanently or seasonally. 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	Species listed as At Risk – Relict, Naturally Uncommon, Recovering found in the ZOI either permanently or seasonally. Locally uncommon or distinctive species. 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	Nationally and locally common indigenous species. 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	Exotic species including pests, species having recreational value. Area rates 'Very Low' for three assessment matters and 'Moderate', 'Low' or 'Very Low' for the remainder.

Table 9. Criteria for describing the magnitude of effects (EIANZ 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 10. Criteria for describing the level of effects (EIANZ 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

Appendix B – Weather data for March-April 2024 Bat Survey

Date	Min temp within 4 hrs of sunset (°C)	Sunset	Rainfall 2hrs after dusk (mm)	Rainfall 4hrs after dusk (mm)	Valid Night?
21/03/2024	5.2	19:30	0	0	No
22/03/2024	12.1	19:29	0	0	
23/03/2024	11.5	19:27	1	1	
24/03/2024	9.4	19:26	0	0	No
25/03/2024	14.8	19:24	0	0	
26/03/2024	11.9	19:23	0	0	
27/03/2024	13	19:21	0	0	
28/03/2024	13.7	19:20	0.5	1	
29/03/2024	4.1	19:19	0	0	No
30/03/2024	7	19:17	0	0	No
31/03/2024	7.3	19:16	0	0	No
1/04/2024	6.8	19:14	0	0	No
2/04/2024	7.9	19:13	0	0	No
3/04/2024	10.1	19:11	0	0	
4/04/2024	16.2	19:10	0	0	
5/04/2024	9.9	19:08	0	0	No
6/04/2024	13.5	19:07	0	0	
7/04/2024	9.7	18:05	0	0	No
8/04/2024	10.4	18:04	0	0	
9/04/2024	14.3	18:03	0	0	
10/04/2024	17.3	18:01	0	0	
11/04/2024	16.7	18:00	2	2.5	
12/04/2024	13.6	17:59	0	0	
13/04/2024	13.3	17:57	0.5	1	
14/04/2024	7.6	17:56	0	0	No
15/04/2024	8.9	17:54	0	0	No
16/04/2024	9.7	17:53	0	0	No
17/04/2024	10.8	17:52	0	0	
18/04/2024	10.8	17:50	0.5	0.5	
19/04/2024	11.5	17:49	0	0	
20/04/2024	15.3	17:48	0.5	0.5	
21/04/2024	11.3	17:47	0	0	
22/04/2024	11.3	17:45	0	0	
23/04/2024	7.7	17:44	0	0	No
24/04/2024	8.3	17:43	0	0	No
25/04/2024	14.4	17:42	0	0	
26/04/2024	13.2	17:40	0.5	0.5	
27/04/2024	8	17:39	0	0	No
28/04/2024	6.8	17:38	0	0	No
*Sunset times and moon phases are for Auckland and are retrieved from the Time and Date website					
*** Rainfall data is sourced from Environmental Data Portal (Auckland Council, Walters Rd Karaka station 741815)					