Rotokauri Strategic Infrastructure Designation - Ecological Impact Assessment

Prepared for Hamilton City Council
Prepared by Beca Limited

24 April 2024

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Contents

Appendices

Revision History

Revision Nº	Prepared by	Description	Date
1	**Sarah Busbridge**	Draft for technical review	3/04/2020
2	**Sarah Busbridge**	Working draft for THAWK review	30/06/2020
4	**Sarah Busbridge**	Draft for technical review	9/08/2021
5	**Sarah Busbridge**	Draft for Stakeholder review	18/08/2021
6	**Sarah Busbridge**	Final for issue	18/03/2022
7	**Emily Fensham**	Final revision for Notice of Requirement	20/06/2023
8	**Emily Fensham** **Claire Webb**	Final s92 revision for issue	24/04/2024

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Sarah Busbridge**		18/03/2022
	Emily Fensham		10/04/2024
Reviewed by	**Claire Webb**		24/04/2024
Approved by	**Craig Sharman**		24/04/2024
on behalf of	Beca Limited		

Executive Summary

Hamilton City Council (HCC) engaged Beca Limited (Beca) to undertake an Ecological Impact Assessment to support the Notice of Requirement (NoR) for the Rotokauri Strategic Infrastructure Designation (the Project) in Rotokauri, Hamilton.

A desk-based review of previous ecological assessments prepared for HCC and other publicly available information on the site was undertaken, as well as supplementary fauna surveys.

Based on the proposed designation, the **unmitigated** impacts of the proposed works are assessed as **High** due to loss and/or modification of aquatic habitat for At-Risk native fish species and potential for injury or mortality of At-Risk native fish species. Nevertheless, with recommended avoidance, management and mitigation measures, the residual level of effects can be controlled to **Low**.

Appropriate measures to address adverse effects should be implemented prior to the commencement of, and throughout construction works. These measures should be incorporated into and implemented via an Ecological Management Plan (EMP) that has been developed to guide the Project and minimise construction effects.

The EMP will be focused on developing specific implementation actions that respond to the detailed design of the Project. There are two key components to the EMP:

1. Develop key management measures for native fauna, and implement identified actions to avoid and minimise adverse ecological effects for this Project; and
2. Confirm and implement a range of mitigation measures that address any residual effects that are not able to be avoided or minimised.

These implementation actions are set out in detail in the recommendations and conclusions of this report.

1 Introduction

This Ecological Impact Assessment (EcIA) has been prepared to support a Notice of Requirement (NoR) for the Rotokauri Strategic Infrastructure Designation (the Project) prepared by Beca Limited (Beca) on behalf of Hamilton City Council (HCC) as a requiring authority pursuant to section 168A of the Resource Management Act 1991 (RMA).

1.1 Scope

The purpose of this report is to identify the ecological values, effects and effects management of the Project.

The scope of this report includes:

- A desk-based review of previous documentation and publicly accessible reports or information.
- Supplementary fauna surveys.
- An assessment of the ecological values affected by the proposed designation.
- An assessment of the ecological effects of the proposed designation.

This report has been prepared in general accordance with the EIANZ Ecological Impact Assessment Guidelines (Roper-Lindsay, Fuller, Hooson, Saunders, & Ussher, 2018).

This assessment has been undertaken based on the proposed designation. Should the Project or the design requirements substantially change, the assessment may need updating, or additional assessments may need to be completed in the affected location.

1.2 Statutory Context

The Project is situated in the northwest of Hamilton and is identified on the Rotokauri Structure Plan (RSP). The Rotokauri growth cell is an existing greenfield area and has been signalled for urbanisation since 1989. Iterations of the RSP have been in place since 2005 providing a land use development blueprint that enables, and will in time, result in a predominantly residential urban environment. The growth cell currently sustains a mixture of remnant rural land uses (pastoral farming, cropping and rural lifestyle living) and transitional urbanisation land uses envisaged under the structure plan. The RSP provides for other urban activities including industrial, employment, educational, recreational, commercial (Suburban Centre) and associated network infrastructure as shown in Figure 2-8: Rotokauri Structure Plan of the Hamilton City District Plan[1].

1.3 The environment against which effects must be assessed

The RSP requires the advanced or concurrent development of critical infrastructure to unlock the urbanisation planned in the catchment, including the designated Rotokauri Greenway corridor and the proposed Rotokauri Arterial Network. The Rotokauri Greenway is a necessary precursor to the construction of a significant component of the Rotokauri Arterial Network. On 12 December 2023, the Environmental Protection Authority accepted an application for resource consents to construct the Rotokauri Greenway and supporting infrastructure. The application is currently before an expert consenting panel appointed to determine the application under the COVID-19 Recovery (Fast-track Consenting) Act 2020.

[1] https://hamilton.isoplan.co.nz/eplan/rules/0/17/0/0/0/82

Urbanisation is under way in the growth cell with various consents lodged and several obtained by adjacent landowners and developers. Particularly relevant to the Rotokauri Arterial Network are the subdivision consents granted to RDL (197 lots) and Te Wetini Developments (5 lots). It is acknowledged that a degree of integration between HCC as the requiring authority and the development community is necessary during this transitional development phase. As such, it is anticipated the Rotokauri Arterial Network may be refined in co-ordination with adjacent landowners in the future.

1.3.1 Timing and sequencing

While exact timing and sequencing of development within the RSP will be influenced by development demands, the following assumptions have been made in relation to the state of the environment:

- **The Greenway corridor**

Construction of the Rotokauri Arterial Network will not commence ahead of the construction of the Greenway corridor, as it is the first critical piece of infrastructure required to support urbanisation of the area, given the significant stormwater issues associated with Rotokauri. The construction of the Greenway will span several construction seasons involving significant bulk earthworks and associated effects which will be managed by a suite of proposed designation conditions, resource consents, and associated management plans. The existence of the Rotokauri Greenway and associated wetlands is assumed in all effects assessments.

The assessment of effects on the environment set out in Section 4 of this report has therefore been prepared on the basis that the Greenway is completed and native planting will be in the early establishment phase (i.e. planting completed).

- **Urban development**

Development planning is well advanced with three master plans prepared for large greenfield areas of Rotokauri. This includes the Rotokauri North Structure Plan area at the northern extent of the proposed designation for which the zoning is now operative and could commence at any time (subject to regional consents and the provision of other infrastructure). Other developers are progressing the design and construction of the Greenway corridor and roading networks (some of which includes delivering part of the NOR works), which will provide the necessary infrastructure for stormwater management, treatment and discharge, along with critical roading connectivity, to enable the urbanisation of a large portion of Rotokauri. It is therefore feasible to assume that urban development across the RSP will have advanced at the time the construction of the balance of the Rotokauri Arterial Network commences.

The assessment of effects has been prepared on the basis that urbanisation is occurring and in progress with some areas will be under development at the time the Project construction commences and assumes a background level of noise and lighting disturbance akin to a suburban environment.

1.4 Project Overview

The proposed designation of the strategic transportation and infrastructure corridor is to occur in a way that:

- Responds to the RSP context.
- Meets the vision for development in Rotokauri as encapsulated within the RSP.
- Responds to an increasingly urgent need to secure an infrastructure corridor.

The proposed designation as depicted in Figure 1 and 2 below covers a combined 5.8km length of corridors, including the design of a new 5.2km corridor relating to greenfield area which will support future growth and development in Rotokauri.

The Project is comprised of the following:

1. Proposed major arterial – approx. 0.7km widening on Te Kowhai East Road (purple dash in Figure 1).
2. Proposed minor arterials – approx. 3.8km, north-south arterial and a portion of Te Kowhai East Road to connect to the existing corridor (red dash in Figure 1).
3. Proposed collector roads – approx. 0.8km Chalmers Road extension and Arthur Porter Drive north realignment (yellow dash in Figure 1).
4. Proposed local road – approx. 0.5km connection to Arthur Porter Drive realignment to provide continued access to industrial/commercial properties (blue dash in Figure 1).
5. Associated three waters infrastructure and network utilities.

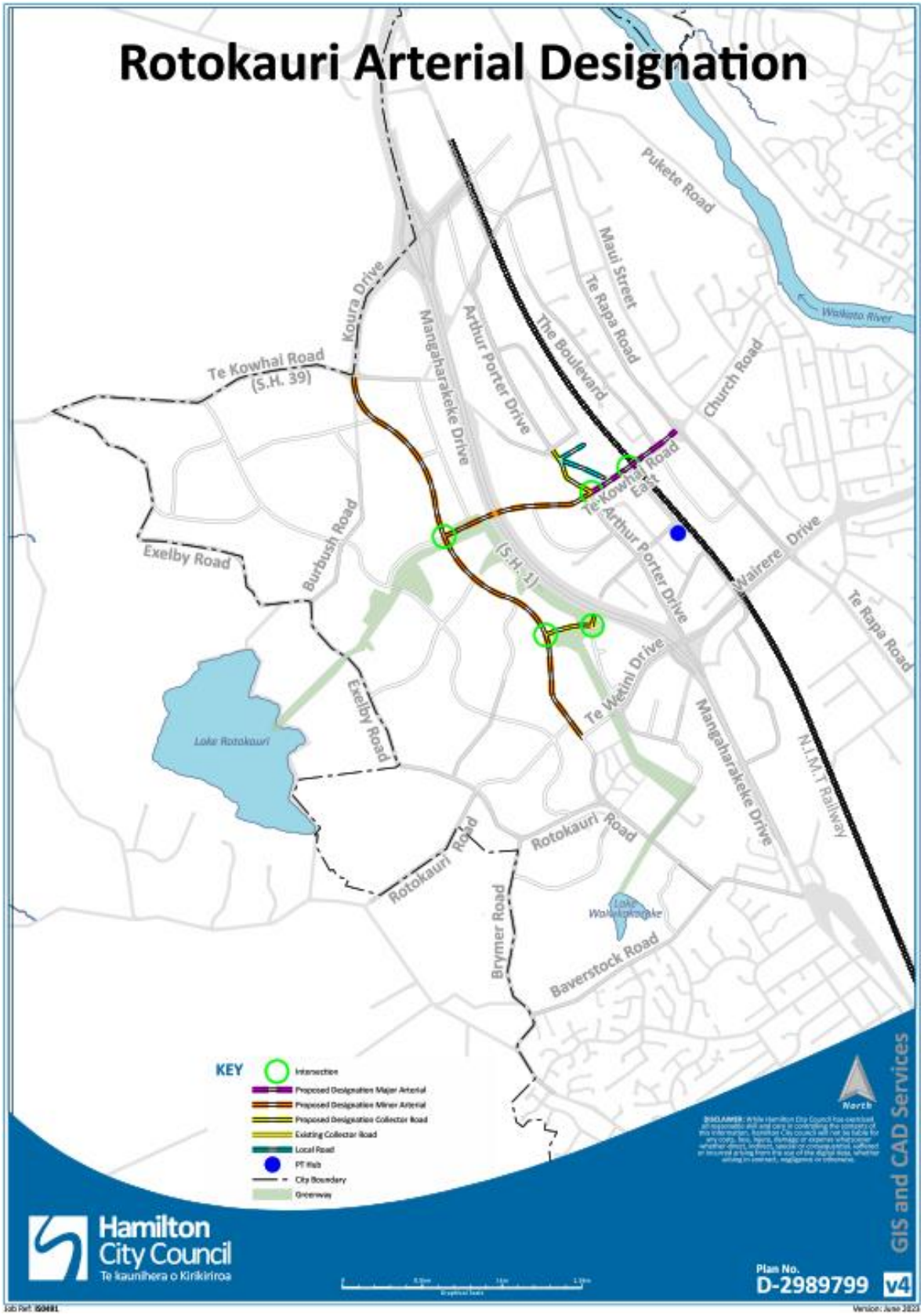

Figure 1: Proposed Rotokauri Arterial Network (Source: Hamilton City Council)

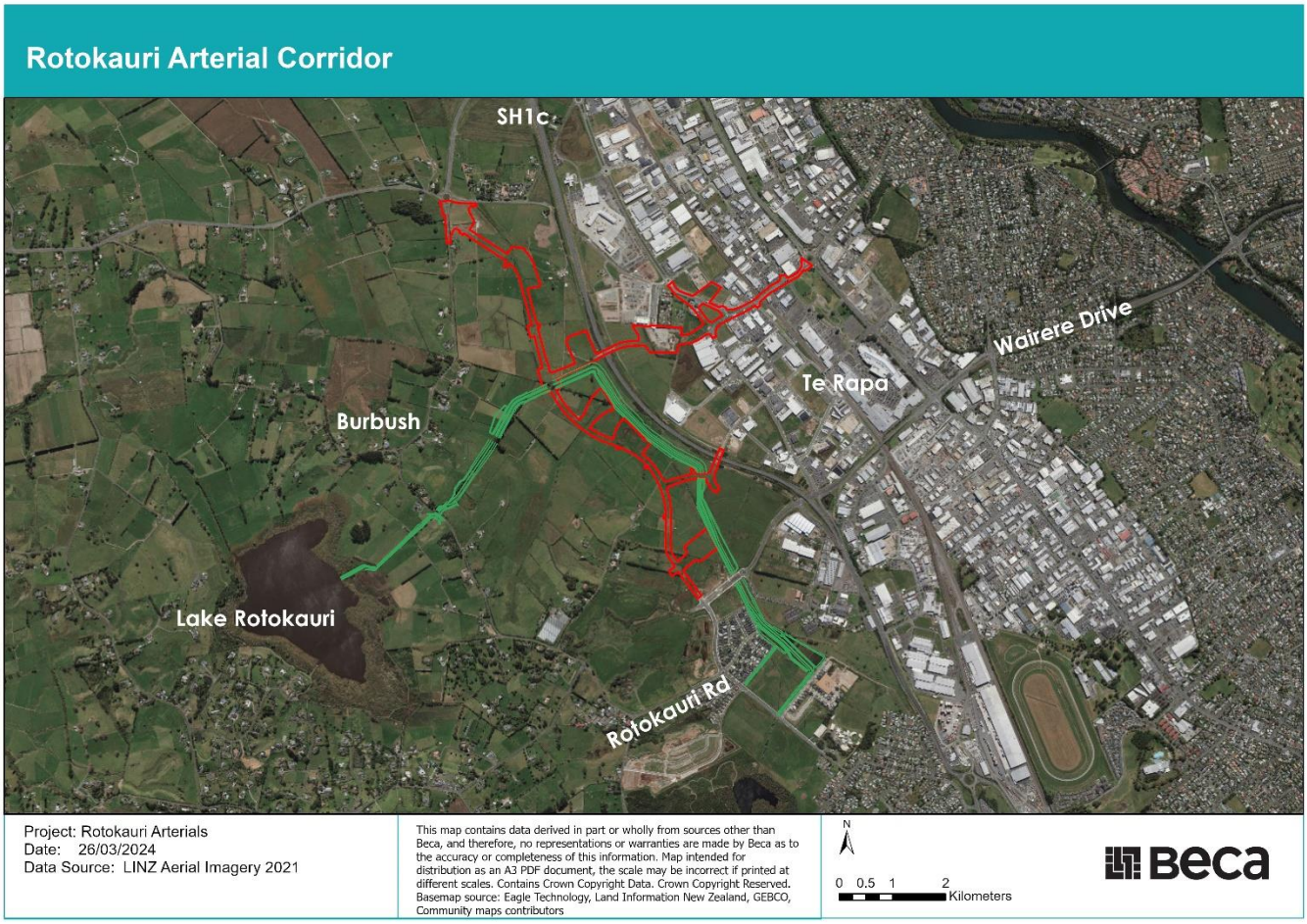

Figure 2: Proposed designation (red) in relation to the Greenway designation (green).

The proposed design of the Rotokauri Arterial Network has a strong urban design focus contributing to achieving HCC's strategic objectives for land use planning, urban growth infrastructure provision and economic development. These include those core aspects associated with the primary use of multimodal transportation and secondary functions of a strategic network designation including associated infrastructure provisions and how they affect the spatial requirements of the land to be designated. Broadly, these include multimodal transportation facilities, bus stops, parking, spatial provisions for utilities network including three waters infrastructure, connections to recreational spaces and small amenity areas where there is a transition in land-use or context.

They also include associated stormwater facilities including rain gardens and treatment swales directly associated with the road that would be needed to provide an appropriate level of treatment and allow the construction of the network to give effect to the designation. Some elements of the broader Rotokauri scheme overlap with the proposed designation for the stormwater areas with specific wetland treatment areas to be included within the designated corridor.

The Project will build on the Greenway with stormwater facilities intended to work in conjunction with the Greenway and provide modal connections which enhance the identified recreation functions associated with the Greenway. Further descriptions and details of the Rotokauri Greenway and the interfacing aspects relevant to the proposal are outlined in the NoR document.

The eastern part of the alignment sits within the Mangaheka and Te Rapa catchments which run through predominantly commercial/ light industrial areas.

Proposed works intersect the present farm drains and modified watercourses at numerous points and will also intersect with the designated Greenway Project which is designed to be the main stormwater system for the catchment and comprises a conveyance channel and adjacent wetlands.

2 Methodology

2.1 Desktop Review

A desk study was undertaken that sourced ecological information from the following sources:

- Hartland Environmental. (2017). *Rotokauri - Intergrated Catchment Management Plan.* Prepared by Hartland Environmental Ltd for Hamilton City Council.
- Tonkin & Taylor. (2018). *Rotokauri Greenway Notice of Requirement: Ecological Assessment.* Report prepared by Tonkin & Taylor Ltd for Hamilton City Council.
- Champion, P., Parkyn, S., & Chisnall, B. (2001). *Rotokauri Structure Plan - Ecological Asessment.* NIWA Client Report (BCH01201) Prepared for Beca Carter Hollings & Ferner Ltd. .
- Price, J., van der Zwan, W., Bartels, B., & Mueller, H. (2016). *Rotokauri ICMP - Ecological Assessment and Inputs.* Prepared by Kessells Ecology for Hamilton City Council.
- Other publicly accessible reports or information (as referenced).

2.2 Fauna Survey

Mudfish, bat, and lizard surveys were conducted for this assessment. The detailed methodology for these surveys can be found in the Supplementary Ecology Report prepared by Ecology New Zealand (2021; Appendix 2). Data collected during previously conducted surveys was also assessed as part of this report, as was the potential effects of the proposed and completed works on suitable habitat.

2.3 Wetland Classification

A wetland classification was also undertaken for this assessment to determine whether any natural wetland(s) under the National Policy Statement for Freshwater Management (NPS-FM) were present within the Project area. The detailed methodology and results of this classification can be found in the Wetland Classification Report (Beca, 2021; Appendix 3).

2.4 Assessment methodology

An assessment of ecological effects was undertaken in accordance with EcIA EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems (Roper-Lindsay et al., 2018).

The EIANZ guidelines set out a methodology to assign ecological value to species and ecosystems based on four assessment criteria which are consistent with significance assessment criteria set out in the National Policy Statement for Indigenous Biodiversity (2021) Appendix 1: Criteria for identifying significant indigenous vegetation and significant habitat of indigenous fauna. These are reproduced in this report as Appendix 1: Tables 1.1-1.4. In summary:

- Various attributes are considered when determining ecological value or importance. These attributes relate to matters such as representativeness, the rarity and distinctiveness, diversity and patterns, and the broader ecological context.
- Determining Factors for valuing terrestrial species; terrestrial species span a continuum of very high to negligible, depending on aspects such as whether species are native or exotic, have threat status, and their abundance and commonality at the site impacted.
- Ecological Values are scored based on an expert judgement, qualitative and quantitative data collected.

Once ecological values have been identified and valued, the severity of potential impacts is assessed by determining the change from baseline ecological values likely to occur as a result of the proposal along the lines of a magnitude of effect as determined by the criteria set out in Appendix 1: Table 1.5.

Finally, once these two factors have been determined (the ecological value and the magnitude of effect), an overall level of effect on each of the identified ecological values is determined by applying the matrix shown in Appendix 1: Table 1.6.

3 Site Description

3.1 Ecological Context

The Project is approximately 5.8km in length and is located within the Hamilton Ecological District in the Waikato Ecological Region (McEwen, 1987). Historically, the area would have consisted of bog, fen and swamp wetland, scrub and fernland, and swamp forest (McEwen, 1987). Presently, outside of the urban centre, the district is almost entirely farmed after vegetation being cleared for farmland from the mid-1800's. HCC operates a catchment management strategy for individual stormwater catchments and this project falls within the Rotokauri, Ohote, Mangaheka, and Te Rapa catchments.

The topography of the Rotokauri catchment area is generally flat with occasional ridgeline and gully areas around the periphery. Currently, Rotokauri is a predominantly greenfield catchment that supports a mixture of rural land use and lifestyle blocks as well as a recent encroaching residential subdivision. The catchment retains a lot of run-off which is discharged slowly, meaning that water levels rise and fall over longer timeframes than in most urban catchments (Hartland Environmental, 2017).

The Mangaheka catchment also has a flat lying topography and consists of alluvial plains that have recently been converted from rural pasture to predominantly commercial and light industrial land use. The Project runs through the southern part of the catchment characterised by the Mangaheka stream and artificial watercourses (see Figure 4).

The main ecological features in and around the Project area are Lake Rotokauri, the Rotokauri Drain (the main corridor link between the Lake Rotokauri and Lake Waiwhakareke) and artificial watercourses (drainage network). It is however noted that at the time of construction of the Project, the construction of the Greenway will be completed and replaces the Rotokauri Drain. The Greenway and remaining artificial watercourses will be the main ecological features in and around the Project area at the time of construction. These watercourses are shown in Figure 4 below. The Project will intersect with the Greenway and artificial drains. The Greenway, remaining drains and Lake Rotokauri will be the receiving environment for any sediment discharges during construction.

Lake Rotokauri has poor water quality but retains high ecological, biodiversity, cultural and recreation values, and several agencies are undertaking various improvement initiatives to restore the lake and surrounding sub-catchment areas (Hartland Environmental, 2017).

3.2 Ecosystem Values and Significance

3.2.1 Vegetation

There are no existing or proposed Significant Natural Areas within the proposed designation (HCC geospatial layers accessed March 2024). Vegetation within the proposed designation is mainly grazed pasture with low-lying areas of rushes, blackberry, and exotic tree species used for hedging such as barberry or shelterbelts including pine, macrocarpa, poplar and eucalyptus (see Figure 3). Larger trees, hedgerows and shelter belts provide habitat for native fauna as discussed in more detail in Section 3.3.

Bank vegetation along the Rotokauri Drain will be replaced by native plantings of the Greenway. Native plantings occur immediately adjacent to the proposed designation where the Project crosses SH1 and ultimately intersects with Arthur Porter Drive and again where the Project crosses the Greenway to join with Chalmers Road.

Figure 3: Site vegetation looking south-west to Lee Road

Vegetation found within existing farmland (pasture, shelter belts and exotic trees) have **Very Low** ecological values as set out in Table 1. Ecological value of the establishing riparian and wetland plantings of the Greenway is expected to be **High** as shown in Table 2.

Table 1. Scoring and justification for assigned ecological value to **farmland vegetation** within the proposed designation.

Matter	Rating	Justification
Representativeness	Very Low	Exotic species dominant. Expected indigenous species not present.
Rarity/Distinctiveness	Moderate	No rare/distinctive vegetation but some vegetation types provide habitat for native fauna
Diversity and Pattern	Very Low	Low diversity and complexity.
Ecological context	Low	Small, fragmented areas of vegetation. Limited contribution to overall ecological network. Stepping stone habitat for native fauna within the Rotokauri catchment scale.
		Overall value: **Very Low**

Table 2. Scoring and justification for assigned ecological value to the **Rotokauri Greenway** vegetation within the proposed designation.

Matter	Rating	Justification
Representativeness	High	Dominated by maturing native plantings.
Rarity/Distinctiveness	Low	No rare/distinctive vegetation (maturing native plantings) but provides habitat for native fauna

Matter	Rating	Justification
Diversity and Pattern	Moderate	Establishing mosaic of riparian and wetland plantings
Ecological context	High	Future ecological corridor within an otherwise depauperate landscape.
		Overall value: **High**

3.2.2 Artificial Watercourses (Rural drainage network)

The proposed designation intersects with farm drains, excluding the future Greenway, at 18 points along the length of the corridor (Figure 4). The drainage network is largely unvegetated and rarely fenced to exclude stock (Figure 5). The drainage network is deemed to be of **Moderate** ecological value based on a high rating for rarity/distinctiveness, a moderate rating for ecological context, and very low ratings for representativeness and diversity and pattern (Table 3).

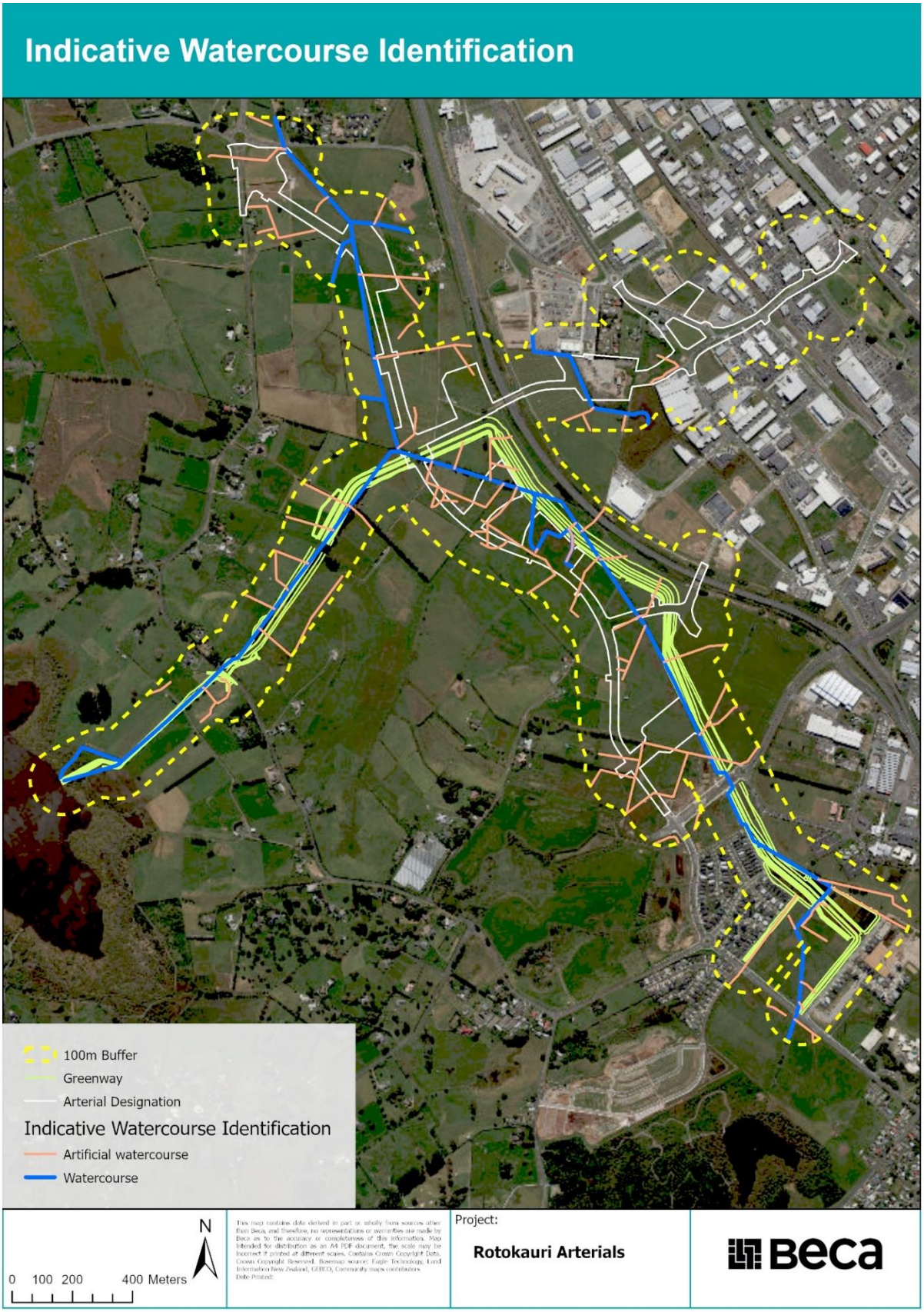

Figure 4: Artificial and modified watercourses within 100m of the proposed designation.

Figure 5: Typical rural drain within the proposed designation.

Table 3. Scoring and justification for assigned ecological value to the rural drainage network within the proposed designation.

Matter	Rating	Justification
Representativeness	Very Low	Straightened and channelised - channel modification has reduced habitat heterogeneity. Lack of riparian vegetation.
Rarity/Distinctiveness	High	Habitat for At Risk Species.
Diversity and Pattern	Very Low	Low diversity and complexity.
Ecological context	Moderate	Important contribution to overall ecological network. Modified in-stream habitat. Lack of riparian habitat and ongoing stock access. Catchment dominated by agricultural land-use.
		Overall value: **Moderate**

3.2.3 Rotokauri Greenway

Rotokauri Greenway is comprised of main channel with wetland margins and will run between Lake Waiwhakareke and Lake Rotokauri. It will be connected to the aforementioned drainage network in the surrounding area (Figure 4). The proposed designation intersects the Greenway at two points towards its centre and northern end.

The Greenway is deemed to be of **High** ecological value based on high ratings for rarity/distinctiveness and ecological context and low ratings for representativeness and diversity and pattern (Table 4).

Table 4. Scoring and justification for assigned ecological value to the Rotokauri Greenway corridor.

Matter	Rating	Justification
Representativeness	Moderate	Constructed stormwater conveyance, treatment and ecological mitigation wetland feature.
Rarity/Distinctiveness	Moderate	Future habitat for At-Risk freshwater fauna species.
Diversity and Pattern	High	High habitat complexity and diversity.
Ecological context	High	Important migration corridor and important part of the overall ecological network. Catchment dominated by agricultural land-use.
		Overall value: **High**

3.2.4 Mangaheka tributary

A straightened, modified tributary of the Mangaheka stream runs through the southern Mangaheka catchment area and intersects with the proposed designation at one point (Figure 5). Mangaheka stream receives ongoing inputs of suspended solids, turbidity, nutrients, metals, and faecal pathogens. As such, the stream has poor water quality, and a low Macroinvertebrate Community Index indicative of severe pollution (Hamilton City Council, 2019). In the lower catchment 'At Risk' black mudfish and longfin eels are present. Nevertheless, adverse effects from the Project construction are unlikely to extend to this area. Where the tributary intersects with the proposed designation, it is straightened with intermittent flow, high water temperatures, low dissolved oxygen and poor water clarity (Hamilton City Council, 2019). Shortfin eel are the only native species that have been recorded near the proposed designation in the stream and at this location.

The immediate reach of the stream that will be impacted by construction is considered to have **Very Low** ecological value based on very low ratings for representativeness, rarity/distinctiveness, diversity and pattern, and a low rating for ecological context (Table 5). Further downstream, the Mangaheka Tributary is expected to have higher ecological value.

Table 5. Scoring and justification for assigned ecological value to the Mangaheka Tributary.

Matter	Rating	Justification
Representativeness	Very Low	Straightened and channelised – channel modification has reduced habitat heterogeneity. Lack of riparian vegetation. Poor water and habitat quality.

Matter	Rating	Justification
Rarity/Distinctiveness	Very Low	Not expected to support At Risk or Threatened species.
Diversity and Pattern	Very Low	Low diversity and complexity.
Ecological context	Low	Modified in-stream habitat. Lack of riparian habitat and degraded water and habitat quality. Surrounded by light industrial land use. Intermittent habitat for shortfin eel.
		Overall value: **Very Low**

Figure 6: Proposed designation intersection with Mangaheka tributary.

3.2.5 Lake Rotokauri

Lake Rotokauri is a large, shallow peat lake with a surface area of 77ha and maximum depth of 4m. It is characterised by poor water quality and nutrient enriched (hypertrophic) conditions due to legacy effects of past land use change. The outfall of the lake is currently controlled by an artificial weir that sets the level of the lake. The lake has a Secchi depth of 0.6m, total phosphorus concentration of 118mg/m^3, total nitrogen concentration of 1900mg/m^3 and Chlorophyll a concentration of 79mg/m^3 (Source: WRC). These nitrogen and phosphorus concentrations exceed the National Bottom Line values defined in the National Policy Statement for Freshwater Management (2020).

Despite poor water quality, the lake has high ecological value. It includes 360ha of wetland areas dominated by indigenous vegetation and an extensive marginal vegetation zone that supports a diversity of wetland birds and buffers nutrient and sediment inputs from land run-off (Hartland Environmental, 2017). The lake also provides habitat for At-Risk giant kokopu and longfin eel, as well as an important fish migration pathway between the Waipa River and the upper catchment (Tonkin & Taylor, 2018). Lake Rotokauri is not within the proposed designation but will be the receiving environment for any potential sediment discharges during construction. The Rotokauri Drain is the primary source of sediment and nutrient inputs into Lake Rotokauri and will be the conduit for sediment discharges during Project construction (Hartland Environmental, 2017).

The lake is considered to have **High** ecological value, based on high ratings for representativeness and rarity/distinctiveness, and moderate ratings for diversity and pattern and ecological context (Table 6).

Table 6. Scoring and justification for assigned ecological value to the Lake Rotokauri.

Matter	Rating	Justification
Representativeness	High	Includes indigenous vegetation and wetland habitat representative of the Waipa peat lake complex. Poor water quality.
Rarity/Distinctiveness	High	Habitat for At Risk Species. Includes wetland associated with a peat lake which have been depleted regionally and nationally
Diversity and Pattern	Moderate	Includes open water, wetland and riparian vegetation that supports indigenous fish and wetland bird communities despite land use pressures in surrounding catchment.
Ecological context	Moderate	Important contribution to local ecological network Wetland buffer present. Catchment dominated by agricultural land-use. Poor water quality.
		Overall value: **High**

3.2.6 Wetlands

Within 100m of the proposed designation, eight wetlands were identified with a combined area of 3.85ha (Figure 8) see 2021 Wetland Classification Report by Beca for more details). These wetlands were all in extremely degraded condition due to drainage and ongoing grazing, but nevertheless, retained enough characteristics to meet be classified as Natural Wetlands according to New Zealand wetland delineation protocols, and current guidance on NPS-FM wetland definition interpretation from MfE (Clarkson, 2018; Ministry for the Environment, 2020, 2021b, 2021a).

Historically, the low-lying sections of the proposed designation would have consisted of a mosaic of bog, fen and swamp wetlands (McEwen, 1987). It is expected that these eight wetlands are remnants of this larger complex that have retained wetland hydrology due to underlying hydric soils and geomorphic position despite significant modification. Although wetlands are in a degraded state due to alterations to hydrology and ongoing stock access, they may provide some limited ecosystem service values, reducing nutrient loads in surface water runoff and attenuating peak flows. Pied stilt (*Himantopus leucocephalus;* Not Threatened) were also observed foraging in these areas.

The current overall ecological value of wetland areas is assessed as **Moderate** based on a high rating for rarity/distinctiveness, low rating for ecological context, and very low ratings for representativeness and diversity and pattern (Table 7).

Table 7. Scoring and justification for assigned ecological value to Wetlands identified within the proposed designation.

Matter	Rating	Justification
Representativeness	Very Low	Highly modified vegetation communities dominated by exotic species.
Rarity/Distinctiveness	High	Peat wetland ecosystem – greatly reduced in extent regionally and nationally.
Diversity and Pattern	Very Low	Low diversity and complexity.
Ecological context	Low	Provision of buffering functions. Intermittent habitat for bird species.
		Overall value: **Moderate**

Figure 7: Wetland areas identified within 100m of the proposed designation.

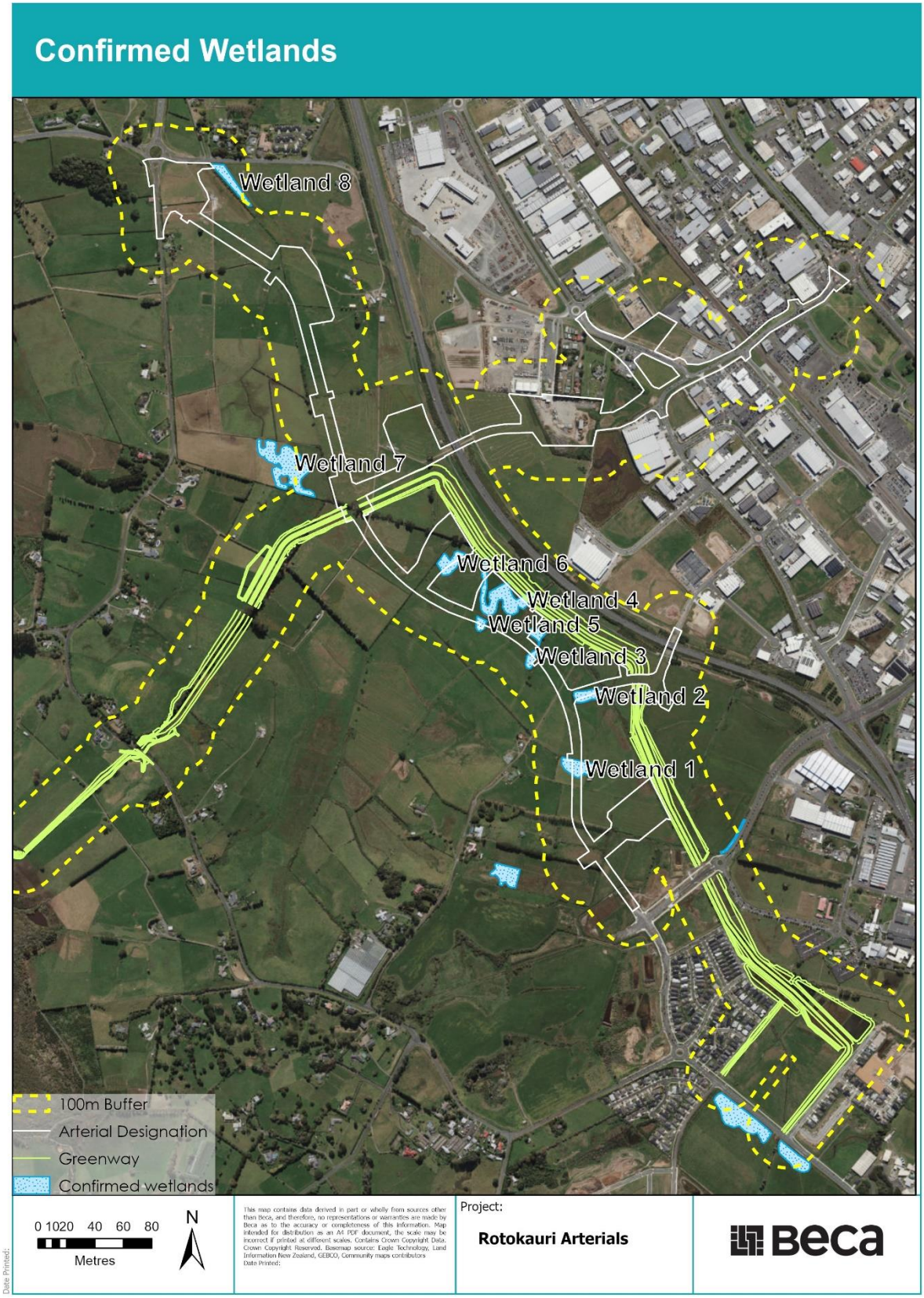

Figure 8: Confirmed wetlands located within 100m of the proposed designation (Beca, 2021).

3.3 Native Fauna

3.3.1 Avifauna

Native avifauna within the proposed designation includes predominantly pasture and open country species. Species observed within the proposed designation during the site visit include swallow, kotare, pied stilt, fantail, and spur-winged plover (Table 8).

Additional species, including At-Risk wetland birds have also been recorded in the wider Project area, and are associated with Lake Rotokauri, Lake Waiwhakareke and stormwater treatment wetland (HJV wetland). This also includes the transient use of the existing drainage network for foraging habitat for other species like black shag and little black shag (black shag were noted alongside drain habitat during the site visit). It is reasonable to assume that Australasian bittern might also be present on occasion although no confirmed records or sightings of this species occur in the proposed designation.

Overall, the proposed designation has **High** avifauna values due to the confirmed and possible presence of At-Risk species.

Table 8. Native bird species of conservation importance found within the proposed designation during the site visit and species record search. Conservation status assigned according to (Robertson, et al., 2016).

Common name	Scientific Name	Conservation Status	Present in habitat in corridor	NPS-IB Highly Mobile Fauna
Black shag	*Phalacrocorax carbo*	At Risk – Relict	Sighting near lakes	-
Little black shag	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	Sighting near lakes	-
Pied shag	*Phalacrocorax varius*	At Risk – Recovering	Ponds and river margins	yes
NZ Falcon	*Falco novaeseelandiae*	At Risk – Vulnerable	Open grasslands	yes
Swamp harrier	*Circus approximans*	Not Threatened	Flying overhead	-
White-faced heron	*Egretta novaehollandiae*	Not Threatened	Larger drains, ponds and river margins	-
Grey warbler	*Gerygone igata*	Not Threatened	River margins	-
Pied stilt	*Himantopus leucocephalus*	Not Threatened	Larger drains, ponds and river margins	-
Welcome swallow	*Hirundo neoxena*	Not Threatened	River margins	-
Little Shag	*Microcarbo melanoleucos*	Not Threatened	Larger drains, ponds and river margins	-
Pukeko	*Porphyrio melanotus*	Not Threatened	Larger drains, ponds and river margins	-
Kōtare	*Todiramphus sanctus*	Not Threatened	Forest, Larger drains, ponds and river margins	-
Spur-winged plover	*Vanellus miles*	Not Threatened	Open grasslands	-

3.3.2 Bats

'Nationally Critical' long-tailed bats (*Chalinolobus tuberculatus*) are known to occur in the Hamilton City gully system and surrounding landscape (Le Roux & Le Roux, 2012). Project Echo and Ecology NZ have both recorded long-tailed bat activity near Lake Waiwhakareke, to the South of the study area but close to the proposed designation in 2019 (refer Appendix G). Given the presence of bats in the surrounding area, bat surveys and roost tree risk assessments were undertaken within the proposed designation by Ecology NZ (2021).

A single long-tailed bat pass was detected during the survey at a stand of mature macrocarpa trees (*Cupressus macrocarpa*), adjacent to a farm shed area (see Figure 9). These trees are situated on a farming property adjacent to the proposed designation. The nature of this detection was determined to be commuting related.

A total of 43 trees or groups of trees across the proposed designation and immediate surrounds met the potential bat roost criteria of having a DBH >15cm and at least one identified roost feature (Ecology New Zealand, 2021). Of these, 12 were classified as High Risk, 15 as Moderate, and 16 as Low. High-Risk trees were found in isolated pockets adjacent the proposed designation and along the Rotokauri Drain / Greenway alignment.

The proposed designation is assessed as having **Very High** bat species values due to the presence of long-tailed bats and high-risk roost trees within the surrounding area.

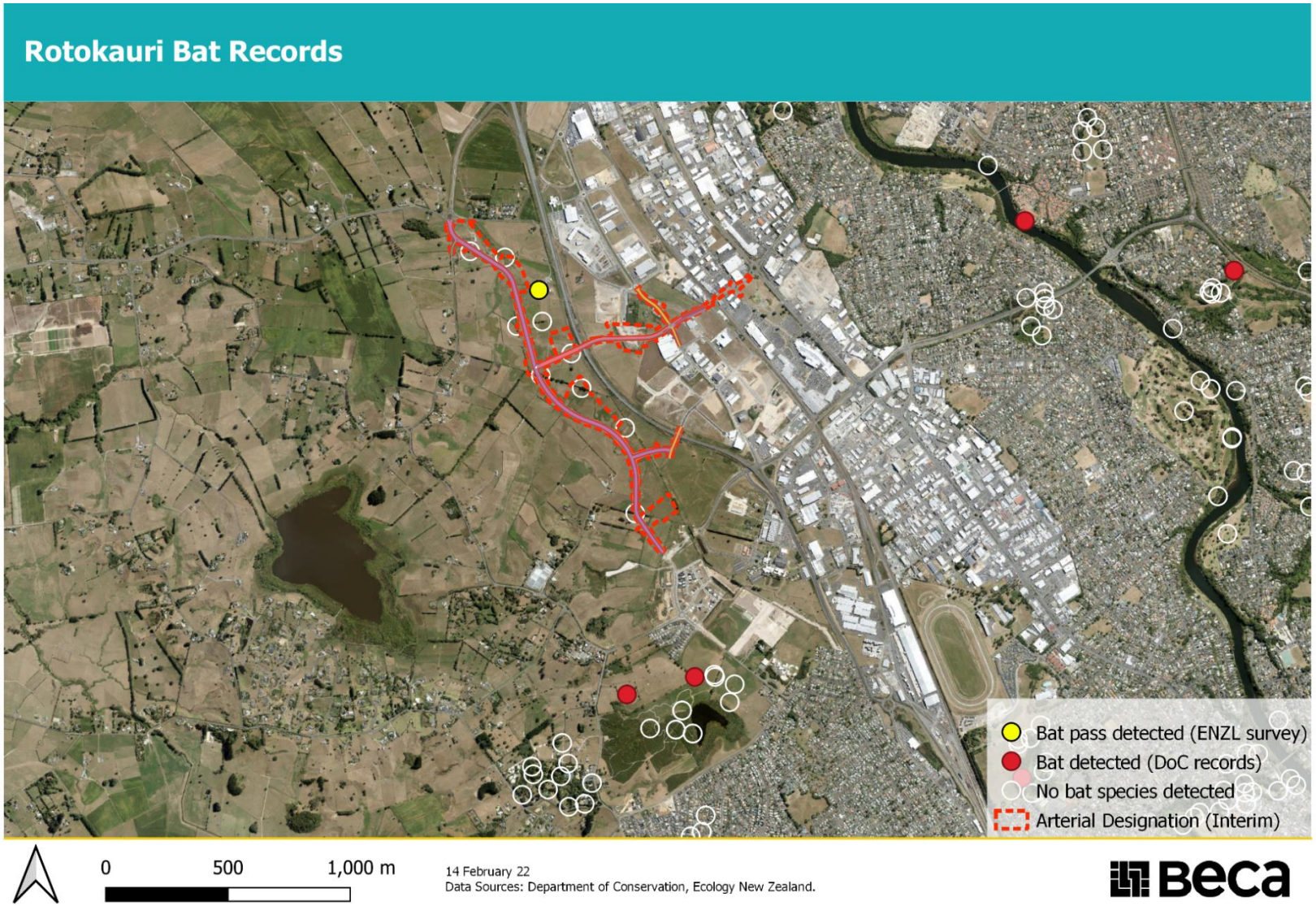

Figure 9: Bat records in the surrounding landscape (Source: DoC, Project Echo & Ecology NZ).

3.3.3 Lizards

The highly modified rural landscape contains little high-quality lizard habitat. Lizard species present are limited to the indigenous copper skink (*Oligosoma aeneum)* where suitable habitat is present, and the exotic plague skink (*Lampropholis delicata*) (Ecology NZ, 2021). Copper skinks are currently listed as an 'At Risk – Declining' species and can be found within farmland across the Waikato where they persist in rank grass, shelter belts, hedges, residential gardens, and remnant bush (Figure 10).

The proposed designation is considered to have **High** ecological value for lizards, and native lizards are absolutely protected under the Wildlife Act 1953.

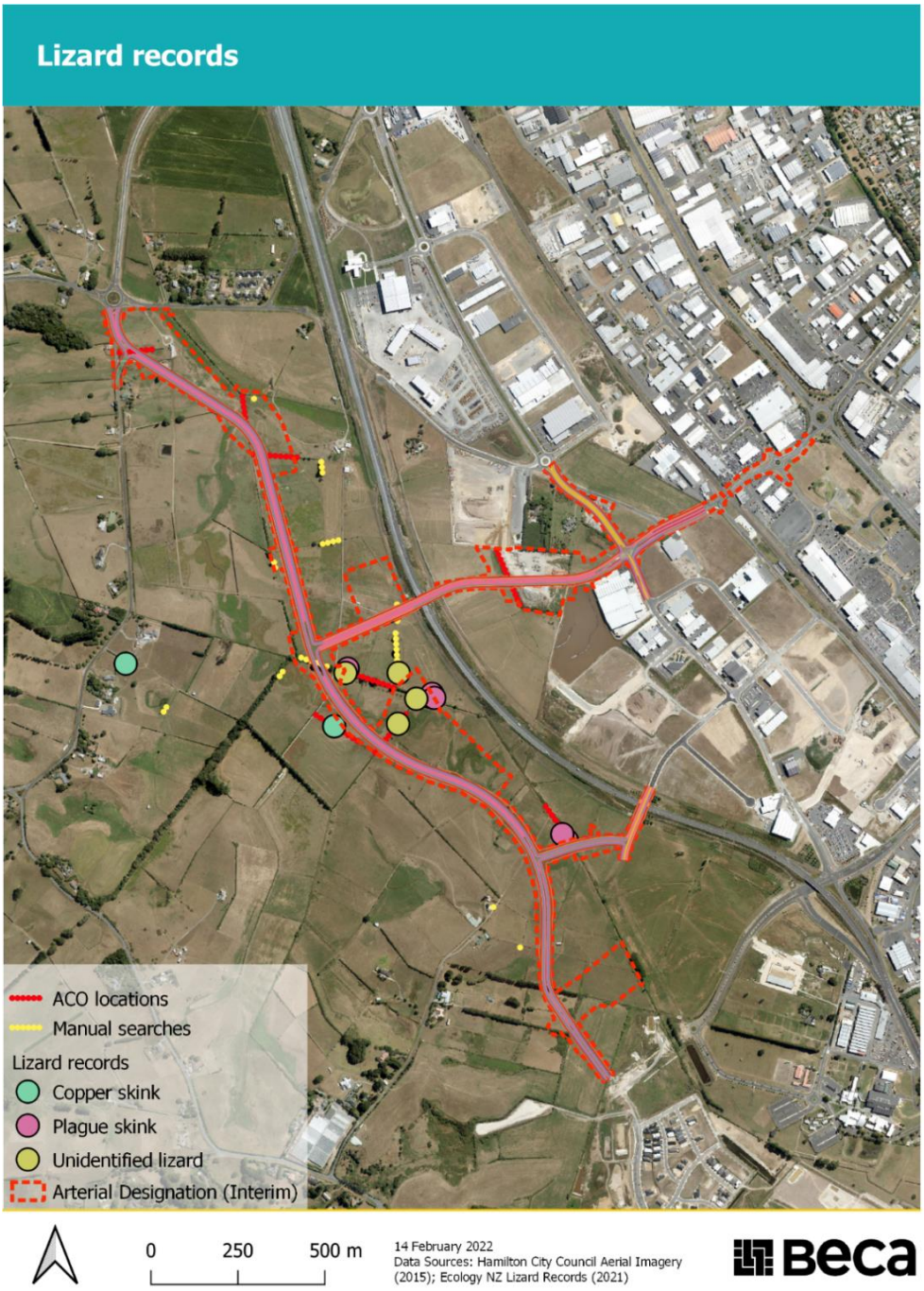

Figure 10: Lizard records in the surrounding landscape (Source: Ecology NZ).

3.3.4 Native Fish

Fish surveys conducted by Champion, Parkyn, & Chisnall (2001), Ecology New Zealand (2021), NZFFD records (Crow, 2017), and ecological assessments conducted by Tonkin & Taylor (2018), confirmed the presence of several fish species known to occur in the adjoining Rotokauri catchment including black mudfish (Figure 11).

Water levels in the catchment rise and fall over longer timeframes than in most urban catchments due to perched water levels and low permeability soils across the area (Hartland Environmental, 2017) which may contribute to the creation of ephemeral habitat suitable for black mudfish. Much of the proposed designation is also located on peat soils (Whenua, 2021) which mudfish are typically associated with (Hicks & Barrier, 1996). Due to the relatively high inter-connectedness of the drain network, it is possible that mudfish could be present throughout the drainage network and within the Project area during winter months, and the drains may also have value as migration pathway for other species when water levels are high.

Based on the presence of At-Risk species in the adjoining Rotokauri catchment and relatively high interconnectedness of the drain network, the proposed designation is assessed as having **High** freshwater fish values (Table 99).

Table 9. Freshwater fish known to occur in the area (Sources: Champion et al., 2001; Price et al., 2016; NZFFDB; Hamitlon City Council, 2011; Hartland Environmental, 2017). Conservation status assigned according to Dunn, et al., (2018).

Species	Conservation Status	Location
Black Mudfish (*Neochanna diversus*)	At Risk - Declining	Farm drain network Mangaheka stream
Longfin Eel (*Anguilla dieffenbachia*)	At Risk - Declining	Greenway / Rotokauri Drain Mangaheka stream
Giant Kokopu (*Galaxias argenteus*)	At Risk - Declining	Greenway / Rotokauri Drain
Īnanga (*Galaxias maculatus*)	At Risk - Declining	Greenway / Rotokauri Drain
Rudd (*Scardinius erythrophthalmus*)	Introduced and naturalised	Greenway / Rotokauri Drain
Trout (*Salmo trutta*)	Introduced and naturalised	Greenway / Rotokauri Drain
Gambusia (*Gambusia affinis*)	Introduced and naturalised	Greenway / Rotokauri Drain Mangaheka Stream Farm drain network
Catfish (*Ameiurus nebulosus*)	Introduced and naturalised	Farm drain network
Shortfin Eel (*Anguilla australis*)	Not threatened	Greenway / Rotokauri Drain Mangaheka tributary
Common Bully (*Gobiomorphus cotidianus*)	Not threatened	Greenway / Rotokauri Drain
Banded kokopu (*Galaxias fasciatus*)	Not threatened	Mangaheka stream Greenway / Rotokauri Drain

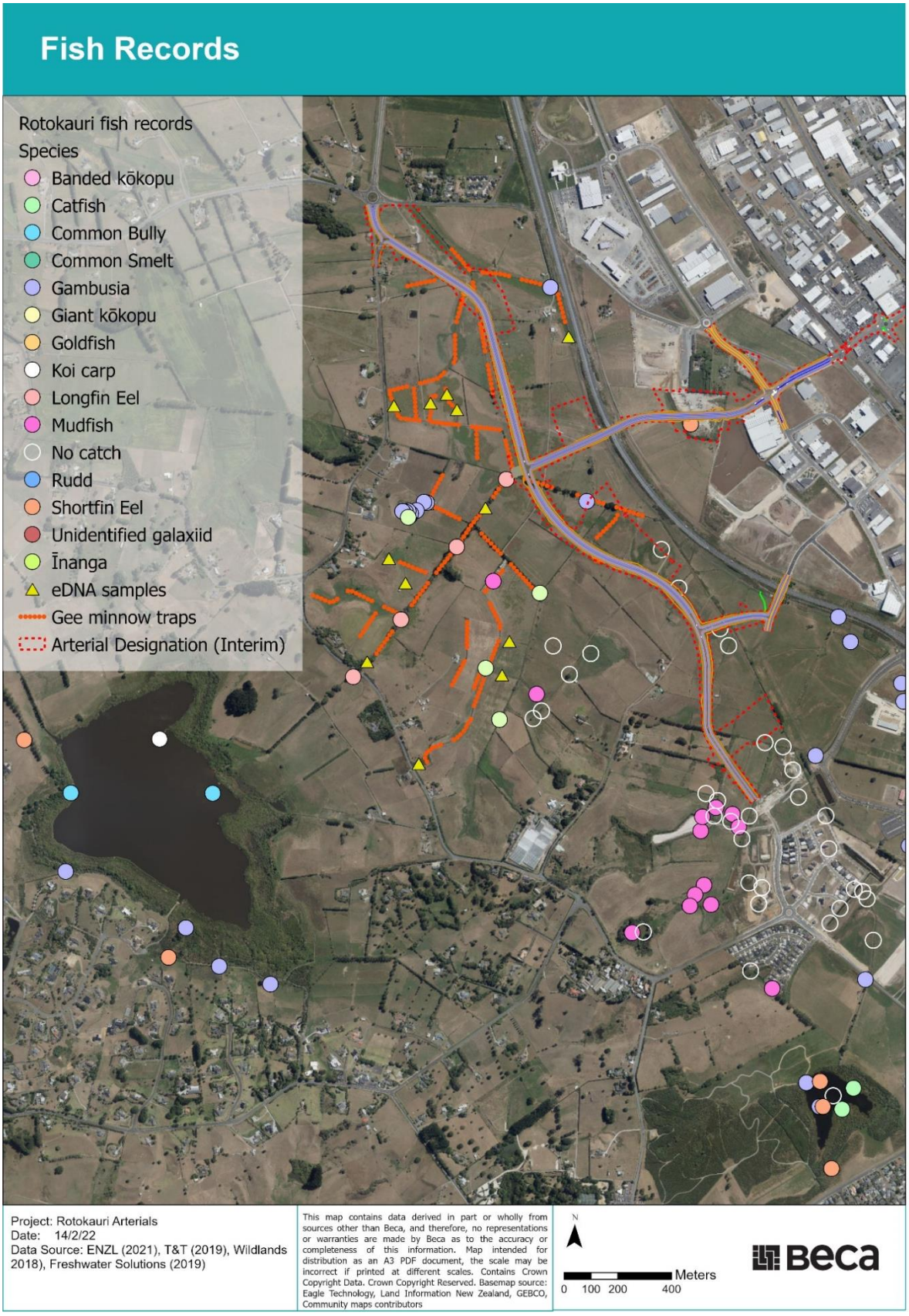

Figure 11: Locations where black mudfish have been identified and fish surveys have been undertaken.

4 Ecological Effects

Ecological effects are associated with the temporary effects arising from the construction phase as well as long term effects once the Project is constructed. The assessment of ecological effects has been undertaken in accordance with the EIANZ guidelines (2018). Level of effects are assessed as the product of the **magnitude** (determined according to the duration of effects, the degree of change that will be caused and the extent of potential impact), and the ecological **values** impacted. The effects assessed are described in detail below.

4.1 Proposed activities

The proposed works include the construction of approximately 5.2km of new transport corridors as well as an upgrade of existing roads and tie-in to existing roads in the north-west of Hamilton. The proposed designation commences in the south at the intersection of Rotokauri Road and Mangaharakeke Drive and runs in a north-western direction to the Koura Drive/Te Kowhai Road (SH39) roundabout. The proposed designation also includes west-east corridors that link the area to Te Rapa and the wider Hamilton transport network. The eastern part of the proposed designation sits within Mangaheka and Te Rapa catchments runs through predominantly commercial/light industrial areas. The main arterial alignment is shown below in Figure 12. Proposed works intersect with farm drains and modified watercourses at numerous points and will also intersect with the designated Rotokauri Greenway.

Assumptions that underpin the assessment of ecological effects are discussed in detail in Section 1.3 and form the baseline for this report. Construction of the Greenway will commence ahead of the proposed designation. The ecological value of the Greenway is assumed to be that which would exist immediately post-construction. This would reflect a recently disturbed environment in the process of re-establishing vegetation cover and native fauna habitat values (see Section 3.2.3 for further detail).

The construction of the Greenway and progressive urbanisation will also result in the partial diversion / infilling of the rural drain network and the drainage of wetlands. Where there is overlap in affected features between the proposed designation and the Greenway, it has been assumed that adverse effects have been addressed as part of the Greenway NoR, designation conditions and regional consents and are disregarded for this effects assessment.

4.2 Zone of Influence / Scale of Assessment

Zone of influence (ZOI) is defined as the "*areas/resources that may be affected by the biophysical changes caused by the proposed project and associated activities*" (Roper-Lindsay et al., 2018). The ZOI and the scale of assessment is the Rotokauri and Mangaheka catchment for freshwater environments and associated fish populations, and the proposed designation boundary for vegetation.

The ZOI and scale of assessment for wetland birds takes into account the sub-populations that inhabit the Rotokauri catchment and in particular, Lake Rotokauri and Waiwhakareke and the Waikato River margins as key habitat areas. The ZOI for long-tailed bat includes populations within the wider Hamilton area. The bat pass detected as part of this Project suggests that bats traverse the Project area, possibly moving between key habitat areas i.e. southern gullies, lakes and Waikato River and possibly further north of Hamilton where other known populations occur. As such, the scale of assessment for long-tailed bats considers effects in context of the known Hamilton bat populations and confirmed bat habitat (Hamilton City Wide Bat Survey, 2023).

The ZOI and scale of assessment for native skinks considers effects on the sub-populations of lizards present in the Project corridor as native lizards have small home ranges and can occur in isolated populations.

4.3 Effects Assessment

4.3.1 Aquatic habitat loss and risk of injury/mortality of native fish

The Rotokauri Strategic Infrastructure Designation Design Report (Appendix D of NoR application) includes design criteria required by the ICMPs for the Rotokauri, Mangaheka and Te Rapa catchments. The design solution also reflects the staged development of the wider RSP area in that temporary culverts are proposed that will be upgraded as development commences sequentially.

Reclamation, diversion, piping and culverting of waterways will cause the loss and modification of aquatic habitat that provides habitat for At Risk freshwater fish species including black mudfish, īnanga, longfin eel, and giant kokopu. Black mudfish distribution within the drain network has not been thoroughly mapped but they are known to be present in tributaries of the Greenway (Figure 12). Project construction activities have the potential to cause injury or mortality of mudfish and any other native freshwater fish that are present within the drainage network including At Risk longfin eel, giant kokopu and īnanga.

The quantum of loss attributed to the Project at the time of construction will depend on the staging of development, and the final design of the Project. The loss and modification of aquatic habitat and the consequential impact on native fish populations is likely to result in a **High** magnitude of effect. This is due to the major loss or alteration of key habitat and migration corridors for At Risk freshwater fish species in the area. It is expected that overall level of habitat loss effects and any associated stream offset and compensation requirements will be addressed through the regional consenting process and implementation of an Environmental Management Plan (EMP).

In addition to habitat loss, the magnitude of injury / mortality of native fish and consequential fish populations is **High** during construction.

4.3.2 Fish Passage and habitat connectivity

The Rotokauri Strategic Infrastructure Designation Design Report (Appendix D of NoR application) includes design criteria to maintain fish passage (in accordance with the NZ Fish Passage Guidelines (Franklin et al., 2018)). It is expected that fish passage design will form part of the regional consenting process and that no loss of habitat connectivity will occur if the design criteria and fish passage standards are met. Thus, the magnitude of adverse effect is **Low** with these assumed embedded controls.

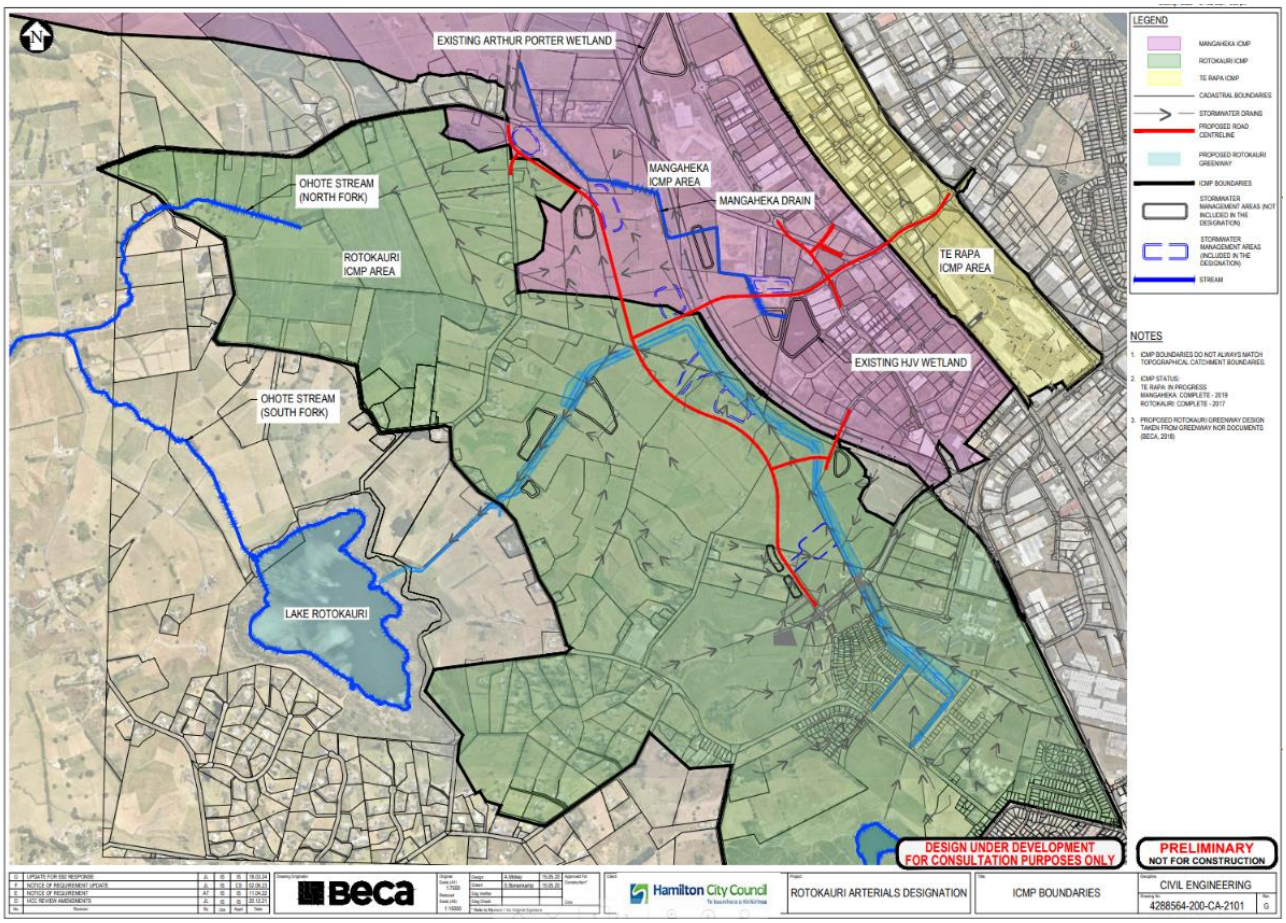

Figure 12: Proposed designation (red line), Rotokauri Greenway and associated wetlands (blue polygons) and stormwater drains in the area (dark blue lines).

4.3.3 Loss and modification of natural inland wetland

The proposed designation intersects with six wetlands and is located within 100m of a further two wetlands. The Greenway and surrounding developments also intersect with these wetlands and the construction of the Greenway will result in the loss of wetland extent and value in the southern section of the proposed designation, prior to the construction of the Project. This is being addressed through a suite of regional resource consents for the Greenway and therefore effects on those six wetlands are disregarded for this Project. For the remaining two wetlands in the northern extent of the proposed designation, a **high** magnitude of wetland loss and modification is anticipated, and wetland offset and/or compensation will be required.

In this context, the alteration or loss of wetland extent and value attributable to the Project will need to be addressed through the regional consenting process prior to construction.

4.3.4 Degradation of water and habitat quality due to sediment discharge

Earthworks and excavation near or within aquatic habitat have the potential to result in sedimentation of aquatic ecosystems and have adverse effects on water quality and habitat quality.

Uncontrolled sediment discharge to the receiving environment from sediment disturbance during earthworks and later erosion, could result in an alteration to existing water quality and substrate composition. Suspended sediments increase water turbidity and can directly lead to fish mortality through clogging of the

gills. Increases in suspended sediments can also negatively impact aquatic plant photosynthesis through reduced light attenuation, lowering dissolved oxygen levels in the waterbody.

For watercourses located within or adjacent to the works and Lake Rotokauri, the potential magnitude of effect is expected to be **Moderate**, resulting in a partial change in existing baseline condition and reduction in habitat quality for aquatic life including At Risk fish species.

For wetlands, the magnitude of effect is **Low** as aquatic fauna are not expected to reside in or depend on these areas, and submerged macrophytes are not present. Thus, there is expected to be no more than a minor shift away from existing baseline conditions.

Erosion and sediment controls required to manage effects will be addressed as part of regional consenting process.

4.3.5 Terrestrial and riparian vegetation loss

Little to no indigenous terrestrial vegetation occurs within the Project corridor and riparian vegetation along the Rotokauri Drain will be replaced by Greenway native plantings. Vegetation clearance for the Project will have a **Low** magnitude of effect due to the small extent of indigenous vegetation clearance expected. Clearance of Greenway native plantings to facilitate the construction of the Project will also have a **Low** magnitude of effect due to the anticipated limited extent of clearance of maturing native plantings.

Loss of fauna habitat is addressed in the sections below.

4.3.6 Long-tailed bat habitat loss and risk of injury or mortality of bats

Roost and foraging habitat loss from vegetation clearance and watercourse loss/modification has a **Low** magnitude of effect on long-tailed bat populations. This is because there is no evidence, based on long-tailed bat surveys, that bats are roosting or foraging within the proposed designation. The survey information shows that even though there are exotic trees with roost characteristics present as well as watercourses that could provide a food resource, long-tailed bat activity is very low in the wider north Hamilton area.

Notwithstanding, the low population effects from habitat loss, there is a minor risk of injury/mortality of roosting bats wherever suitable roost trees are present. This is because long-tailed bats routinely change roost trees throughout the landscape and may use trees outside of key habitat areas on occasion.

The likelihood of roost occupancy on-site is expected to be low given the results of the bat survey and the context of historical survey results within the surrounding landscape (Ecology New Zealand, 2021). A tree removal protocol is considered appropriate prior to the removal of potential roost trees. There is, however, a small chance that bats could suffer injury or mortality through vehicle strike during the operation of the Project. Due to the low density of bats recorded in the Project area (a single pass), this is assessed as a **Low** magnitude of effect as a very small proportion of the known population is expected to be impacted.

4.3.7 Copper skink habitat loss / risk of injury or mortality of lizards

Vegetation clearance and earthworks have the potential to cause injury and/or mortality of native copper skink within the proposed designation. All native lizards are absolutely protected under the Wildlife Act (1953).

Copper skinks are present within the proposed designation at a low abundance and density with individuals concentrated along hedgerows, riparian vegetation and inorganic debris. It is noted that riparian vegetation is largely associated with the Greenway and that riparian vegetation clearance and the impact on copper skink populations has been addressed as part of the Greenway Designation. The remaining lizard habitat within

the proposed designation comprises of rank grass, exotic hedgerows/shelterbelts and debris on specific properties.

Vegetation clearance and debris removal may result in a loss of a high proportion of suitable habitat in the proposed designation. Thus, this is assessed as a **High** magnitude of effect.

4.3.8 Native bird habitat and connectivity loss / risk of injury or mortality of avifauna

The loss of supplementary foraging habitat provided by wetlands, the drainage network and pastoral foraging for NZ falcon attributable to the Project having a **Low** magnitude of impact on avifauna populations. This includes At-Risk and Nationally Critical species that may be present in the proposed designation.

This is because the supplementary foraging habitat is considered secondary habitat with primary habitat areas remaining unaffected by the Project i.e. Lake Rotokauri and Waiwhakareke. The Greenway will also provide wetland and riparian habitat for these species in advance of the construction of the Project. As discussed in Section 4.3.1, the magnitude of adverse habitat loss attributable to the Project will need to be addressed at a regional consenting stage and in context of the progressive urbanisation of the wider area. The loss of pastoral foraging habitat for open country species, including NZ falcon, a low magnitude of population effect is also anticipated.

The risk of injury/mortality of avifauna species during construction is **Low** but will require management as a precaution to avoid the direct mortality of eggs and/or juveniles of native species protected under the Wildlife Act (1953).

The NPS-IB directs that adverse effects on highly mobile species must be managed to maintain viable populations across their natural range (NPS-IB Section 3.20 (3)). Given the anticipated, low magnitude of habitat loss in context of remaining habitat areas, including wider pastoral areas, a **Low** magnitude of population effects is also expected.

4.3.9 Native fauna disturbance and displacement effects during operation

Operational disturbance and displacement (indirect habitat loss) will arise from lighting, noise, traffic and pedestrian movements. These effects typically lead to the abandonment of previously occupied habitats, disruption of dispersal pathways or affect the fitness (health and breeding success) of species remaining within the Project corridor.

The magnitude of disturbance and displacement effects are contextualised by the predicted environmental conditions when the Project becomes operational. Key assumptions on the future environment are captured in Section 1.3 and 4.1.

Bats

The construction of the Project will result in an increase in anthropogenic disturbance due to increases in noise and lighting both during the construction phase, and as a result of vehicle movements and operational lighting once constructed. Previous research on the Hamilton south population has shown that a shift from rural roads (generally unlit) to residential roads with operational lighting can reduce bat activity (Le Roux & Le Roux, 2012).

Adverse effects are however considered in context of the progressive urbanisation of the wider Rotokauri area. This assumes a background level of disturbance, both noise and lighting at the time that the Project is constructed. A **Low** magnitude of disturbance and indirect habitat loss will occur due to this background level of disturbance coupled with the existing low density of bats recorded in the area and low likelihood of roost

occupancy (Ecology New Zealand, 2021). Consequential population-level effects are therefore also of a **low** magnitude.

Birds

A **low** magnitude of adverse operational effects on avifauna is expected as adverse effects on native birds, will largely occur during the construction phase of the Project. Those remaining in the Project corridor are likely to be urban-adapted species that are already present in the proposed designation. Wetland species such as pukeko, Australasian bittern, shag and pied stilts may be attracted to the Greenway wetlands and main channel as habitat matures over time with limited interaction with the Project.

Lizards

Negligible ongoing adverse effects on native lizard populations are expected as suitable lizard habitat will have been removed during the construction phase and any lizards present relocated out of the proposed designation. It is very unlikely that native lizards will recolonise the proposed designation as no contiguous lizard habitat with no populations will remain in the landscape.

Fish

Operation effects on native fish will be of a **Low** magnitude as fish passage will be maintained through culverts and connectivity with the Greenway (high quality habitat) established. Treatment wetlands and swales proposed for the Project will maintain water quality in the remaining watercourses.

5 Ecological Effects Management

In accordance with the EcIA Guidelines (Roper-Lindsey, 2018), adverse effects that have an overall level of effect of moderate or higher as well as any effects identified by expert ecologists require effects management.

For the Project, these include the following:

- Loss and modification of aquatic habitat.
- Loss and modification of natural inland wetland.
- Degradation of water and habitat quality due to sediment discharge.
- Copper skink habitat loss / risk of injury or mortality of lizards.
- Injury/mortality of native fauna during construction.

Effects should be managed in accordance with the Effects Management Hierarchy as set out in the RMA, NPS-FM and NPS-IB. We recommend that the following measures are implemented to avoid, remedy, minimise and mitigate adverse ecological effects.

5.1 Avoidance

5.1.1 Erosion and Sediment Controls

The effects of sediment discharges during construction activities can be avoided and/or minimised with erosion and sediment control measures to protect the watercourses and wetlands during the construction period, to a degree that the magnitude of effect would be considered **Low** and **Very Low** respectively.

Following construction, all bare earth areas should be re-sown with grass or replanted with ecologically appropriate native vegetation and surrounded by mulch to reduce invasion by weed species. If re-sowing cannot occur immediately, coverage with geotextile fabric or similar can use used in the short-term.

Erosion and sediment control measures should be implemented in accordance with WRC good practice guidelines (Environment Waikato, 2009) to limit sediment discharges, in-stream works during native fish spawning and migration seasons are to be avoided.

5.2 Minimisation

5.2.1 Stormwater and Fish Passage Design

Aquatic habitat loss can be minimised through design in accordance with the requirements set out in the Rotokauri and Mangaheka Integrated Catchment Management Plans. These seek to protect and enhance watercourses where practical. This is reflected in the stormwater design criteria set out in the Rotokauri Strategic Infrastructure Design Report (Appendix D of NoR application) and should be integrated into further detailed design of the Project. Similarly, fish passage design must avoid creating new barriers to fish passage where possible and minimise effects where not possible by following New Zealand Fish Passage Guidelines (NIWA, 2018) for all new culverts and remediating any existing culverts. We agree on the recommendation in the report by Tonkin & Tonkin (2018) proposing that the “Stream Simulation” culvert design is used for any new culvert installations (refer Section 4.2.1 of the guidelines). In summary the key design criteria from the guidelines are as follows:

- Alteration of watercourse gradient should be avoided or minimised.
- Culvert span will be greater than bankfull width. A rule-of-thumb is that the stream bed inside the culvert should be 1.2 x bankfull width + 0.6m.

- Open bottom culverts will be used, or the culvert invert will be embedded by 25 - 50% of culvert height.

Substrate matching the composition and stability of the reference stream will be present throughout the full length of the culvert bed.

5.2.2 Ecological Management Plan

Native fauna habitat loss and the risk of injury and mortality must be addressed to minimise adverse effects. An EMP is required to guide best practice and must align with the Greenway EMP to facilitate a co-ordinated and consistent approach to managing adverse ecological effects common to both designations. The EMP for this Project must include the following:

Fish Management Protocols

Project construction methodology should be designed to minimise the extent of aquatic habitat modification and loss where practicable. Where habitat loss or modification cannot be avoided, mitigation should include fish rescue and relocation prior to the commencement of construction. Methods should follow best practice procedures for capture and relocation of the present species, and careful consideration should be given to species habitat requirements when selecting or constructing habitat for relocation. Relocated populations of At-Risk species should be monitored for at least two years following relocation to ensure the survival of populations (this is particularly important for mudfish as relocation success rates are low). Adaptive management measures may need to be implemented should At Risk populations fail to establish. These measures should be included in the EMP.

Any captured fish species declared to be pests by WRC will be humanely euthanised using acceptable methods. Potential relocation options for native freshwater fish species should be confirmed in the EMP but could include:

- Lake Waiwhakareke.
- Lake Rotokauri.
- Rotokauri Greenway (assuming construction is completed).
- Newly constructed or restored habitat.

To avoid the potential injury or mortality of black mudfish, works disturbing the stream bed of known mudfish habitat should be avoided during the summer months when no surface water is present as mudfish may be aestivating.

Lizard Management

The risk of harm to native lizards within the works footprint requires lizard search and rescue operations to be undertaken in conjunction with vegetation removal. Any habitat removal is to be undertaken by a suitably qualified herpetologist in accordance with a Wildlife Act Authorisation from the Department of Conservation to search for and rescue any native lizards within the works footprint and relocate them to alternative habitat or beyond the area affected by the construction to a suitable adjoining area. A lizard management plan is to be developed and implemented as part of the EMP and this will outline an appropriate relocation site, management measures to be put in place prior to lizard relocation into that area and monitoring and reporting actions following lizard relocation.

Avifauna Management

The clearance of vegetation will directly remove some habitat for native birds. Due to their highly mobile nature, it is likely that direct impacts on adult birds on-site will be largely avoided as they are expected to disperse to other habitat during vegetation clearance. Potential impacts on nesting adult native birds, and

both their eggs and unfledged chicks should be avoided by timing construction to avoid nesting season (August to January). Avoiding the nesting season can however be challenging as it coincides with earthworks season when rainfall and runoff is at its lowest. If vegetation clearance during the peak of the bird breeding season is unavoidable, then those areas should be checked by a suitably qualified ecologist for nesting birds immediately prior to vegetation removal and, if any active nests (i.e. one or more viable eggs or live chicks are present) are detected, vegetation clearance in the immediate vicinity of the nest (e.g., within a 10m radius) should be delayed until a suitably qualified ecologist confirms that any nests present are no longer active.

Bat Management

To manage any residual risk of adverse effects on long-tailed bats due to roost tree clearance, any high-risk roost trees located on edges of the designation should be avoided. This will require survey prior to construction and pending findings, development of management protocols including replacement of roost trees and / or use of bat boxes as offset or compensation. Further, it is recommended that prior to the commencement of works, a bat management plan is developed and implemented as part of the EMP. The bat management plan will outline roost tree management, tree felling protocol, and any other appropriate mitigation measures for loss of any confirmed roost trees and operational disturbances. This could include measures such as the use of directional lighting and the installation of bat boxes to replace lost roost habitat.

5.3 Remediation

5.3.1 Revegetation Planting

Revegetation of the construction footprint is recommended to replace cleared vegetation in the surrounding area with species appropriate to the natural ecosystem type where feasible, with the goal of increasing indigenous dominance in the local landscape and enhancing habitat value for native fauna. A planting plan detailing appropriate species, area to be planted and required maintenance should be submitted to council in conjunction with the pre implementation phase.

5.4 Residual Effects

5.4.1 Native fauna habitat offset and compensation

As part of fauna management, the offset or compensation of any habitat lost should be calculated using best practice methods such as biodiversity offset and accounting models or biodiversity compensation model, to determine commensurate methods and quantum of habitat replacement required.

5.4.2 Wetland offset / compensation

As part of regional consenting process, wetland loss, offset and compensation will be addressed. This should include wetland classification and delineation required prior to construction to determine the extent of wetland loss using best practice methods e.g., BOAM or BCM calculations.

The permanent loss of wetland extent will require offset or compensation in the form of wetland creation or restoration of remaining habitat. Several severely degraded wetlands are present in the wider Rotokauri area and may provide opportunities for restoration using indigenous species, while underlying peat soils with poor drainage provide suitable conditions for wetland creation in the area surrounding the alignment.

As the classification of areas within the Project corridor as natural wetlands was marginal in some instances, it is recommended that sites be reassessed with greater sampling effort prior to the commencement of works to confirm whether they are natural wetlands as defined by the NPS-FM, and to delineate wetland extent at

this time (Beca, 2021) noting that further development may occur in these areas ahead of the Project being constructed. This area should then be used to calculate offset and/or compensation requirements using a biodiversity offset and accounting model (or stream compensation model) and undertaken in accordance with the NPS-FM 2020.

5.4.3 Stream offset / compensation

It is assumed that modification of watercourses due to construction (i.e., through culverting) will require stream restoration and/or enhancement to address loss of functionality which will form part of the regional consents obtained prior to construction. This could include riparian planting at a minimum 5m on either side of watercourses or installation of in-stream habitat enhancements (i.e., bank lunkers, root wads, 'tuna town houses'). Consideration should be given to the Greenway and Lake Waiwhakareke which could present opportunities in conjunction with other ecological initiatives. Should there be any permanent loss of stream extent, offset or compensation will be required in the form of stream creation and restoration/enhancement of remaining stream habitat in accordance with the NPS-FM 2020 principles for biodiversity offset and compensation.

5.5 Summary of Effects and Effects Management

The construction of the Project has the potential to cause adverse ecological effects, both during the construction phase, and on an ongoing basis due to habitat modification. The actual and potential ecological effects are similar to many aspects as those identified in the Greenway Ecological Assessment (Tonkin & Taylor, 2018) and are listed below:

- Adverse effects on water quality and aquatic life due to sediment discharges during construction and loss or modification of aquatic habitat.
- Adverse effects on fish passage and migration during, and as a result of construction activities.
- Potential for injury or mortality of Threatened and/or At-Risk species during construction.
- Potential barriers to fish passage where the Project and the Greenway and/or farm drains intersect, and culverts are required.
- Potential adverse effects on native bats and lizards.
- Loss and/or modification of aquatic habitat.
- Potential loss of habitat connectivity.

Without management, the magnitude and level of effect is expected to be **High** due to the potential risk of injury or mortality to black mudfish, loss or modification of wetlands, and loss or modification of the habitat and migration pathways of other At-Risk fish species. However, with recommended avoidance and mitigation measures and the implementation of an EMP, the residual level of effects can be managed to **Low levels**.

The management recommendations in Table 10 are considered sufficient to mitigate the identified effects. The level of effects and the type of effects may require revision should construction, location or design plans change.

Table 10. Summary of potential ecological effects on ecological values including magnitude, level of effects and recommended effects management.

Potential ecological effect	Ecological component	Ecological Value	Magnitude of Effect (unmitigated)	Overall Level of Effect (unmitigated)	Effects management
Loss and/or modification of aquatic habitat	Rural Drain Network	Moderate	High	Moderate	Minimise the extent of modification or loss of aquatic habitat. Enhancement or restoration of aquatic habitat in the surrounding area where practical. Biodiversity offset/compensation for permanent loss and enhancement of remaining habitat as part of regional consents.
	Greenway	High	High	Very High	
	Mangaheka Tributary	Very Low	High	Very Low	
	Wetlands	Moderate	High	Moderate	
Degradation of water and habitat quality	Rural Drain Network	Moderate	Moderate	Moderate	The implementation of erosion and sediment control measures in accordance with WRC good practice guidelines (Environment Waikato, 2009) to limit sediment runoff
	Greenway	High	Moderate	High	
	Mangaheka Tributary	Very Low	Moderate	Very Low	
	Wetlands	Moderate	Low	Low	
	Lake Rotokauri	High	Moderate	High	

Potential ecological effect	Ecological component	Ecological Value	Magnitude of Effect (unmitigated)	Overall Level of Effect (unmitigated)	Effects management
Loss of terrestrial and riparian vegetation	Vegetation	Very Low	Low	Very Low	. Replant cleared vegetation using suitable native species where possible. Implement measures to prevent weed invasion.
Potential injury and/or mortality of freshwater fauna during construction	Freshwater fish	High	High	Very High	Minimise the extent of modification or loss of aquatic habitat. Creation of a mudfish management plan in conjunction with Rotokauri Greenways development Timetable works where mudfish are present during summer months when mudfish are likely to be aestivating. Undertake mudfish and native fish rescue and relocation prior to works and undertake post-relocation monitoring and adaptive management to ensure successful relocation. Enhance or restore native fish habitat in the surrounding area. Consider timing of in-stream works and where possible avoid these during the migration period for giant kokopu, īnanga, longfin eels and common bully.
Potential loss of habitat connectivity	Freshwater fish	High	Low	Low	Construct culverts in accordance with New Zealand Fish Passage Guidelines (NIWA, 2018).
Potential risk of injury or mortality	Bats	Very High	Low	Moderate	Avoid clearance of high-risk bat roost trees where possible.

Potential ecological effect	Ecological component	Ecological Value	Magnitude of Effect (unmitigated)	Overall Level of Effect (unmitigated)	Effects management
of local terrestrial fauna					Implementation of vegetation clearance protocols when removing vegetation which could potentially support bat roosts.
	Lizards	High	High	Very High	Lizard search and rescue operations to be undertaken in conjunction with vegetation removal. A LMP and DOC Wildlife Act Permit will be required prior to undertaking this work.
	Birds	High	Low	Moderate	Pre-clearance nest surveys undertaken (Aug-Jan inclusive)
Operational disturbance	Bats	Very High	Low	Moderate	Development of a fauna management plan as part of the EMP with appropriate management of operational effects. .
	Birds	High	Low	Low	
	Lizards	High	Negligible	Very Low	
	Fish	High	Low	Low	

6 Conclusions and Recommendations

There are adverse effects from the construction and operation of the Project that require effects management. Appropriate measures to address adverse effects are required prior to the commencement of, and throughout construction works, and an EMP should be developed to guide the project and minimise adverse effects. With the implementation of recommended avoidance and minimisation measures, and the enactment of an EMP in conjunction with the Greenway, the level of effects can be managed to Low levels with residual effects pertaining the wetland and stream compensation addressed through regional resource consents.

Recommendations to avoid the impact on the surrounding ecological environment of the site include:

- Undertake mudfish and native fish rescue and relocation to a site that meets all relevant habitat criteria prior to the commencement of works. If no suitable habitat for relocation can be identified, habitat may need to be constructed or restored.
- Timetable in-stream works to not occur during native fish spawning and migration seasons.
- Minimise modification or loss of aquatic habitat where possible.
- Avoid clearance of high-risk potential bat roost trees where possible.

Recommendations to minimise the impact on the surrounding ecological environment of the site include:

- The implementation of erosion and sediment control measures in accordance with WRC good practice guidelines (Environment Waikato, 2009) to limit runoff into the receiving environment.
- Construct culverts in accordance with New Zealand Fish Passage Guidelines (NIWA, 2018).
- Minimise the extent of modification or loss of aquatic habitat.
- Implement measures to prevent weed invasion following construction works.
- Develop and implement an EMP (including a mudfish management plan) in conjunction with Rotokauri Greenway.
- Develop and implement a bat management plan as part of the EMP including surveys, if necessary, prior to the commencement of works.
- Pre-clearance bird nest surveys (Aug-Jan inclusive).
- Lizard search and rescue operations to be undertaken in conjunction with vegetation removal.

Recommended mitigation measures include:

- Enhancement or restoration of water bodies that provide native fish habitat in the surrounding area.
- Replanting cleared vegetation using native species appropriate to the natural ecosystem and undertake planting and habitat enhancement in the surrounding area.
- Habitat offset and compensation for black mudfish if suitable habitat for relocations cannot be identified or created through restoration/enhancement of existing habitat.
- Offset/compensation for any permanent loss of aquatic habitat and restoration/enhancement of stream and wetland habitat where practicable.

These measures should be developed and given effect to by way of an EMP prepared by a suitably qualified and experienced person prior to the construction of the Project. Given the overlap of the Project with the Greenway, the EMP may cover the proposed works of both projects to increase cumulative benefits.

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9 Limitations

This report has been prepared by Beca Ltd (Beca) solely for Hamilton City Council (the client). This report is prepared solely for the purpose of the assessment of potential ecological effects of the proposed works (Scope). The contents of this report may not be used by HCC for any purpose other than in accordance with the stated Scope.

This report is confidential and is prepared solely for the Client. Beca accepts no liability to any other person for their use of or reliance on this report, and any such use or reliance will be solely at their own risk.

This report contains information obtained by inspection, sampling, testing or other means of investigation. Unless specifically stated otherwise in this report, Beca has relied on the accuracy, completeness, currency and sufficiency of all information provided to it by, or on behalf of, the Client or any third party, including the information listed above, and has not independently verified the information provided. Beca accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the information provided.

The contents of this report are based upon our understanding and interpretation of current legislation and guidelines (“Standards”) as consulting professionals and should not be construed as legal opinions or advice. Unless special arrangements are made, this report will not be updated to take account of subsequent changes to any such Standards.

This report should be read in full, having regard to all stated assumptions, limitations and disclaimers.

1

Appendix 1 – Ecological Impact Assessment (EIANZ methodology)

Appendix 1: Ecological Impact Assessment Guidelines

Assigning Ecological Value

Freshwater and terrestrial habitat

The ecological values of freshwater and terrestrial systems (riparian vegetation, habitats and species present) potentially impacted by the works were assessed against the following attributes:

- Representativeness;
- Rarity or distinctiveness;
- Diversity or pattern; and
- Ecological context.

These attributes are described in Table 1.1 and Table 1.2 below.

Table 1.1. Matters that may be considered when assigning ecological value to a freshwater site or area.

Matters	Attributes to be assessed
Representativeness	Extent to which site/catchment is typical or characteristic Stream order Permanent, intermittent or ephemeral waterway Catchment size Standing water characteristics
Rarity/distinctiveness	Supporting nationally or locally threatened, at risk or uncommon species National distribution limits Endemism Distinctive ecological features Type of lake/pond/wetland/spring
Diversity and pattern	Level of natural diversity Diversity metrics Complexity of community Biogeographical considerations - pattern, complexity, size, shape
Ecological context	Stream order Instream habitat Riparian habitat Local environmental conditions and influences, site history and development Intactness, health and resilience of populations and communities Contribution to ecological networks, linkages, pathways Role in ecosystem functioning – high level, proxies

Table 1.2. Attributes to be considered when assigning ecological value or importance to a site or area of vegetation/ habitat/community.

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

The freshwater habitat features were assessed considering each of the attributes in Table 1.1, and terrestrial habitat features were assessed considering attributes in Table 1.2. Features of interest were subjectively given a rating on a scale of 'Very Low' to 'High' for each attribute and assigned a value in accordance with the description provided in Table 1.3.

Table 1.3. Rating system for assessing ecological value of terrestrial and freshwater systems (Roper-Lindsay et al. 2018)

Value	Description
Negligible	Feature rates Very Low for at least three assessment attributes and Low to Moderate for the remaining attribute(s).
Low	Feature rates Very Low to Low for most assessment attributes and moderate for one. Limited ecological value other than providing habitat for introduced or tolerant indigenous species.
Moderate	Feature rates High for one assessment attribute and Low to Moderate for the remainder, OR the project area rates Moderate for at least two attributes and Very Low to Low for the rest. Likely to be important at the level of the Ecological District.
High	Feature rates High for at least two assessment attributes and Low to Moderate for the remainder, OR the project area rates High for one attribute and Moderate for the rest. Likely to be regionally important.
Very High	Feature rates High for at least three assessment attributes. Likely to be nationally important.

Species

The EIANZ provides a method for assigning value (Table 1.4) to species for the purposes of assessing actual and potential effects of activities.

Table 1.4. Criteria for assigning ecological values to species.

Ecological Value	Species
Very High	Threatened (Nationally Critical, Nationally Endangered, Nationally Vulnerable)
High	At Risk (Declining)
Moderate	At Risk – Recovering and At Risk – Naturally Uncommon
Low	Nationally and locally common indigenous species

Assigning Magnitude of Impacts

The magnitude of impacts is determined by the scale (temporal and spatial) of potential impacts identified and the degree of ecological change that is expected to occur as a result of the proposed activity (Roper-Lindsay *et al*. 2018).

Based on the assessor's knowledge and experience, the magnitude of identified impacts on the ecological values within the project area and zone of influence were assessed and rated on a scale of 'Very High' to 'Negligible' based on the description provided in Table 1.5.

Table 1.5. Criteria for describing the magnitude of effects (Roper-Lindsay et al. 2018)

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

Assessment also considered the temporal scale at which potential impacts were likely to occur:

- Permanent (>25 years).
- Long-term (15-25 years).
- Medium-term (5-15 years).
- Short-term (0-5 years).
- Temporary (during construction)

Assessing the Level of Effects

The overall level of effect on each ecological feature identified within the zone of influence were determined by considering the magnitude of impacts and the values of impacted ecological features (Roper-Lindsay *et al*. 2018).

Results from the assessment of ecological value and the magnitude of identified impacts were used to determine the level or extent of the overall impacts on identified ecological features within the project area and zone of influence using the matrix described in Table 1.6.

Table 1.6. Matrix combining magnitude and value for determining the level of ecological impacts (Roper-Lindsay et al. 2018).

Effect Level		**Ecological and/or Conservation Value**				
		Very High	**High**	**Moderate**	**Low**	**Negligible**
	Very High	Very High	Very High	High	Moderate	Low
Magnitude	**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

Results from the matrix were used to determine the type of responses that may be required to mitigate potential direct and indirect impacts within the project area and within the zone of influence, considering the following guidelines (Roper-Lindsay *et al*. 2018):

- A ‘Low’ or ‘Very Low’ level of impact is not normally of concern, though design should take measures to minimise potential effects.
- A ‘Moderate’ to ‘High’ level of impact indicates a level of impact that qualifies careful assessment on a case-by-case basis. Such activities could be managed through avoidance (revised design) or appropriate mitigation. Where avoidance is not possible, no net loss of biodiversity values would be appropriate.

A ‘Very High’ level of impact is unlikely to be acceptable on ecological grounds alone and should be avoided. Where avoidance is not possible, a net gain in biodiversity values would be appropriate.

2

Appendix 2 – Supplementary Ecological Report

Supplementary Fauna Surveys

Rotokauri Arterial Designation

Prepared for BECA
13 April 2021

Report Number 20058.1-001-Rev0

ECOLOGY NEW ZEALAND

Document Sign Off

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Document Control

Revision	Date	Details	Status	Authorised by
0	09/04/2021	Supplementary Fauna Surveys	Final	CC

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EXECUTIVE SUMMARY

To support residential and commercial development within the Rotokauri Structure Plan area over the next 20-30 years, Hamilton City Council (HCC) is proposing to create a new arterial road (Rotokauri Arterial Designation) parallel to the current State Highway 1 alignment on the north side of Hamilton city.

This report is prepared to support fauna habitat assessments described in the Ecological Assessment of Effects report for the Rotokauri Arterials Notice of Requirement prepared by BECA. Though construction is not earmarked within the near future, fauna surveys were deemed appropriate to provide baseline information on the current state of environment within the proposed designation footprint.

The surveys detailed within this report provide findings on black mudfish, lizard, and long-tailed bats.

Hamilton City Council and BECA identified targeted areas where knowledge gaps existed for mudfish within the designation area. These un-surveyed areas were located within and adjacent to the Rotokauri Arterial Designation. Desktop assessments were undertaken to further identify potential watercourses to target survey efforts. Infield verification was subsequently undertaken to determine watercourse presence and suitability for trapping by means of Gee-minnow traps and Environmental DNA sampling. With a total of 272 traps deployed across the survey area over the four survey days, only one adult mudfish was captured. This specimen was detected outside of the designation footprint. DNA sampling failed to detect mudfish but did indicate the presence of giant kōkopu (*Galaxias argenteus*) and long-fin eel (*Anguilla dieffenbachii*), both of which are At-Risk species.

Bioacoustic surveys were undertaken for long-tailed bats across the proposed designation footprint. Bat presence was very low with only 1 commuting call detected. Desktop reviews from historical surveys north-west of Hamilton also demonstrate low bat activity and support our survey results. Roosting habitat for bats was found across the alignment, mainly associated with mature macrocarpa and pine. Though roost habitat is present, the likelihood of utilisation by bats is low given the low activity detected on-site and in the surrounding landscape.

Desktop assessments support by in-field habitat assessments, provided understanding that native lizard presence on-site was likely to be restricted to copper skinks. To best support these assessments, multiple checks of artificial cover objects and manual searches were undertaken across the proposed designation footprint to confirm species presence. Both copper skinks and plague skinks were detected within the designation at low numbers. Copper skinks were found within hedgerow habitat and underneath debris items within a farm paddock.

The presence of native fish, bats and lizards will require consideration during the preparation of ecological impact assessment. These assessments will need to commensurately detail specific avoidance and management of any foreseeable impacts on these protected species.

1. INTRODUCTION

This report[1], prepared by Ecology New Zealand Limited ('ENZL') for BECA Limited ('the client'), presents the results of targeted fauna surveys within the Rotokauri Arterial Designation ('the site'). Specifically, this report details the methodology and results of native bat, lizard and fish surveys.

1.1. Background, Purpose and Scope

To support growth in the Rotokauri area, the Rotokauri Structure Plan (RSP) was developed to provide high-level direction on the alignment of the Rotokauri Arterial Designation and locations of community facilities (Rotokauri Greenway project) which will support residential and commercial development within the area for the next 20-30 years. Hamilton City Council (HCC) proposes to create a new arterial road parallel to the current State Highway 1 alignment on the north side of Hamilton city. The proposed footprint transects several private properties between SH1 to the east and Burbush Rd/Exelby Rd/Rotokauri Rd to the west.

The findings from this report are to be used to support the fauna habitat assessments described in the Ecological Assessment of Effects report prepared for the Rotokauri Arterials Notice of Requirement (NOR). The report aims to highlight the presence or potential presence of indigenous fauna species (e.g. mudfish, long-tailed bats and lizards) that will require specific consideration, in order to inform project feasibility and potential future management requirements.

1.2. Site Location, Description and Ecological Context

The Rotokauri Arterial Designation is effectively a north-south corridor that commences in the south at the intersection of Rotokauri Road and Mangaharakeke Drive and proceeds in a generally north-western direction to Koura Drive / Te Kowhai Road (SH39) roundabout. The network also includes a series of west-east corridors that link the Rotokauri growth cell to Te Rapa and the wider Hamilton city transport network.

The proposed Rotokauri Designation (Figure 1)consists entirely of productive agricultural land (predominantly cattle farming) (Table 1). As such the landscape is dominated by intensively grazed pasture grass interspersed with hedgerows and large exotic trees. The site is transected by a number of artificial farm drains, which drain groundwater from the farms into two main drains:

- Drain Number 43 ('Barris' or 'Rotokauri Drain') drains into Lake Rotokauri to the west;
- Drain Number 41 ('McBeth') eventually drains into a tributary of the Waipa River to the west.

[1] This report is subject to the Report Limitations provided in Appendix A.

Legend

Draft designation

The Site

Hamilton

ECOLOGY NEW ZEALAND

0 250 500 m

N

1:6,300 @ A3

Projection: NZTM 2000 / NZGD 2000

Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ

FIGURE 1

Site Context

Date: 17 March 2021 | Revision : 0

Plan prepared for BECA

by Ecology New Zealand Limited

Author: BO

2. METHODOLOGY

2.1. Freshwater Fish

2.1.1. Desktop Assessment

Prior to on-site surveys, a desktop assessment was completed of the New Zealand Freshwater Fish Database to obtain baseline information for the site and look for previous records of target species. The conservation status[2] and pest animal status[3] of each species recorded was then obtained from the relevant technical documents.

2.1.2. Trapping and eDNA Surveys

The freshwater fish surveys were primarily designed to detect the presence of black mudfish (*Neochanna diversus*) due to its conservation status (At-Risk, Declining) and the limited knowledge regarding this species distribution. While the methodologies applied were tailored towards detecting black mudfish, the sampling methods and tools used also provided insight into other non-target native fish present within surveyed areas.

A scope for conducting mudfish surveys across key areas of interest was provided by BECA and was used for planning survey activities (Figure 1Figure 2). The key areas of interest aim to fill in knowledge gaps for this species to determine their presence in areas which had not been historically surveyed.

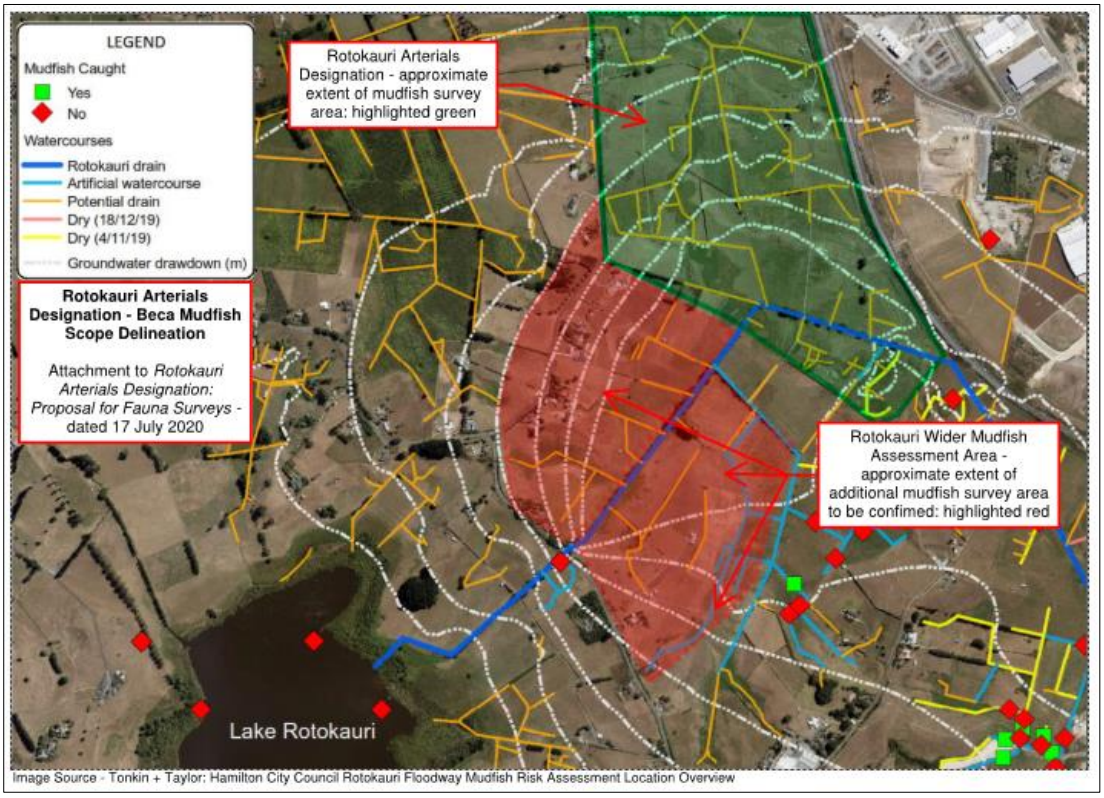

Figure 2 Black mudfish 'scope of survey' map provided by BECA and used to plan field works

[2] Dunn NR, Allibone RM, Closs GP, Crow SK, David BO, Goodman JM, Griffiths M, Jack DC, Ling N, Waters JM, Rolfe JR 2018. Conservation status of New Zealand freshwater fishes, 2017. New Zealand Threat Classification Series 24.
[3] Waikato Regional Council. Waikato Regional Pest Management Plan 2014-2024

All farm drains across the site were mapped via aerial imagery and on-site ground-truthing prior to surveys commencing. Theoretical survey reaches were identified as a result of these preliminary assessments. Immediately prior to surveys, individual drains were again assessed for suitability for trapping and the number of survey reaches were refined from this information. The purpose of this mapping was to identify suitable survey reaches, not to accurately map all drain reaches across affected properties.

For each reach, a representative 100m survey reach was identified resulting in a total of 28 survey transects. A total of four nights of trapping was completed, with one night of trapping being completed per reach over that time. Within each reach, trapping was completed using fine-mesh Gee's minnow traps at 10m spacings. Where habitat was found to be sporadic along the length of the reach, traps were spaced as close as possible to 10m apart within available habitat.

Given the poor oxygenation of water in artificial drain habitats, traps were placed partially submerged – allowing access to the trap entrance, whilst ensuring atmospheric air was available to breath for any captured fish. Where water depth was too shallow to allow this, traps were dug into the soft substrate in the base of the drain. Traps were secured with a stake and string where required and all were marked with flagging tape and GPS (using *Avenza maps*).

Traps were left in place for one night (no less than 12hrs) prior to checking and where traps were in exposed areas, shade was provided (e.g. covering the trap with vegetation) to prevent stress or harm to any captured fish. Due to the focus on black mudfish, traps were set un-baited, to avoid encouraging predators into the trap.

To supplement trapping effort, a total of 16 Environmental DNA (EDNA) samples were taken across the survey area. A single sample was taken at each of the survey areas according to lab instructions. These were then labelled and marked on Avenza maps before being sent to 'Wilderlab' in Wellington for processing. Ten samples were analysed using single species assays (for black mudfish) and the remaining eight were analysed using a multispecies assay.

Two opportunistic dip net surveys for juvenile black mudfish were also completed in suitable habitat. These were completed as per the mudfish survey guidelines within deeper farm drains where water clarity appeared greatest (2013)[4].

2.2. Long-tailed Bats

2.2.1. Desktop Assessments

The following documents and databases were consulted to determine the presence of long-tailed bats across the subject site and wider landscape:

- Department of Conservation National Bat Database
- Angove-Emery, S (2020) 256 Brymer Road-Bat Assessment. Report Number 20026.1-001 Rev1. Ecology New Zealand Ltd.
- Le Roux, D. S. & Le Roux, N. N. (2012) Hamilton City Bat Survey 2011-2012. Kessels & Associates Ltd.

[4] Ling, N.; O'Brien, L.K.; Miller, R.; Lake, M. 2013: A revised methodology to survey and monitor New Zealand mudfish. Department of Conservation, Wellington (unpublished).

- Mueller,H., Ulrich, C., Purcell, A. (2017) DRAFT Hamilton City Long-tailed Bat Survey 2016-2017. Kessels & Associates Ltd.
- Dixon, O (2020). Spatial distribution survey of long-tailed bats (*Chalinolobus tuberculatus)* north of Hamilton City. University of Waikato.

A review of available satellite imagery of the proposed designation area was undertaken to identify key areas of vegetation cover to target in-field assessments. Key vegetation areas were mapped for later field assessments and were loaded onto the *AVENZA* mobile application to assist field staff to navigate to all areas of interest.

2.2.2. Roost Habitat Assessments

All accessible trees within the proposed project designation were assessed in regard to their potential to host roosting Long-tailed bats (*Chalinolobus tuberculatus*). Assessments focussed on all trees or groups of trees with a diameter at breast height (DBH) ≥15cm. Where trees ≥15cm DBH were noted, a ground level assessment was undertaken by a Level D competent bat ecologist[5]. Potential bat roost trees were considered trees with one or more of the following attributes:

i. Cracks, crevices, cavities, fractured limbs, or other deformities, large enough to support roosting bat(s);
ii. Sections of loose flaking bark large enough to support roosting bats.
iii. A hollow trunk, stem or branches; and
iv. Deadwood in canopy or stem of sufficient size to support roost cavities or hollows.

Where trees or groups of trees were identified as having one or more of the above attributes, they were assigned a roost suitability category based on their likelihood of being occupied by bats.

Table 1 Potential bat roost classifications.

Suitability category	***Roosting Habitat***
Low	*A tree over 15cm DBH with limited roosting potential, e.g. some loose bark or rotted branch tip but low suitability for individual bat to roost.*
Moderate	*A tree over 15 cm DBH with one or more potential roosting features that could be used by individual bats or where it is not clear from the ground inspection if a feature does provide a suitable cavity for bats to roost and therefore requires further inspection.*
High	*A tree over 15cm DBH with one or more potential roost features that are clearly suitable for use by multiple bats.*

[5] Details on bat ecologist competency levels can be found within: Smith, D., Borkin, K., Jones, C., Lindberg, A., Davies, F., & Eccles, G. (2017). Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature (No. 623).

2.2.3. Bioacoustic Surveys

Reviews of available satellite imagery were undertaken of the site and surrounding landscape to plan the positioning of acoustic survey equipment for bats. Automatic Bat Monitors (ABM; DOC model AR-4) were used to record ultrasonic echolocation calls emitted by bats. ABMs record and store data passively and remotely and have the capacity to record both long-tailed (40kHz) and lesser short-tailed (28kHz) bat calls at a range of up to approximately 40m[6].ABM survey locations considered coverage of the proposed designation, the presence of linear vegetation corridors, on-site watercourses, and the results of roost habitat assessments.

ABMs were set at 10 locations around the site in areas where bats would be expected to be foraging, commuting, or roosting. ABMs were deployed approximately 3 – 4m high in mature trees, in positions where they were free from foliage and directed into open space areas. ABMs were programmed to record from one hour before sunset to one hour after sunrise each night to ensure date is captured from prior to bats existing their roost, activity throughout the night, and until after they had returned to their roost.

Long-tailed bat activity is influenced by overnight temperatures and rainfall, therefore weather data from the survey period was analysed to ensure conditions were suitable[7]. Valid survey nights were defined as having a minimum overnight temperature of 7°C, less than 5mm of rainfall during the night and low winds. Raw ABM data was analysed using Department of Conservation (DOC) BatSearch Version 3.11. The data from this programme was then entered into an ENZL bat processor which outputs data relating to mean bat passes and total passes for the site. The data was further analysed with regards to date and time of bat passes to determine the timing of activity across site and the occurrence of feeding buzzes was also noted.

2.3. Lizards

2.3.1. Desktop Reviews

The following documents and databases were consulted to determine the diversity and presence of native lizards within the subject site and wider landscape:

- Department of Conservation National Herpetofauna Database (2020).
- Van Winkel, D., Baling, M., & Hitchmough, R. (2020). Reptiles and Amphibians of New Zealand. Bloomsbury Publishing.

A review of available satellite imagery of the proposed designation area was undertaken to identify potential habitat types across the site to target in-field assessments based on the expected diversity on-site. Key vegetation areas were mapped for later field validation and assessments; these were loaded onto the *AVENZA* mobile application to assist field staff to navigate to areas of interest.

[6] Department of Conservation, 2012. Bats: Counting away from roosts – automatic bat detectors
7 O'Donnell, C. F. (2000). Influence of season, habitat, temperature, and invertebrate availability on nocturnal activity of the New Zealand long-tailed bat (Chalinolobus tuberculatus). New Zealand Journal of Zoology, 27(3), 207-221.

2.3.2. Artificial Cover Objects

A preliminary site walk over of the site was undertaken on 17 September 2020 to distinguish the available habitat types across the proposed designation area. During the walk over, key habitat areas were noted to be targeted for the deployment of Artificial Cover Objects (ACOs).

ACOs were industry standard black onduline roofing material measuring approximately 450mm x 450mm. ACOs were installed in representative areas of key habitat types on-site. Installation aimed to bisect habitat areas or were installed on the interface between two habitat types; e.g. pasture grass and vegetated hedgerows. Transects were used to survey targeted areas with an aim to inform species presence/absence.

As ACOs aim to provide supplementary novel refugia, these require a settlement period to ensure animals discover and utilise these new objects in their environment. ACOs would be left undisturbed for no less than 8 weeks to settle in their environment prior to any checks for occupancy were performed.

2.3.3. Visual Encounter Surveys

Visual Encounter Searches were performed by ecologists alongside ACO checks and opportunistically during all other fauna survey field work (i.e. bat and fish surveys). Searches included ecologists passive scanning habitat for basking and forging lizards and where potential refugia was encountered, these were carefully lifted and inspected to detect the presence of lizards. Key refugia/micro-habitat items searched would include both woody debris and strewn rubbish/building materials found across the farmland habitat.

3. SURVEY RESULTS

3.1. Freshwater Fish Surveys

3.1.1. Desktop Assessment

A search of the NZFFD revealed no records of fish or invertebrates within the site. Aerial imagery appears to show the northernmost drains draining to a tributary of the Waipa River, whilst the southernmost drains flow to Lake Rotokauri via the large drain under Exelby Road. Records from Lake Rotokauri included three 'At-Risk species', whilst records from the Waipa River Tributary included two 'At-Risk species'. Additional more recent records provided by Tonkin and Taylor (via BECA) showed records of black mudfish (*Neochanna diversus*) in drains connected to those on-site (see Figure 3). Table 2 lists records from both the NZFFD search and from Tonkin and Taylor (Figure 2).

Table 2: Fish records from catchments contiguous with the site - NZFFD and Tonkin & Taylor

Scientific Name	Common Name	Maori Name	Conservation Status
Anguilla dieffenbachia	Longfin eel	tuna	At-Risk – Declining
Galaxias argenteus	Giant kōkopu	kōkopu	At-Risk – Declining
Galaxias maculatus	Inanga	īnanga	At-Risk – Declining
Neochanna diversus	Black mudfish	waikaka	At-Risk - Declining
Anguilla australis	Shortfin eel	tuna	Not Threatened
Galaxias fasciatus	Banded kōkopu	kōkopu	Not Threatened
Gobiomorphus cotidianus	Common bully	kōkopu, tīpokopoko	Not Threatened
Ameiurus nebulosus	Brown bullhead catfish	n/a	Pest animal
Carrassius auratus	Goldfish	n/a	Pest animal
Gambusia affinis	Gambusia	n/a	Pest animal

Legend
Draft designation
Drains
Stream
At-Risk Fish Records (NZFFD)
Historic Mudfish Records

N
0 0.25 0.5 0.75 1 km
1:12,000 @ A3

ECOLOGY NEW ZEALAND

Projection: NZTM 2000 / NZGD 2000
Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ
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Figure 3
Historic Freshwater Records
Date: 18 March 2021 | Revision : 0
Plan prepared for BECA
by Ecology New Zealand Limited
Author: BO

3.1.2. Trapping

Locations of survey transects are shown in Figure 6. A total of five species of fish were found during surveys (see Table 3 and Figure 7) including both native and pest fish species[8]. In general, the drains were sparsely populated with shallower drains generally containing fewer fish. Incidental findings of other species included introduced bell frogs (*Litoria* sp.), adult and larval damselflies (possibly *Xanthocnemis* sp.), mayfly larvae (unknown genus) and aquatic beetles (unknown genus). Dip net surveys for mudfish fry did not result in any capture. Targeted macroinvertebrate surveys were not within the scope of this assessment.

Table 3: Fish species caught during surveys within the proposed alignment

Scientific Name	Common Name	Maori Name	Conservation Status
Anguilla dieffenbachia	Longfin eel	tuna	At-Risk – Declining
Neochanna diversus	Black mudfish	waikaka	At-Risk - Declining
Anguilla australis	Shortfin eel	tuna	Not Threatened
Ameiurus nebulosus	Brown bullhead catfish	n/a	Pest animal
Gambusia affinis	Gambusia	n/a	Pest animal

Two At-Risk species were found during trapping, but in low abundance (three longfin eels and one black mudfish). Other species found during trapping (shortfin eels and pest fish) are commonly found in artificial habitats with poor water quality such as the farm drains on-site. These species are widespread in the Waikato (based on NZFFD records and ENZL's experience). Overall, pest fish species dominated the catch (Figure 4) and of the native species found, the shortfin eel was the dominant species (Figure 5) as was expected for this habitat type.

[8] As classified under the Waikato Regional Pest Management Plan, 2014 - 2024

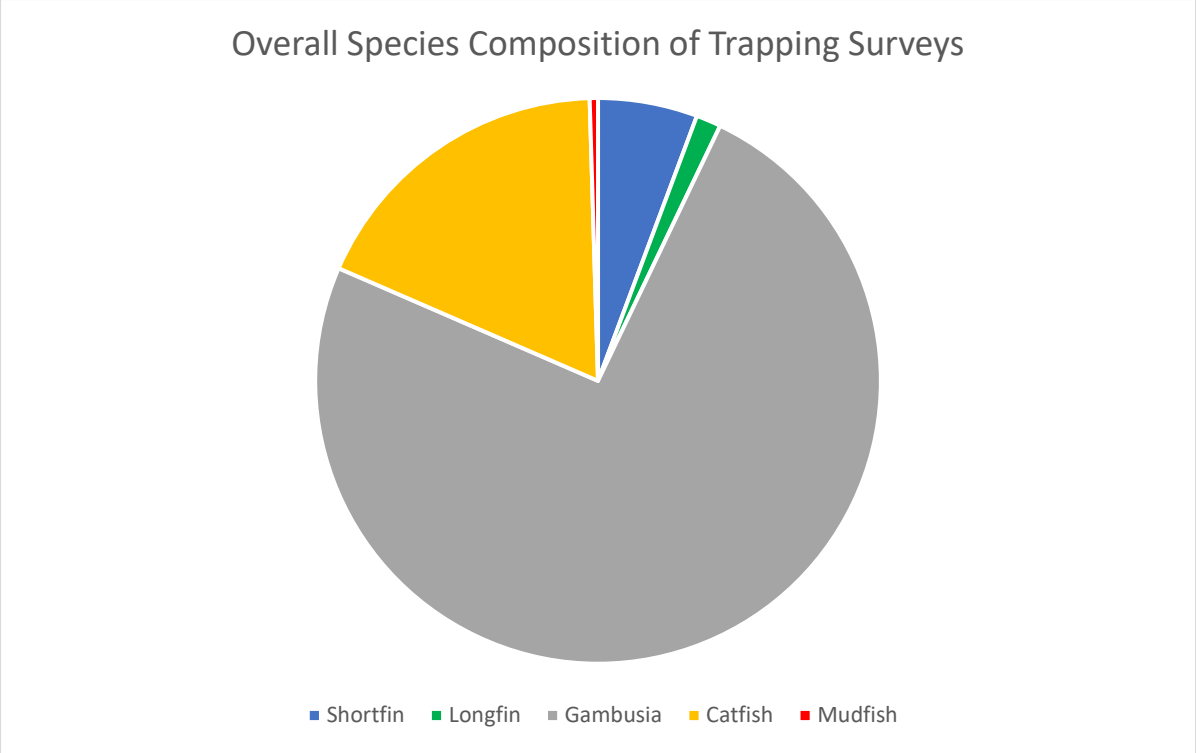


Figure 4: Species found during fish trapping

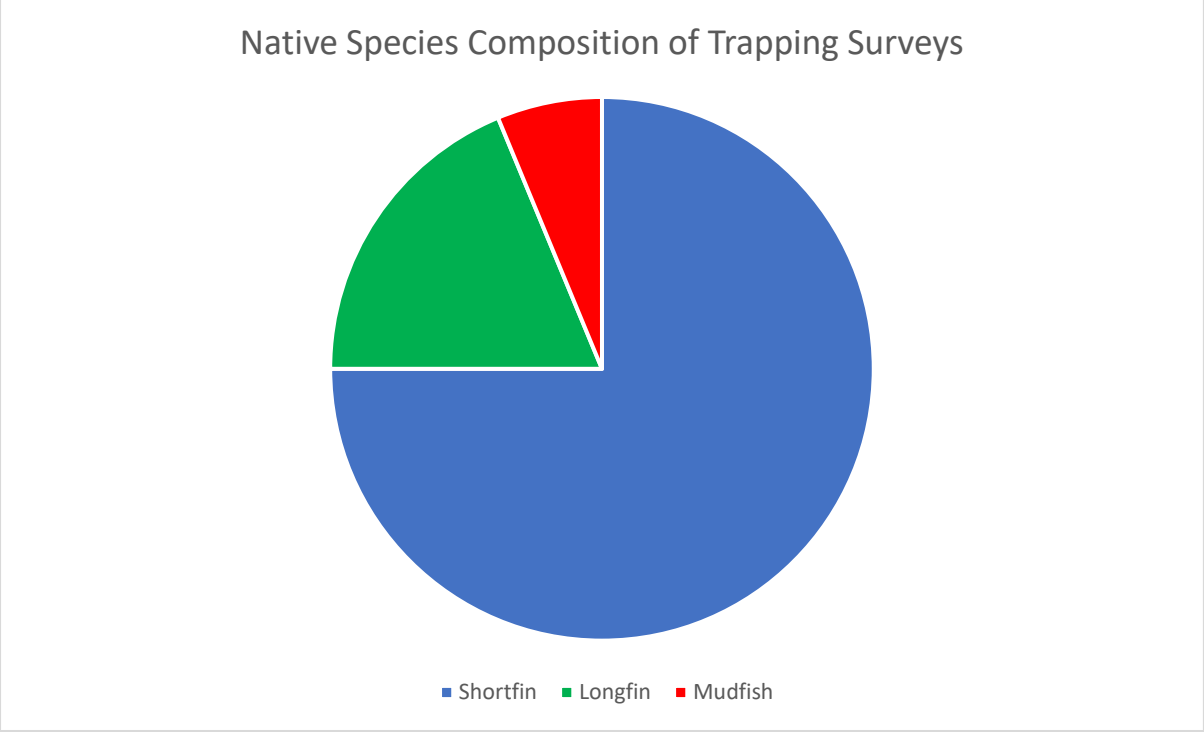


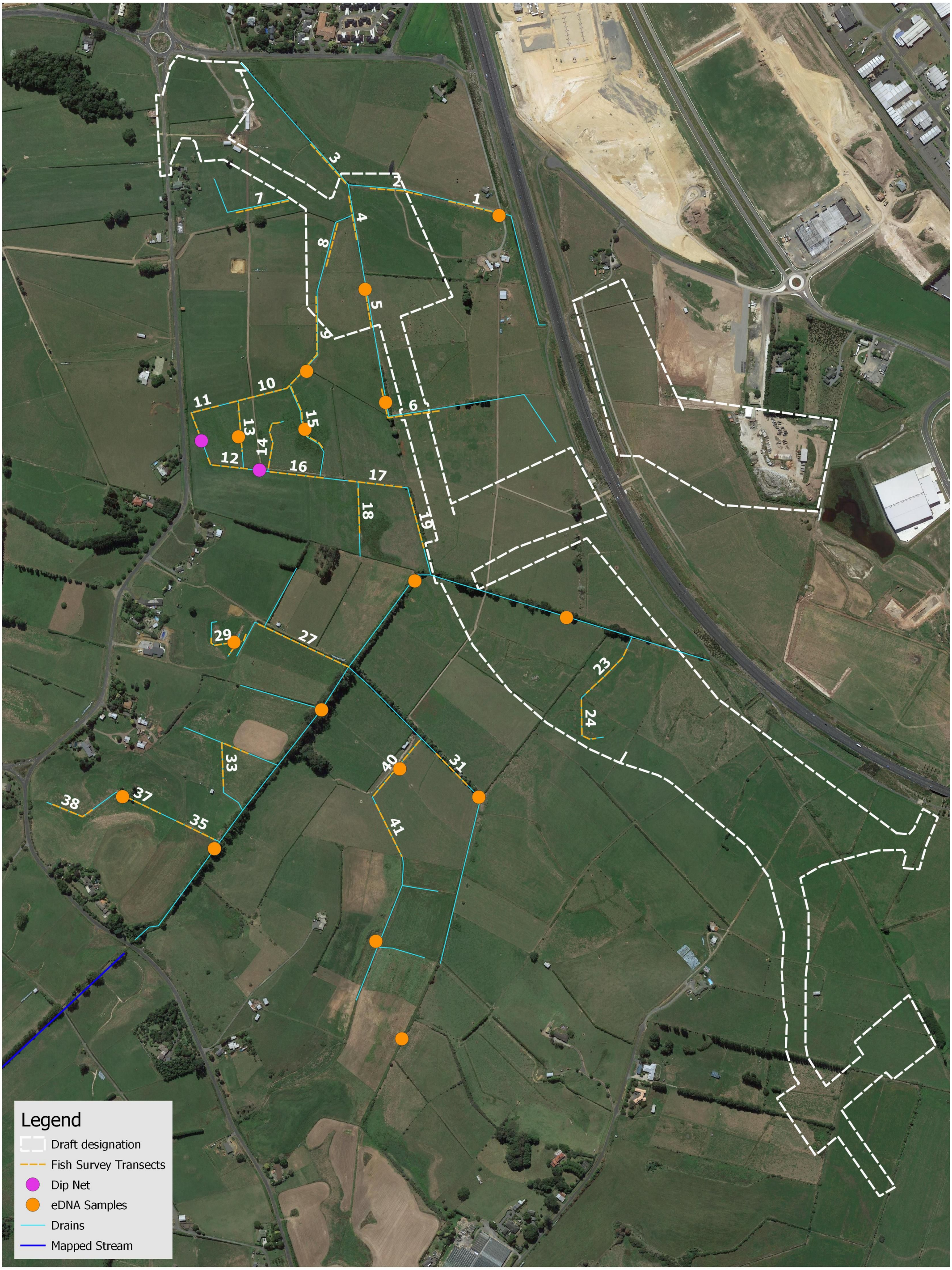
Figure 5: Native fish species found during fish trapping

3.1.3. EDNA Surveys

Sample locations for the 16 eDNA samples are shown in Figure 6. Sampling revealed the presence of six species of fish as detailed in Table 4 below. Whilst this technique revealed a species that wasn't identified during trapping efforts (Giant kōkopu), it was not able to detect the presence of black mudfish. Giant kōkopu were detected only in the large Rotokauri drain in the southern part of the site whilst shortfin eels were detected in both the Rotokauri drain and in several smaller drains. Samples in the middle of the site did not detect any fish species, although shortfin eels were caught in low numbers during trapping.

Table 4: Fish species identified during eDNA surveys

Scientific Name	Common Name	Maori Name	Conservation Status
Anguilla dieffenbachia	Longfin eel	tuna	At-Risk – Declining
Galaxias argenteus	Giant kōkopu	kōkopu	At-Risk – Declining
Anguilla australis	Shortfin eel	tuna	Not Threatened
Ameiurus nebulosus	Brown bullhead catfish	n/a	Pest animal
***Cyprinid* spp**	Not specified	n/a	Exotic or pest animal
Gambusia affinis	Gambusia	n/a	Pest animal



ECOLOGY NEW ZEALAND

N

0 250 500 m

1:6,600 @ A3

Projection: NZTM 2000 / NZGD 2000
Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ
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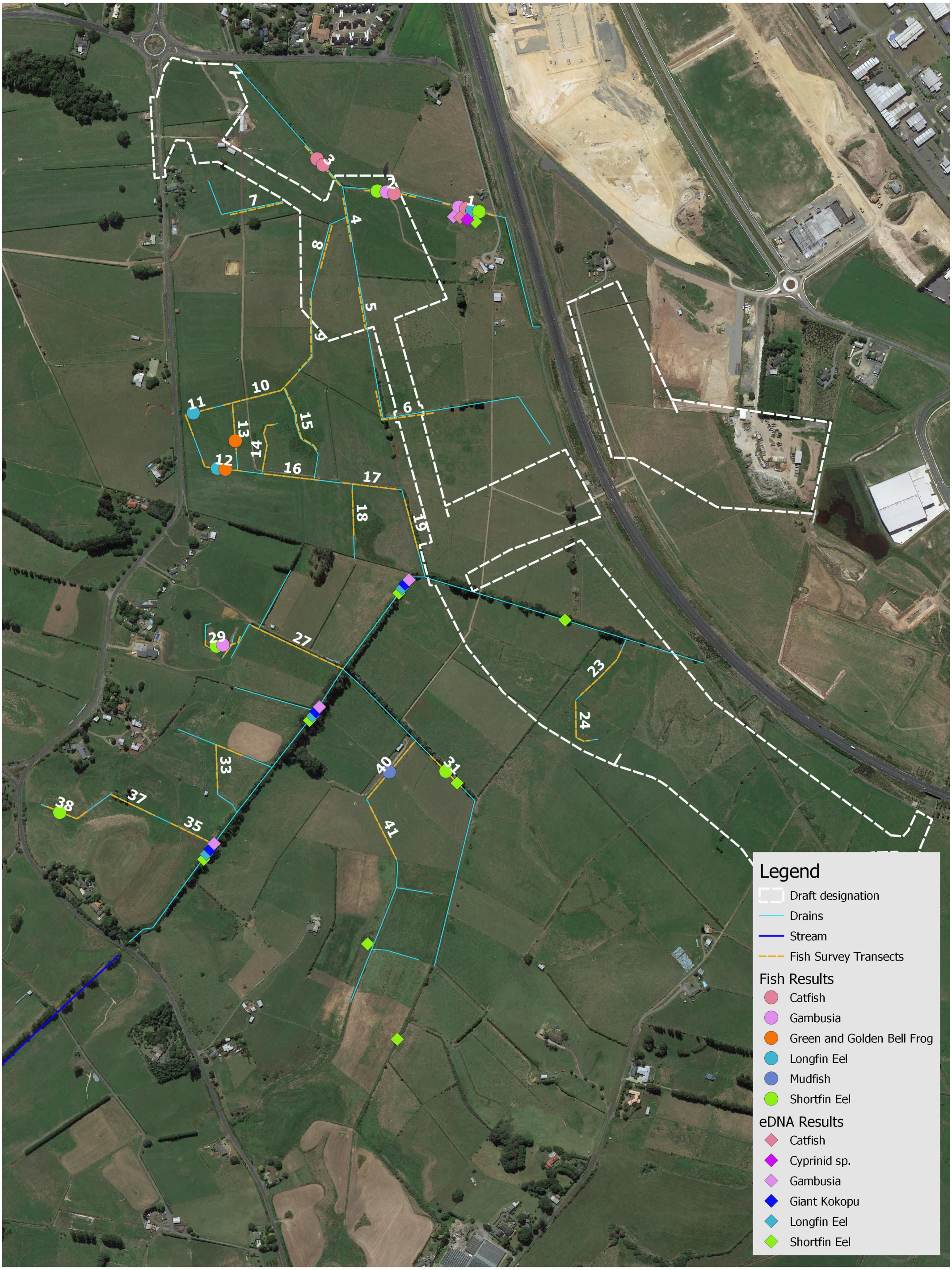
Figure 6
Freshwater Survey Effort

Date: 17 March 2021 | Revision : 0

Plan prepared for BECA
by Ecology New Zealand Limited
Author: BO



ECOLOGY NEW ZEALAND

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0 250 500 m

1:6,600 @ A3

Projection: NZTM 2000 / NZGD 2000

Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ Crown Copyright Reserved

Figure 7

Freshwater Results

Date: 18 March 2021 | Revision : 0

Plan prepared for BECA

by Ecology New Zealand Limited

Author: BO

3.1.4. Discussion

The combination of eDNA and trapping surveys found a total of six fish species as well as an unspecified cyprinid (exotic). Those caught during trapping surveys were in low abundance and sparsely populated as would generally be expected in marginal habitat. In addition, the lack of water depth and the focus on black mudfish generally excluded the use of fyke nets which may have eliminated the capture of larger eels. Three 'At-Risk' species were recorded – Giant kōkopu, longfin eel and black mudfish across the survey area.

The discrepancies between trapping results and eDNA detections may be attributable to the hydrological influences on the habitats sampled. eDNA sampling protocols have so far been based mainly on flowing streams[9] and as such sampling of habitats which are more lentic in nature may require a refinement of sampling methodologies. This is because the DNA fragments may not be mixed to any degree in more lentic environments compared to in flowing water (i.e., lotic environments).

A single black mudfish was found within the proposed footprint. This was found within a pool immediately preceding a culvert in one of the minor farm drains on-site. Whilst no other fish were caught within the subject surveyed area of this drain, eels were found in a larger drain immediately downstream of the survey area (see Figure 7). Previous records of black mudfish are known in the surrounding area, in systems connected to those on-site[10] (Figure 3). This species is known to occur in small remnant populations particularly in areas that were historically wetlands (often areas that are now farms with artificial drain systems) and around the margins of peat lakes[11].

Waikato Regional Council provides a data layer showing an approximation of vegetative cover in the Waikato Region in the 1840s, including wetland vegetation (Figure 8). Around half of the designation is mapped as having contained wetland vegetation in this era, which aligns with the low-lying topography and requirement for a drainage network across the site. As such, small remnant populations could be expected in the drains on-site, particularly as they can survive periods of drying due to their ability to aestivate.

Giant kōkopu were recorded in three locations along one large drain in the south-west of the survey area. This drain was not trapped due to the lack of likely habitat for mudfish but was contiguous with a watercourse leading to Lake Rotokauri where mudfish have been recorded previously. Longfin eels were also detected in this drain. The presence of predatory fish such as eels and giant kōkopu may have an influence on the ability of black mudfish to persist more widely across the drain network. However, the absence of mudfish in any survey cannot be considered conclusive evidence of their absence due to the chance nature of them encountering a trap and being caught.

[9] Pers. Comms. Shaun Wilkinson, Wilderlab
[10] Pers. Comms. Claire Webb, BECA
[11] Pers. Comms. Bruno David, Waikato Regional Council

ECOLOGY NEW ZEALAND

N

0 500 1000 1500 m

1:20,000 @ A3

Projection: NZGD 2000 / New Zealand Transverse Mercator 2000
Sources: Map data ©2020 Google, NZ Property Titles sourced from LINZ Crown Copyright Reserved

Figure 8
Historic Wetland Vegetation

Date: 17 March 2021

Plan prepared for BECA by Ecology New Zealand Limited
Author: Jasmine Dungey

3.2. Long-tailed Bats

3.2.1. Desktop Assessments

Desktop reviews from the DOC National Bat Distribution Database and both Hamilton City surveys undertaken between 2011- 2017 do not provide historical information of bat survey works undertaken across the subject Rotokauri Arterial Designation area (Figure 9). The closest historic bat record from the DOC database comes from Horseshoe Lake, approximately 900m from the southern extent of the designation where long-tailed bats had been recorded in 2017. Reviewing this data, over 20 survey locations across Horseshoe Lake and neighbouring tree land to the west have resulted in bat detection at only one location.

A bioacoustic survey for long-tailed bats was undertaken by ENZL between April 30 to 18 May 2020[12], immediately north of horseshoe lake and 650m from the southern extent of the designation at 256 Brymer Road for an unrelated residential development project (Figure 9.). This survey included the use of 15 acoustic bat monitors which recorded for on average 18 valid survey days. During this survey only 4 potential bat passes, and one confirmed bat pass was recorded.

A previously completed bioacoustic survey undertaken by Dixon between 21 November 2019 to 28 January 2020[13] did not detect bats in proximity to the Designation area (Figure 10). Key conclusions within this report detail that long-tailed bat activity appears lower in the northern surrounds (i.e., with 10 km) of Hamilton City compared to the southern edge of the city, and that bat activity tended to be higher in kahikatea forest remnants. These findings aligned with those found in the ENZL study and historical records within the DOC database.

[12] Angove-Emery, S (2020) 256 Brymer Road-Bat Assessment. Report Number 20026.1-001 Rev1. Ecology New Zealand Ltd.
[13] Dixon, O (2020). Spatial distribution survey of long-tailed bats (*Chalinolobus tuberculatus*) north of Hamilton City. University of Waikato.

ENZL No Bats Recorded
ENZL Potential Bat Activity
Draft designation

DOC Bat Records
Long-tailed Bats recorded
No Bats Recorded

N

0 0 1 2 km

1: 25000 @

Projection: ESPG: 2193
Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ Crown Copyright Reserved

Figure 9
Historic Bat Presence Across The Landscape

Date: 9 March 2021 | Revision : 0

Plan prepared for BECA
by Ecology New Zealand Limited
Author: Marc Choromanski

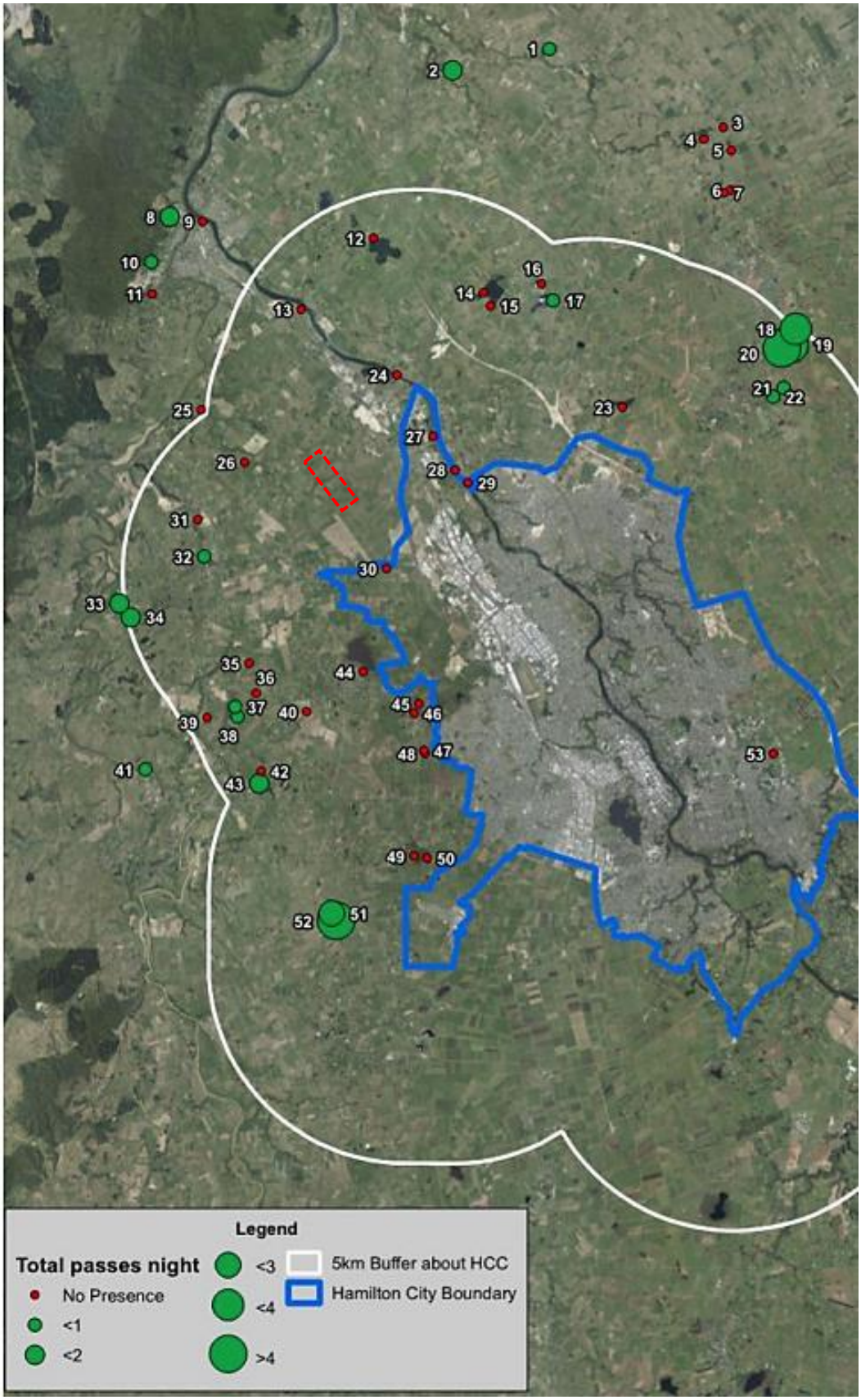


Figure 10: Dixon, O (2020) Locations of ABMs deployed between 21 November 2019 and 28 January 2020. Overlaid dotted red line indicates approximate designation area.

3.2.2. Bioacoustic Survey Results

A total of 10 ABMs were installed across the designation area and set to record between 5th of February to the 26th of February 2021. The survey was conducted during the recognised bat survey period (October to April) when bat activity is at its peak. Regarding long-tailed bat ecology, February reflects an expected post-parturition period for bats where juvenile bats are recently volant[14]. ABMs were positioned across the extent of the designation and focused on areas where resident bats would be expected to be foraging, commuting, or roosting based on habitat assessments on -site.

Hourly weather data during the survey period was sourced from the nearest weather station available in New Zealand's National Climate Database (Hamilton, Ruakura 2 Ews; Appendix B) and included temperature, rainfall, humidity and windspeed data. Over the deployment period, all survey days were considered valid; with rain not occurring on any days within the first 4 hours after sunset.

A single long-tailed bat pass was detected during the survey session at ABM Unit Number 21 (22:35 on the 19th of February 2021) (Figure 11,Figure 12). This result is reflective of the low levels of activity detected in previously completed surveys (refer to Section 3.2.1). The pass was considered a commuting call, and not a social call or feeding buzz. The subject ABM was positioned at a stand of mature macrocarpa trees (*Cupressus macrocarpa*), adjacent to a farm shed area. Several of these trees demonstrated roosting features suitable for bats (refer to Section 3.2.3); however, the timing of the pass (22:35) does not indicate roosting behaviour.

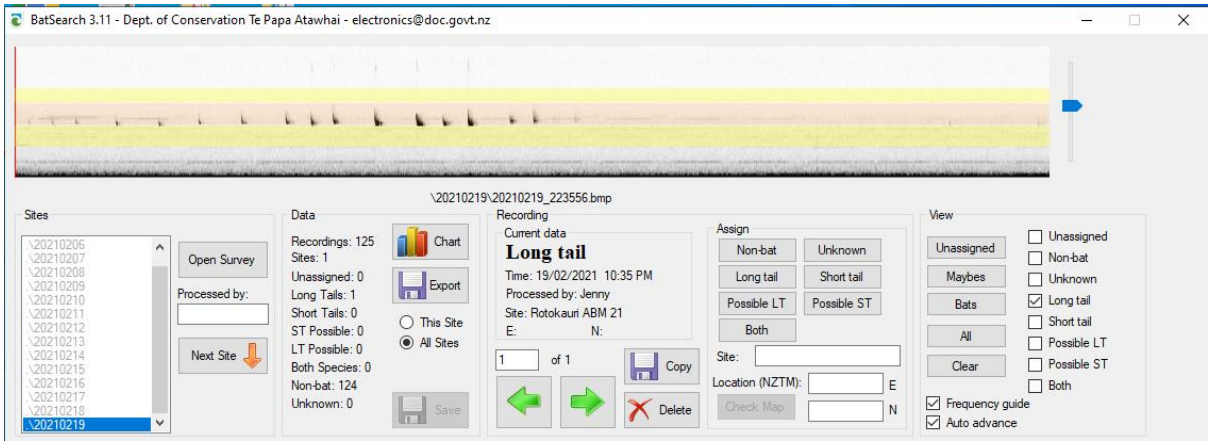
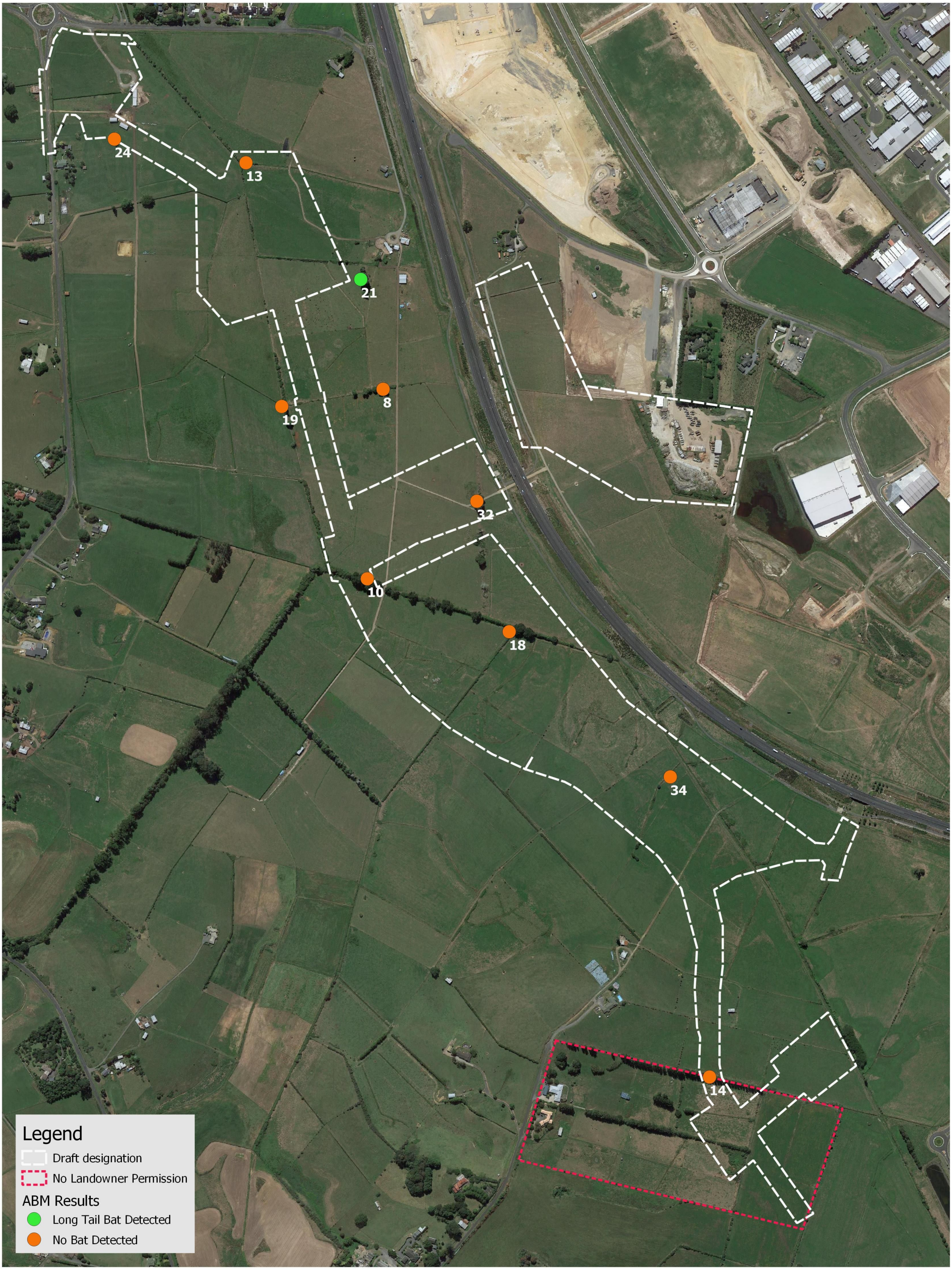


Figure 11 Long-tail bat pass detected at ABM Unit 21.

[14] O'Donnell, C. F. (2002). Timing of breeding, productivity and survival of long-tailed bats Chalinolobus tuberculatus (Chiroptera: Vespertilionidae) in cold-temperate rainforest in New Zealand. Journal of Zoology, 257(3), 311-323.



ECOLOGY NEW ZEALAND

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0 250 500 m

1:6,300 @ A3

Projection: NZTM 2000 / NZGD 2000
Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ
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Figure 12

ABM Results

Date: 09 March 2021 | Revision : 0

Plan prepared for BECA
by Ecology New Zealand Limited
Author: BO

Battery depletion varied on each ABM providing a range of survey efforts at each site (Table 3). Survey limitations included 1 ABM malfunction and 2 ABMs being found on the ground during retrieval. It is assumed that these two ABMs fell during the night of the 16th where maximum recorded wind gusts (13.4m/sec) were noted during the survey period (Appendix B). ABMs record omnidirectionally and may still record upwards from the ground; however, data from after the 15th of February was considered compromised and not included in the below summary table[15].

Table 5 Summary of ABM survey results.

ABM Unit No.	No. Days Recording	No. Valid Nights	Number of Bat Passes	Mean Bat Passes/Valid Night	No. Feeding Buzzes	Activity Within 1 hour of Sunrise/Sunset
8*	-	-	-	-	-	-
10	14	14	0	0	0	0
13	16	16	0	0	0	0
14	14	14	0	0	0	0
18**	11	11	0	0	0	0
19**	11	11	0	0	0	0
21	15	15	1	0.07	0	0
24	14	14	0	0	0	0
32	5	5	0	0	0	0
34	14	14	0	0	0	0

*ABM malfunction – no recordings.
**ABM found on ground during retrieval – Data from after 15th Feb compromised.

3.2.3. Roost Assessment Results

Trees within the designation boundary were surveyed on the 4th,5th, and 26th of February to determine their potential to be long-tailed bat roosts. Industry-standard criteria were used to guide this assessment which was undertaken by a Level D bat ecologist[16]. Where appropriate, binoculars were used to thoroughly assess the higher up branches and tree trunks. High level commentary noted for each tree/group of trees is included in Appendix C and includes details on:

- *Date and time of assessment;*
- *Unique tree identification number;*
- *GPS location of the tree;*
- *Tree species;*
- *DBH range estimate;*
- *Description of the feature;*
- *Roost suitability category;*

All assessed trees/groups of trees had a red marker nailed onto them and unique tree identification given. Trees were primarily associated with shelter belts but also included isolated mature trees and stands of trees. With exception to a small stand of seven kahikatea in the

[15] A review of the 'compromised' data did not show any indication of bat passes.
[16] Smith, D.; Borkin, K.; Jones, C.; Lindberg, S.; Davies, F.; Eccles, G. (2017). *Effects of Land Transport Activities on New Zealand's Endemic Bat Populations: reviews of ecological and regulatory literature*. NZ Transport Agency.

northern extent of the designation area. All trees that had roosting features were exotic; primarily pine (Pinus sp) and macrocarpa.

A total of 43 trees/group of trees across the designation area and immediate surrounds met the potential bat roost criteria of having a DBH >15cm and at least one identified roost feature (Figure 13). Of these, 12 were classified with suitability categories/Risk ratings as High, 15 as Moderate, and 16 as Low.

Legend

Draft designation

No Landowner Permission

Bat Tree Risk Rating

No Risk

Low

Moderate

High

Bat Tree Risk Rating Clumped

No Risk

Low

Moderate

High

ECOLOGY NEW ZEALAND

N

0 250 500 m

1:6,300 @ A3

Projection: NZTM 2000 / NZGD 2000

Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ

Figure 13

Bat Tree Risk Ratings

Date: 09 March 2021 | Revision : 0

Plan prepared for BECA

by Ecology New Zealand Limited

Author: BO

3.2.4. Discussion

The mosaic of farmland and specimen exotic trees found across the designation area is characteristic of the rural Hamilton and Waikato Region. While bat activity may be high within this habitat type south-east of Hamilton, increasing evidence is indicating that bat activity appears low in the north-western areas of Hamilton. The bioacoustic data presented in this report provides further evidence for this, with just a single bat pass detected during the survey period. Impacts on long-tailed bat commuting and feeding are therefore expected to be minimal for local bats across the Designation area, and likely limited to impacts at an individual level as oppose to impacts at a population level. Multi-year surveys during key times within the bat survey season will provide more certainty around these impacts.

With little to no bat activity across the designation and immediate local landscape, the potential provision of suitable roosting habitat on-site is not likely to be recognised by resident bats on-site or in the wider landscape. For this reason, the loss of these potential roosting trees may not lead to population level impacts for bats within the local area. The likelihood of bats being within trees during felling activities is also considered low; however, these risks could be further mitigated through pre-clearance management (i.e pre-clearance surveys and/or roost inspections).

It should be recognised that trees which provide potential roosting habitat are rare within the rural setting of the Waikato Region and should be considered for retention where this feasible. Trees which were assigned with 'High' roosting suitability during field works, were mainly located on edges of the proposed Designation (Figure 13). The location of these trees would expectantly mean that they could be avoided during later design and construction phases of the project.

3.3. Lizard Surveys

3.3.1. Desktop Assessments

Desktop reviews of the DOC national herpetofauna database indicates native species presence is restricted to only copper skink (*Oligosoma aeneum*) within a 5km radius from the designation area. Copper skink are currently listed as a 'Not Threatened'[17] species and are often detected within farmland across the Waikato where they persist in rank grass, shelter belts, hedges, residential gardens, and remnant bush. Within a 10km radius, a record of pacific gecko (*Dactylocnemis pacificus*, 'At Risk – Relict') exists along the Waikato river. This species does occur across a range of habitat types (i.e from the coast to lowland forests[18]) but is less likely to occur across a highly modified farmland landscape. Within the 10km radius, additional exotic species include plague skink (*Lamproholis delicata*), and *Ranoidea* frog species.

Of particular interest ornate skinks (Oligosoma ornatum – At Risk Declining) have recently been detected within the Hamilton area[19]. This species is extremely rare in Hamilton, with this observation coming from a remnant block of forest, reflecting the species' natural habitat preference. This species has been documented within novel habitats such as thick weedy

[17] Hitchmough, R.; Barr, B.; Lettink,M.; Monks, J.; Reardon, J.; Tocher, M.; van Winkel, D.; Rolfe, J. 2016: Conservation status of New Zealand reptiles, 2015. New Zealand Threat Classification Series 17. Department of Conservation, Wellington. 14 p.
[18] van Winkel, D., Baling, M., & Hitchmough, R. (2020). Reptiles and Amphibians of New Zealand. Bloomsbury Publishing.
[19] N Harker 2021, pers comm. New Zealand Herpetological Society.

ground cover and rank grassland, but most commonly where there is directly adjacent native bush.

Expectantly, no arboreal species have been detected within proximity to the site due to a general lack of mature forest or scrubland in the landscape.

3.3.2. ACO Survey Results

A total of 75 ACOs were installed across the designation area on 20 October 2020. These were left to settle in the field for over three months, prior to the first check. This settling period was considered suitable to allow enough time for resident lizards to occupy and utilise these retreats. Three independent checks were undertaken of ACOs; undertaken on the 4th and 5th of February and on 11th and 26th of February 2021. This allowed for a total of 207 ACO checks to be completed, noting 18 checks were not completed due to ACOs being grown over and lost or damaged. Checks were generally undertaken between 0930 and 1400 and on warm days without rain (Table 6).

One adult copper skink and two unidentified skinks were documented during ACO checks (Figure 14). Unidentified skinks were not identified due to them fleeing before positive identification. It is however most certain that these were either copper or plague skinks due to their size, shape and known diversity of lizards within the landscape. No confirmed plague skinks were documented under ACO covers. This level of lizard occupancy was considered reasonably low during the survey period which was done during the optimal survey season.

Table 6 Summary of weather data during ACO checks

Station	Date	WDir (Deg)	WSpd (m/s)	GustSpd (m/s))	Rain (mm)	RH (%)	Tmax (c)	Tmin (c)
Hamilton, Ruakura 2 Ews	20210204	147	0.8	8.2	0	79	30.0	11.1
Hamilton, Ruakura 2 Ews	20210205	127	2.3	6.7	0	52	28	14.8
Hamilton, Ruakura 2 Ews	20210211	187	2	9.3	0	78	24.8	15.2
Hamilton, Ruakura 2 Ews	20210226	126	0.5	6.2	0	86	26.4	13.4

Legend

- Draft designation
- No Landowner Permission

ACO Results

- Missing/Damaged
- No Lizard
- Unidentified Lizard
- Copper Skink
- Additional Manual Search Areas

Manual Search Results

- Copper Skink
- Plague Skink
- Unidentified Lizard

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N

0 250 500 m

1:6,300 @ A3

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Sources: Map data sourced from ESRI; NZ Property Titles sourced from LINZ
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Figure 14

Lizard Survey Results

Date: 09 March 2021 | Revision : 0

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by Ecology New Zealand Limited
Author: BO

3.3.3. Visual Encounter Search Results

Visual encounter searches were undertaken during ACO checks, and within suitable habitat during wider fauna survey works (bats and fish) across the designation and wider area. Areas searched included under debris items (organic and inorganic) next to buildings, across pasture, and within vegetated hedgerows and riparian corridors. Two adult copper skinks were documented during these searches; one within the centre of the designation and one to the west of the designation (Figure 14). These skinks were found under woody debris within a paddock (adjacent to a vegetated riparian margin) and under a piece of building timber adjacent to a farm shed. Two unidentified skinks were documented within hedgerow and riparian vegetation. Unidentified skinks were in an area where both plague and copper skinks were found.

A total of five plague skinks were found during manual habitat searches. These animals were found under a woody debris and a plastic bucket container. Plague skinks were not observed at high densities across the site. When at high density, these are normally frequently observed basking and foraging.

Opportunistic encounters were also made during native fish surveys of the introduced Green and Golden bell frog (*Ranoidea aurea*). Multiple frogs were documented within drainage channels and were also captured within a Gee-minnow trap set for native fish surveys. Additionally, this frog species was documented in the results of eDNA analyses undertaken to supplement native fish surveys. No other herpetofauna species were documented in eDNA results.

3.3.4. Discussion

One native lizard species, copper skink, was identified within and adjacent to the Designation area. It is likely that this represents the only native lizard species within the Designation area and immediately surrounding landscape. This species is frequently encountered within novel ecosystems within the Waikato Region including farmland. This species is currently classified as Not Threatened[20], however an upcoming revision of the threat status of New Zealand lizard species may heighten its threat status to 'At Risk'.

Copper skink populations on-site are likely concentrated within hedgerows, riparian vegetation, rank areas of grass adjacent to streams/drains, a large pile or inorganic rubbish and under rotting debris from felled trees. Scattered individuals may also be present between these areas. Commensurate management of effects will be required to mitigate impacts on this species prior to construction. A tailored lizard management plan will be required which should aim to salvage, offset and/or compensate for foreseeable impacts.

4. CONCLUSION

The targeted surveys undertaken within the Rotokauri Arterial Designation and surrounding areas (i.e mudfish survey areas), confirmed the presence of long-tailed bats and copper skink within the Designation footprint. No mudfish were detected within the footprint; however, these fish were detected south-west of the Rotokauri Arterial Designation in a drainage

[20] Hitchmough, R.; Barr, B.; Lettink,M.; Monks, J.; Reardon, J.; Tocher, M.; van Winkel, D.; Rolfe, J. 2016: Conservation status of New Zealand reptiles, 2015. New Zealand Threat Classification Series 17. Department of Conservation, Wellington. 14 p.

channel which is connected to larger drains that flow across the Designation. The presence of native fish, bats and lizards will require consideration during the preparation of ecological impact assessment. These assessments will need to commensurately detail specific avoidance and management of any foreseeable impacts on these protected species.

APPENDIX A

Report Limitations

This Report/Document has been provided by Ecology New Zealand Limited (ENZL) subject to the following limitations:

i) This Report/Document has been prepared for the particular purpose outlined in ENZL's proposal and no responsibility is accepted for the use of this Report/Document, in whole or in part, in other contexts or for any other purpose.

ii) The scope and the period of ENZL's services are as described in ENZL's proposal and are subject to restrictions and limitations. ENZL did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Report/Document. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by ENZL in regards to it.

iii) Conditions may exist which were undetectable given the limited nature of the enquiry ENZL was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigation and which have not therefore been taken into account in the Report/Document. Accordingly, if information in addition to that contained in this report is sought, additional studies and actions may be required.

iv) The passage of time affects the information and assessment provided in this Report/Document. ENZL's opinions are based upon information that existed at the time of the production of the Report/Document. The Services provided allowed ENZL to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

v) Any assessments, designs and advice made in this Report/Document are based on the conditions indicated from published sources and the investigation described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Report/Document.

vi) Where data supplied by the client or other external sources, including previous site investigation data, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by ENZL for incomplete or inaccurate data supplied by others.

vii) The Client acknowledges that ENZL may have retained sub-consultants affiliated with ENZL to provide Services for the benefit of ENZL. ENZL will be fully responsible to the Client for the Services and work done by all of its sub-consultants and subcontractors. The Client agrees that it will only assert claims against and seek to recover losses, damages or other liabilities from ENZL and not ENZL's affiliated companies. To the maximum extent allowed by law, the Client acknowledges and agrees it will not have any legal recourse, and waives any expense, loss, claim, demand, or cause of action, against ENZL's affiliated companies, and their employees, officers and directors.

viii) This Report/Document is provided for sole use by the Client and is confidential to it. No responsibility whatsoever for the contents of this Report/Document will be accepted to any person other than the Client. Any use which a third party makes of this Report/Document, or any reliance on or decisions to be made based on it, is the responsibility of such third parties. ENZL accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this Report/Document.

ix) Where lengths or other measurements have not been provided by a surveyor, ENZL has used basic GIS mapping and measurement systems to estimate these numbers. These should not be taken as surveyor-level accuracy for the purposes of decision making.

APPENDIX B

Summary of Environmental Conditions During Bat Survey –

Station Name	Agent Number	Network Number	Latitude (dec.deg)	Longitude (dec.deg)	Height (m)	Observing Authority
Hamilton, Ruakura 2 Ews	26117C75734	C75734	37.77389	175.3052	45	*NIWA/AGRESEARCH*

Station	Day (Local Date)	WDir (Deg)	WSpd (m/s)	GustSpd (m/s)	Rain (mm)	RH (%)	Tmax (C)	Tmin (C)
Hamilton, Ruakura 2 Ews	20210207	121	1.4	8.2	0	63	27.5	14.5
Hamilton, Ruakura 2 Ews	20210208	54	1	8.8	0	76	26.9	12.8
Hamilton, Ruakura 2 Ews	20210209	125	0.8	8.8	2.6	86	27	13.3
Hamilton, Ruakura 2 Ews	20210210	27	3.6	9.3	4.4	88	23.2	17.3
Hamilton, Ruakura 2 Ews	20210211	187	2	9.3	0	78	24.8	15.2
Hamilton, Ruakura 2 Ews	20210212	239	1.7	9.8	0	65	24.4	9
Hamilton, Ruakura 2 Ews	20210213	356	0.9	8.8	0	92	27.7	8.2
Hamilton, Ruakura 2 Ews	20210214	111	1	8.2	6.4	78	27.8	11.2
Hamilton, Ruakura 2 Ews	20210215	138	2.2	11.8	11	98	22.2	16.6
Hamilton, Ruakura 2 Ews	20210216	156	1.7	13.4	0	90	25	17.1
Hamilton, Ruakura 2 Ews	20210217	193	2.1	9.8	0	68	24.7	12
Hamilton, Ruakura 2 Ews	20210218	157	1.3	6.7	0	61	24.8	8.4
Hamilton, Ruakura 2 Ews	20210219	98	0.6	8.8	0	96	25.2	7.8
Hamilton, Ruakura 2 Ews	20210220	132	0.9	8.2	0	100	29.3	8.9
Hamilton, Ruakura 2 Ews	20210221	181	1.6	6.2	0	92	29.7	9.2

Hamilton, Ruakura 2 Ews	20210222	138	0.9	9.3	0	96	28.2	11.2
Hamilton, Ruakura 2 Ews	20210223	121	1.3	12.4	0	84	26.5	12.2
Hamilton, Ruakura 2 Ews	20210224	63	2.1	10.3	0	76	27.2	16.4
Hamilton, Ruakura 2 Ews	20210225	62	1.1	6.2	0	70	27.5	15.6
Hamilton, Ruakura 2 Ews	20210226	126	0.5	6.2	0	86	26.4	13.4
Hamilton, Ruakura 2 Ews	20210227	77	0.9	7.7	0	91	27.8	12.9

APPENDIX C

Bat Habitat Assessment - Tree Notes

ID	Date	Time	DBH (cm)	Risk	Tree	Notes
1	2021-02-04	10:15:13.000	40	High	Exotic Tree	Multiple small hollows north and south side of tree. Ground endoscope and climb.
2	2021-02-04	10:21:25.000	50	Moderate	Exotic Tree	Possible honey locust. Two possible hollows on the W side, 4m up the leader. Lower, shallow hollows.
3	2021-02-04	10:27:05.000	60	Moderate	Unknown	Two dead erect leaders with possible deep hollows.
4	2021-02-04	10:37:00.000	30-60	High	Kahikatea	Some dead broken branches, need an arborist inspection higher up the tree.
5	2021-02-04	10:47:24.000	120	High	Poplar	Some dead erect branches seen at 8m+ high. New growth on the tree made ground assessments difficult.
6	2021-02-04	10:53:33.000	130	High	Plane	Four large hollows seen on the north side of the tree trunk and leaders 3m up. Further climbing assessments are required as a lot more hollows across the tree.
7	2021-02-04	11:04:17.000	130	High	Oak	Lots of possible features but the rating may drop after its climbed. Hollow 4m up facing south underside of a leader. Loose bark 4m on east side, facing dead branch. Dead erect branch 8m up. Possible hollow 6m up, N facing. Dead branches.
8	2021-02-04	11:33:21.000	30	Low	Pear	Small, possible hollow 3m up facing north. One crack 4m up facing east
9	2021-02-04	11:44:50.000	40	High	Macrocarpa	One large hollow that goes upward/west facing 5m up. Dead erect leader with cracks.
10	2021-02-04	11:47:53.000	30	Low	Macrocarpa	Some Marginal flaking bark around the entire tree
11	2021-02-04	11:55:24.000	50	Moderate	Cypress	East facing leader/branch with 3 possible hollows at 3m and 4m up. Possibly more features further up. Thickets of small branches.
12	2021-02-04	12:04:25.000	-	Low	Macrocarpa	Marginal back and a small erect dead branch 5m up, east side of tree
13	2021-02-04	12:11:08.000	50	Moderate	Macrocarpa	Possible deep feature in east facing split, 4m up. Likely to reassess after climb as low or NA.
13*	2021-02-04	12:26:58.000	60	Moderate	Macrocarpa	One split facing east with possible hollows, climbing assessment could drop to NA/Low
14	2021-02-04	12:19:21.000	120	NA	Macrocarpa	No features documented
15	2021-02-04	12:23:17.000	140	High	Macrocarpa	Complex with broken branches with twists and splits/cracks. No obvious big hollows.
16	2021-02-04	12:32:00.000	20	Low	Macrocarpa	One small hollow
17	2021-02-04	12:35:18.000	70	Low	Macrocarpa	Several possible hollows under branch/trunk joints across tree.
18	2021-02-04	13:41:59.000	200	High	Macrocarpa	South facing branch, 8m facing west. Broken branch facing NW with possible hollow 12m up. Possible hollow on the east leader 10 up on the east side. Possibly more features higher up.
19	2021-02-04	13:48:58.000	-	High	Macrocarpa	South facing branch, 7m up. Deep hollow facing south. Possible hollow on trunk, 6m up facing SW. Dead branches facing N with hollows possibly more at the top of the tree.
20	2021-02-04	13:56:49.000	-	High	Macrocarpa?	Lots of hollows from top to bottom.
21	2021-02-04	14:02:09.000	110	Low	Macrocarpa	Fallen macrocarpa, hollows low to the ground.

22	2021-02-04	14:06:38.000	200	High	Macrocarpa	Complex, north leader, 4m up facing west has deep hollow. Middle leader dead, hollow 7m up facing west. Southern leader, 10m up facing west under branch
23	2021-02-04	14:15:46.000	50	Low	Macrocarpa/Dead	Fallen stag, two low hollows close to the ground.
24	2021-02-04	14:32:37.000	20	Low	Pine	No features on the tree but a thicket of honey suckle.
25	2021-02-04	14:40:18.000	20	Low	Macrocarpa	No features on the tree but a thicket of honey suckle.
26	2021-02-04	14:42:18.000	20	Low	Macrocarpa	No features on the tree but a thicket of honey suckle.
27	2021-02-04	14:42:44.000	20	Low	Macrocarpa	No features on the tree but a thicket of honey suckle.
28	2021-02-04	14:44:20.000	20	Low	Macrocarpa	No features on the tree but a thicket of honey suckle.
29	2021-02-04	14:52:25.000	100	Moderate	Pine	East facing broken branch 5m up with big splits. Broken branch, south facing needs further assessment. Possible hollow tip branch over drain, facing south. May drop to low after climb.
30	2021-02-04	14:56:33.000	100	NA	Pine	No features documented
31	2021-02-04	15:01:35.000	100	Low	Pine	Some broken, small erect branches 8m up.
32	2021-02-04	15:06:39.000	100	Low	Pine	Some small erect broken branches up high.
33	2021-02-04	15:14:15.000	-	Moderate	Pine	Honey suckle thicket on branches, some dead erect small branches.
34	2021-02-04	15:19:59.000	-	Moderate	Pine	One possible branch, S facing over the drain with hollow. Can be inspected from the ground on the south bank.
36	2021-02-04	15:25:37.000	110	NA	Pine	No features documented
37	2021-02-04	15:26:02.000	60	NA	Pine	No features documented
38	2021-02-04	15:31:10.000	100	Moderate	Pine	One big hollow at head height but currently occupied by a possum.
39	2021-02-04	15:33:02.000	60	Moderate	Pine	One south facing branch, 4m up with a possible feature on the top side
40	2021-02-04	15:34:07.000	120	Low	Pine	Small, erect broken branches
40*	2021-02-04	15:35:23.000	120	Low	Pine	Small, erect broken branches
41	2021-02-04	15:40:35.000	100	Moderate	Unknown	Trees north and south assessed as single tree. North tree has N facing dead leader with loose bark sections. Some dead south facing branches on southern tree can be assessed on the ground of the southern bank.
42	2021-02-04	15:52:17.000	110	High	Pine	Hollow 4m up on main leader. Loose bark and possible hollows on dead stag.
42*	2021-02-04	15:55:02.000	40	NA	Pine	No features documented
43	2021-02-04	16:01:14.000	100	NA	Pine	No features documented
43	2021-02-11	13:40:50.000	100	NA	Pine	No features documented
44	2021-02-11	13:44:35.000	100	Moderate	Pine	One broken branch, cannot see end, 6m up facing north.
45	2021-02-11	13:47:50.000	100	NA	Pine	No features documented
46	2021-02-11	13:51:29.000	100	Moderate	Pine	Split branch facing north, 4m up.
47	2021-02-11	13:55:17.000	100	NA	Pine	No features documented

48	2021-02-11	14:04:06.000	100	Moderate	Pine	Potential gap between the branches and leader.
49	2021-02-11	14:06:59.000	60	NA	Pine	Four leaders, no features documented
50	2021-02-11	14:08:59.000	60	NA	Pine	Three leaders, no features documented
51	2021-02-11	14:13:28.000	100	NA	Pine	No features documented
52	2021-02-11	14:22:39.000	45	NA	Tree Privet	No features documented
53	2021-02-11	14:23:32.000	30	Moderate	Chinese Privet	Hollow branch facing east, 2m up.
53	2021-02-11	14:28:29.000	25	NA	Tree Privet	No features documented

*13, 40, 42, 53 tags have been doubled up in-field. Independent notes and GPS points differentiate are used to trees.

3

Appendix 3 – Wetland Classification Report

Sens

Rotokauri Arterials - Wetland Classification Report

Prepared for Hamilton City Council
Prepared by Beca Limited

20 June 2023

Creative people together transforming our world

Sensitivity: General

Revision History

Revision Nº	Prepared By	Description	Date
1	Sarah Busbridge	Draft for technical review	4/8/21
2	Sarah Busbridge	Draft for approval	9/8/21
3	Sarah Busbridge	Draft for stakeholder review	18/8/21
4	Sarah Busbridge	Final for issue	18/3/22
5	Sarah Busbridge Anna Kostiuk-Warren	Final revision	20/06/2023

Document Acceptance

Action	Name	Signed	Date
Prepared by	Sarah Busbridge Anna Kostiuk-Warren		20 June 2023
Reviewed by	Claire Webb		20 June 2023
Approved by	Craig Sharman		30 June 2023
on behalf of	Beca Limited		

Contents

Appendices

Executive Summary

Urban growth and development of the Rotokauri area is set to increase in accordance with the Rotokauri Structure Plan. The proposed Rotokauri Arterial is required for transport services to serve the urbanisation of the Rotokauri growth cell. The project includes new transport corridors through greenfield areas as well as an upgrade of existing roads and tie-in to existing roads

Beca Limited (Beca) have been commissioned by Hamilton City Council to undertake a wetland classification within 100m of the proposed Rotokauri Arterial alignment to determine whether any natural wetland(s) under the National Policy Statement for Freshwater Management 2020 – 2023 Amendment (NPS-FM) are present to support the Notice of Requirement process for the arterial construction.

Eight wetlands were identified within grazed pasture. These wetlands were all in extremely degraded condition due to drainage and ongoing stock access, but nevertheless, retained enough characteristics to be classified as Natural Wetlands according to New Zealand wetland delineation protocols (Clarkson, 2018; Ministry for the Environment, 2022, 2021) and the NPS-FM (2020). However, as the classification of many of these areas was marginal, it is recommended that these sites are reassessed with greater sampling effort prior to the commencement of works to confirm this classification and delineate wetland extent at this time. It is expected that wetland extent naturally expands and contracts depending on weather patterns and land management practices.

This report is intended to be read in conjunction with the Ecological Impact Assessment – Rotokauri Arterials report (Beca, 2021) which includes an effects assessment of the wetlands identified in this classification report.

Sensitivity: General

1 Project Description

This Rotokauri Arterial Network Notice of Requirement (2022) has been prepared to support a Notice of Requirement (NoR) being prepared by Beca Limited (Beca) on behalf of Hamilton City Council (HCC) as a requiring authority pursuant to section 167 of the Resource Management Act 1991 (RMA). HCC requires land to be designated in Hamilton City for the construction and operation of the 'Rotokauri Arterial Network' (the designation).

The NoR is seeking the designation of a key transportation network and strategic infrastructure corridor servicing the Rotokauri Growth Cell. The designation will enable:

- Land associated with key corridors to be secured by HCC
- Future construction of the infrastructure networks
- Facilitate planned future urban growth within the Rotokauri area.

Rotokauri is situated to the northwest of Hamilton as shown in Figure 1 below. Rotokauri is identified as one of four areas of future growth for Hamilton City. Future growth has been earmarked for the Rotokauri area since 1989 and included as a 'structure plan area', with the Rotokauri Structure Plan (RSP) notation included in the Hamilton District Plan since 2005.

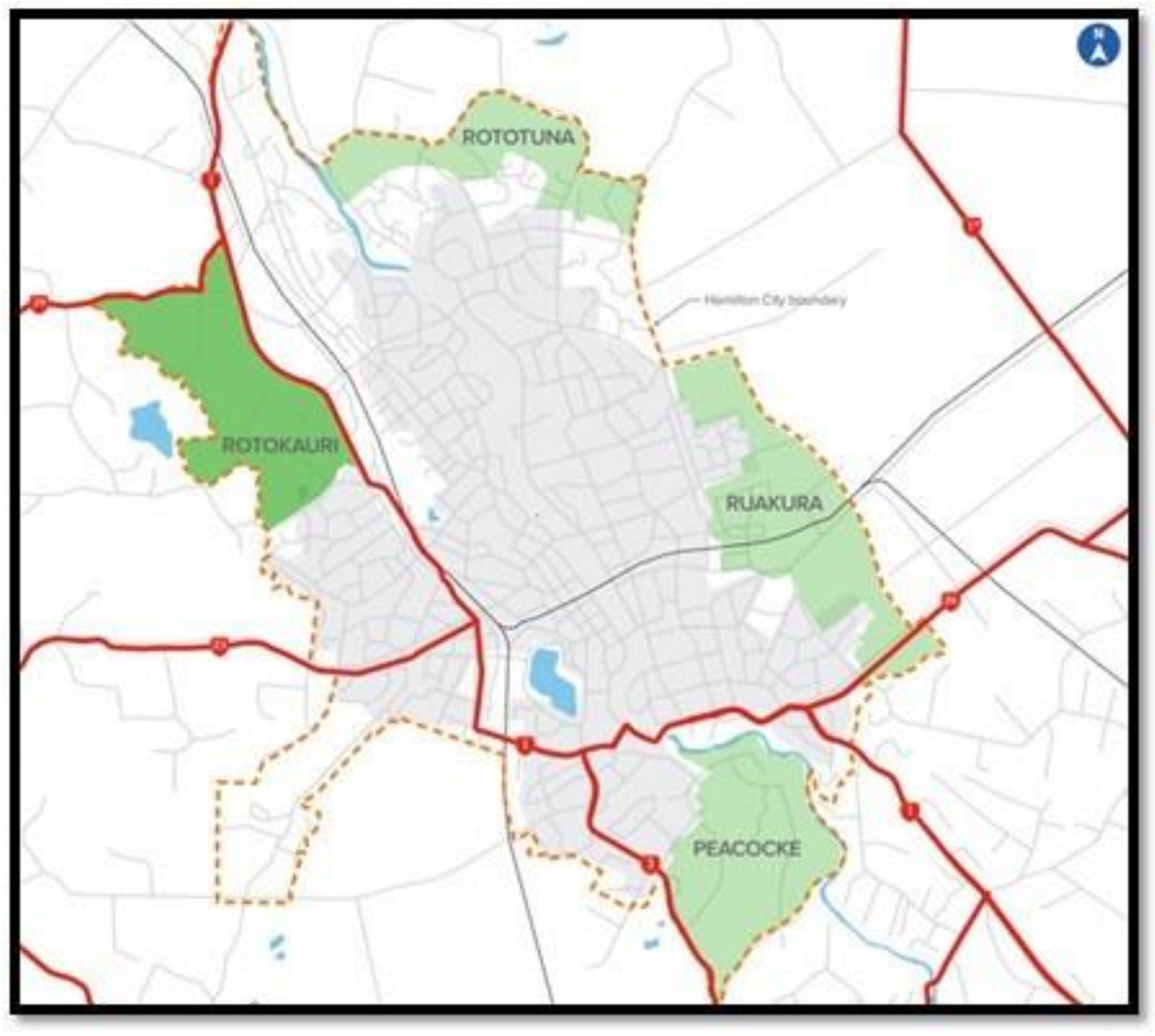


Figure 1. Rotokauri Development Location Plan (Source Hamilton City Council Urban Growth Strategy)

The designation of the strategic transportation and infrastructure corridor is to occur in a way that:

- Responds to the RSP context
- Meets the vision for development in Rotokauri as encapsulated within the RSP
- Responds to an increasingly urgent need to secure an infrastructure corridor

The designation of the strategic transportation and infrastructure corridor will in the short term protect the corridor network from 'build-out' by private developments along the preferred routes. The long-term purpose includes a facilitation of an integrated transport network.

Development of Rotokauri in the southern section is underway with residential subdivision and development occurring in areas that are serviced by existing networks. To date the developments are generally consistent with the RSP and the anticipated level of development with the routes for key connections provided. Master planning and development pressures will continue to create spatial pressures and therefore necessitates route protection as soon as possible. Private Plan Change 7 also proposes 2,000 dwellings and a neighbourhood commercial centre in the north of the RSP area.

The Rotokauri arterial network designation as depicted in Figure 2 below covers a combined 5.8km length of corridors, including the design of a new 5.2km corridor relating to greenfield area which will support future growth and development in Rotokauri.

- Proposed major arterial – approx. 0.7km on existing roads (purple)
- Proposed minor arterials – approx. 3.8km (red)
- Proposed collector roads – approx. 0.7km (yellow)

This includes a north-south corridor that commences in the north at the State Highway 39 (SH39) and Koura Drive roundabout, and proceeds in a south-eastern direction to the future intersection with Te Wetini Drive.

There are also two east-west corridors (Te Kowhai East Road and Chalmers Road) that align with existing grade separated underpasses under State Highway 1 and link the Rotokauri growth cell to key transport destinations, and the wider Hamilton city transportation network. Arthur Porter Drive is a strategic local road (collector) connection which with an enhanced connection between two existing portions of the corridor to better connect the transportation network in this location.

Sensitivity: General

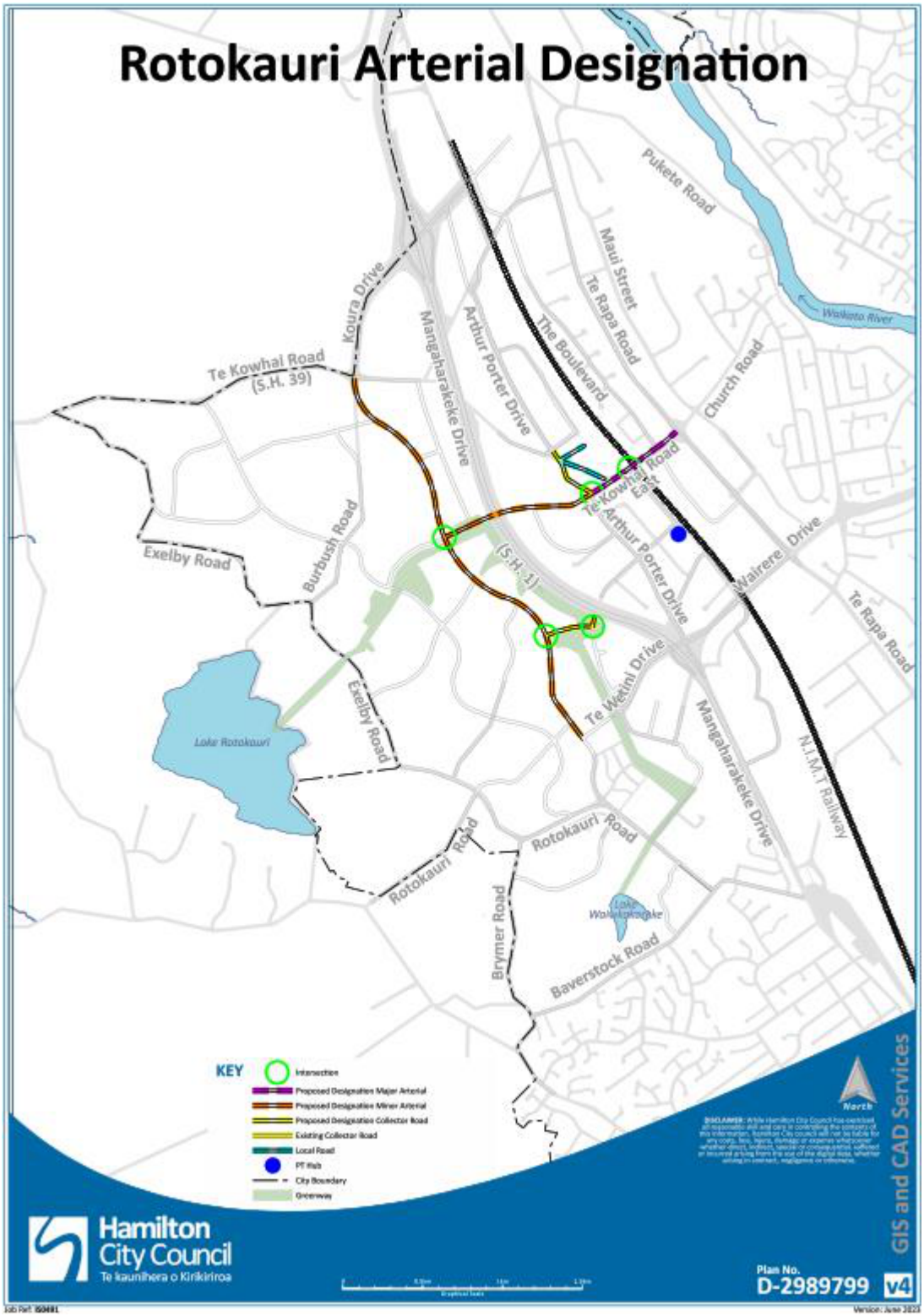


Figure 2. Proposed Rotokauri Arterial Network (Source: Hamilton City Council)

The proposed design of the transport network has a strong urban design focus contributing to achieving HCC's strategic objectives for land use planning, urban growth infrastructure provision and economic

development. These include those core aspects associated with the primary use of multimodal transportation and secondary functions of a strategic network designation including associated infrastructure provisions and how they affect the spatial requirements of the land to be designated. Broadly, these include multimodal transportation facilities, bus stops, parking, spatial provisions for utilities network including three waters infrastructure, connections to recreational spaces and small amenity areas where there is a transition in land-use or context.

They also include associated stormwater facilities including rain gardens and treatment swales directly associated with the road that would be needed to provide an appropriate level of treatment and allow the construction of the network to give effect to the designation. Some elements of the broader Rotokauri scheme overlap with the proposed designation for the stormwater areas with constructed stormwater management wetlands included within the designated corridor.

There is an existing HCC designation already in effect as it relates to the Rotokauri Greenway Corridor which is an identified precursor to any development of the land within the RSP or of the strategic arterial networks which are the subject of the NoR. The Rotokauri Arterial Network will build on the Greenway Project with stormwater facilities intended to work in conjunction with the Greenway and provide modal connections which enhance the identified recreation functions associated with the Greenway. Further descriptions and details of the Rotokauri Greenway and the interfacing aspects relevant to the proposal are outlined in the NoR document.

2 Introduction

The Arterial is located within the Hamilton City suburb of Rotokauri, a predominantly rural area that has been developed and used for farming over the past 100 years. Some urban developments are established in the eastern portion of the project area, including a recent residential subdivision. Urban growth and development of the area is set to increase in accordance with the Rotokauri Structure Plan. The proposed Rotokauri Arterial is required for transport services to serve the urbanisation of the Rotokauri growth cell. The project includes new transport corridors through greenfield areas as well as an upgrade of existing roads and tie-in to existing roads.

Beca Limited (Beca) was commissioned by Hamilton City Council to undertake a wetland classification within 100m of the proposed Rotokauri Arterial corridor to determine whether any natural wetland(s) under the National Policy Statement for Freshwater Management (2022 amendment) (NPS-FM) are present. This will help to decide whether the National Environmental Standard for Freshwater Regulations (NES-F) apply to this development.

Sensitivity: General

3 Site Location and Ecological Context

The land subject to the Rotokauri Arterials Notice of Requirement is 5.8km in length and is located within the Hamilton Ecological District in the Waikato Ecological Region (Figure 3; McEwen, 1987). Historically, the area would have comprised bog, fen and swamp wetland, scrub and fernland, and swamp forest (McEwen, 1987). However, these areas have been extensively drained and presently the district is almost entirely farmed. HCC operates a catchment management strategy for individual stormwater catchments and this project falls within the Rotokauri, Mangaheka, and Te Rapa catchments. The majority of the alignment runs through rural pasture areas in the Rotokauri catchment.

The topography of the Rotokauri catchment area is generally flat with occasional ridgeline and gully areas around the periphery. Vegetation was cleared for farmland from the mid-1800's. Currently, Rotokauri is a predominantly greenfield catchment that supports a mixture of rural land use and lifestyle blocks as well as a recent residential subdivision. The catchment retains runoff which is discharged slowly, meaning that water levels rise and fall over longer timeframes than in most urban catchments (Hartland Environmental, 2017).

The Mangaheka catchment also has a flat lying topography and consists of alluvial plains that have recently been converted from rural pasture to predominantly commercial and light industrial land use. The arterial alignment runs through the southern part of the catchment which includes a modified, straightened stream, artificial swales, and an artificial pond.

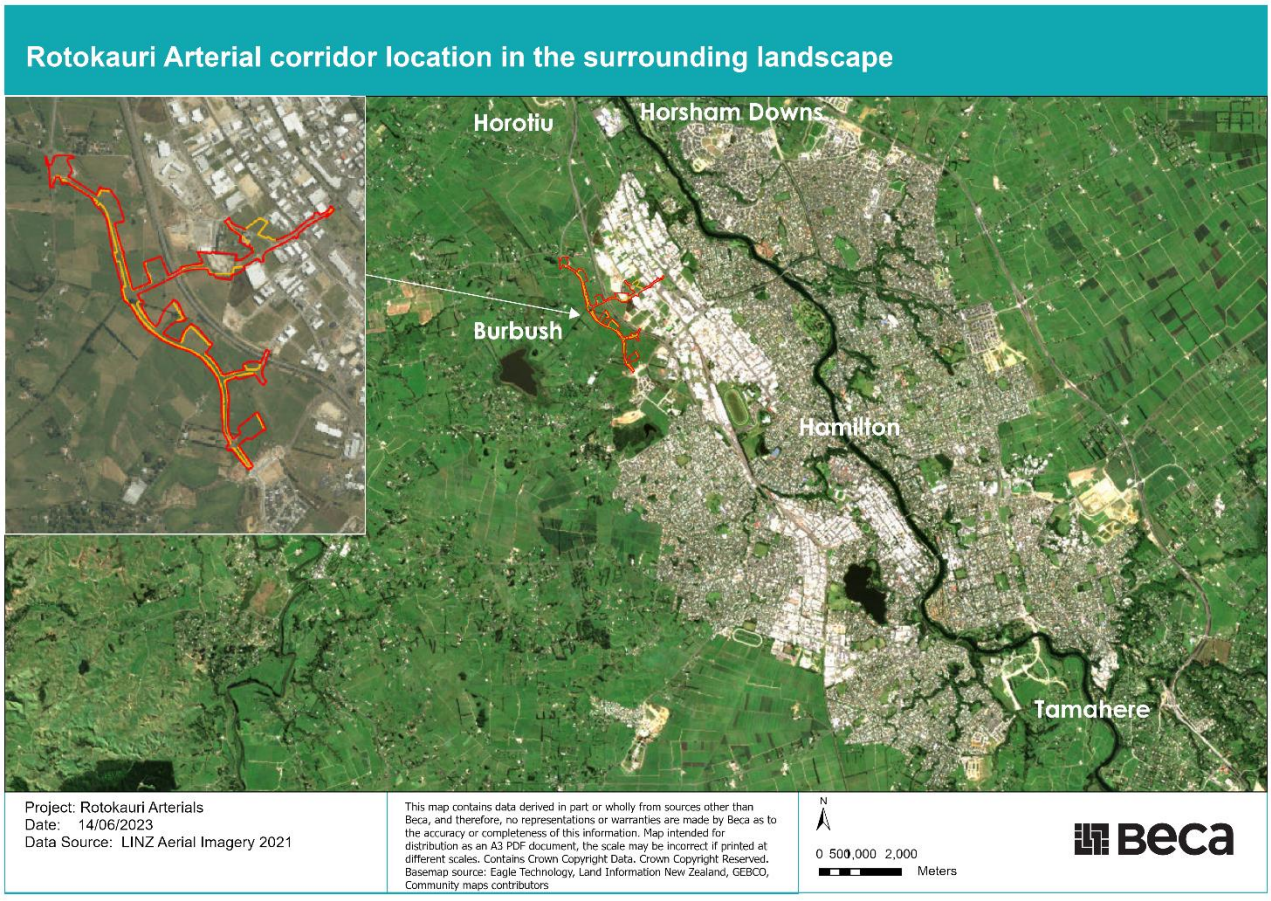


Figure 3. Location of the proposed arterial corridor within the surrounding landscape.

4 Methodology

4.1 Wetland Identification

Potential wetlands located within 100m of proposed work were identified based on the following desktop information:

- Hamilton City Council and Waikato Regional Council geospatial layers including catchment and hydrology layers
- Google Earth and LINZ aerial imagery
- Manaaki Whenua S-Map soil information
- Retrolens historical imagery
- Freshwater Environments of New Zealand (FENZ) estimated historic extent of wetlands in New Zealand geospatial layer.
- Other publicly accessible reports or information.

4.2 Wetland Classification

The Resource Management Act 1991 (RMA) defines wetlands 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”.

The National Environmental Standards for Freshwater (2020; NES:FW, amended 2022) sets out controls relating to developments relating to ‘natural inland wetlands’. ‘Natural inland wetlands’ are defined in the NES:FW (via the National Policy Statement for Fresh Water Management (2020; NPS-FM) as:

‘… a natural inland wetland means a wetland (as defined in the 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 arounds 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* 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.

A desktop and field assessment of ecology, hydrology, wetland and catchment characteristics was undertaken to classify the potential wetland (e.g. non-wetland, artificial wetland, or natural wetland) in accordance with the New Zealand Wetland Delineation Protocols (Clarkson, 2018; Ministry for the Environment, 2020, 2021; see Figures 4-6).

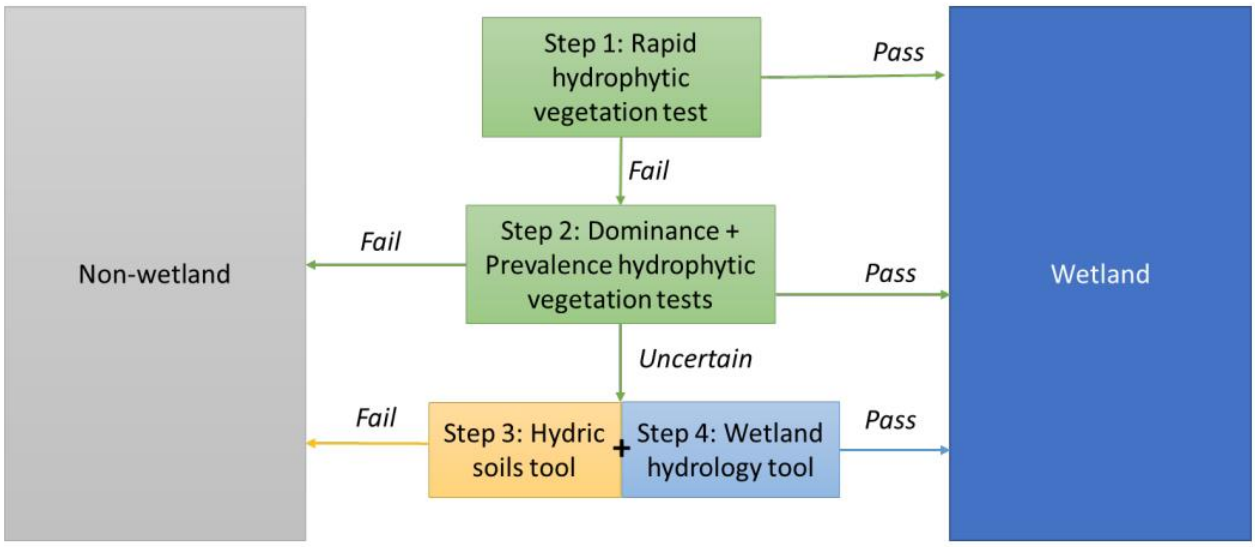


Figure 4. The sequence of steps for delineating wetlands using the hydrophytic vegetation, hydric soils and wetland hydrology tools (Ministry for the Environment, 2021)

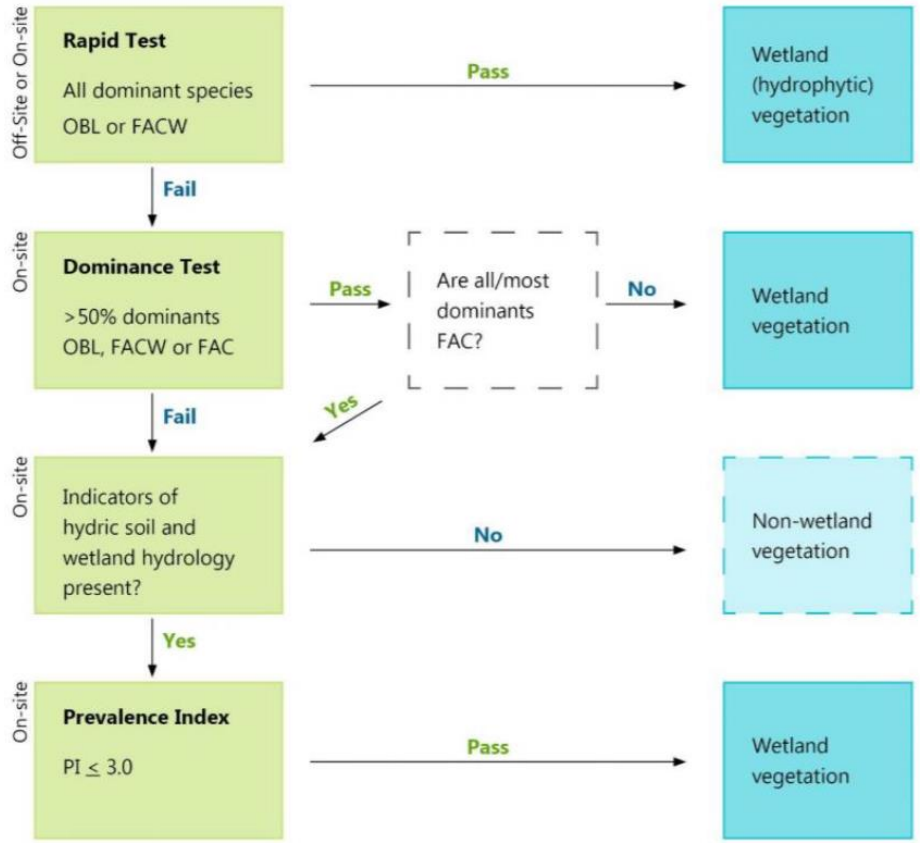


Figure 5. Landcare Research hydrophytic (wetland) vegetation test tool. Wetland indicator status abbreviations: FAC = facultative; FACW = facultative wetland; OBL = obligate wetland (Ministry for the Environment, 2020).

Sensitivity: General

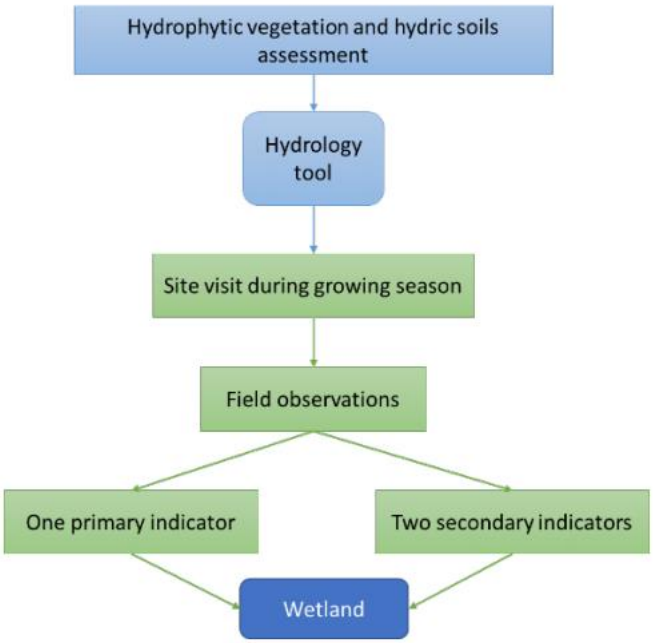


Figure 6. Flow diagram for wetland hydrology tool (Ministry for the Environment, 2021).

5 Wetland Classification

Potential wetlands within the 100m of the Rotokauri Arterials corridor were identified as outlined in Section 4.1. These areas are shown below in Figure 7. These potential wetlands were then ground-truthed following the methodology outlined above in Section 4.2. Sites 3 and 4 were not able to be ground-truthed as the landowner had not approved access to the property, however, they were able to be viewed from vantage points and assessed at a high level. Site visits were undertaken on the 19th of May, 2021 and 7th June 2021 (within the growing season for Hamilton) as outlined in the Wetland Hydrology Tool. Locations visited are shown in Figure 8 and photos of each site are included in Appendix A.

On the first site visit, sites 1, 2, 4, 5, 7, 8, 9 and 10 were assessed. There had been 23.9mm of rainfall in the 7 days preceding the site visit, and 42.8mm in the 14 days preceding the site visit (Hamilton, Ruakura 2 Ews; NIWA, 2021). The weather on the day of the site visit was fine with periods of cloud.

On the second site visit, sites 3, 6, and 11-20 were assessed. There had been 7.7mm of rainfall in the 7 days preceding the site visit, and 22.3mm in the 14 days preceding the site visit (Hamilton, Ruakura 2 Ews; NIWA, 2021). The weather on the day of the site visit was overcast with periods of light rain.

The results of these investigations are outlined below in Table 1, and confirmed wetlands shown in Figure 9. It should be noted that many of these wetlands were marginal (although hydrological indicators and hydric soil was present, vegetation was not always hydric), and in a highly degraded condition due to drainage of the area for agriculture and ongoing grazing. As Wentworth et al. (1988) cautioned that the vegetation assessment alone was not accurate between Prevalence Index values 2.5 to 3.5, professional judgement has been applied in the case of Site 8 as although vegetation in one plot was technically hydric, it was very sparsely distributed across an extremely small and narrow area that was considered to have very low restoration potential and did not have more than one secondary indicator of hydrology.

Sensitivity: General

Figure 7. Potential wetland areas identified via desktop within 100m of proposed works.

Sensitivity: General

Figure 8. Areas investigated during the site visit. Plot numbers relate to Table 1 below and Sites identified in Figure 7.

Table 1. Results of the wetland classification in relation to the wetland delineation protocol and NPS-FM (Clarkson, 2018; Ministry for the Environment, 2022, 2021, NPS-FM, 2022). Historic wetland status was assigned accoridng to the Freshwater Ecosystems of New Zealand (FENZ; Leathwick et al., 2010), and Retrolens historic imagery.

Plot number	Rapid test	Dominance Test	Prevalence Test	Pasture Test	Hydric Soils	Hydrology*	Constructed	Historic wetland?	Normal circumstances?	Classification	Wetland name
1a	No	No	NA	NA	Yes	No	NA	Yes - fen	No - cropped and drained	Non-wetland	
1b	No	No	NA	NA	Yes	No	NA	Yes - fen	No - cropped and drained	Non-wetland	
2a	No	No	NA	NA	No	No	NA	No	No - earthworked and drained	Non-wetland	
NA	NA	NA	NA	NA	Yes	Yes (3F, 4B)	No	Uncertain	No - grazed and modified	Unconfirmed wetland (outside buffer)	
4a	No	No	NA	NA	Yes	No	NA	Yes - fen	No - cropped and drained	Non-wetland	
5a	No	No	No	NA	Yes	No	NA	Yes - fen	No - grazed and drained	Non-wetland	
6a	No	No	NA	NA	Yes	No	NA	Yes - fen	No - grazed and drained	Non-wetland	
7a	No	No	NA	NA	Yes	No	NA	Yes - fen	No - grazed and drained	Non-wetland	
8a	No	No	No (3.5)	Yes	Yes	No	No	Yes - fen	No - grazed and drained	Non-wetland	
8b	No	Yes	Yes (2.7)	No	Yes	No	No	Yes - fen	No - grazed and drained	Non-wetland	
9a	No	Yes	Yes (2.4)	No	Yes	Yes (3F, 4B)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 1
10a	No	Yes	No (3.1)	Yes	Yes	Yes (3F, 4B)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 2
10b	No	Yes	Yes (2.6)	No	Yes	Yes (3F, 4B)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 2
11a	No	No	No (3.4)	Yes	Yes	Yes (1A)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 3
11b	No	No	No (3.4)	Yes	Yes	Yes (1A)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 3
12a	No	Yes	No (3.5)	No	Yes	Yes (1A)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 4
12b	No	Yes	No (3.4)	No	Yes	Yes (1A)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 4
12c	No	Yes	Yes (2.9)	No	Yes	Yes (1A)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 4
12d	No	Yes	No (3.1)	No	Yes	Yes (1A)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 5
13a	No	No	NA	NA	Yes	No	No	Yes - fen	No - grazed and drained	Non-wetland	
14a	No	Yes	No (3.2)	Yes	Yes	Yes (1B)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 4
14b	No	Yes	Yes (2.9)	No	Yes	Yes (1B)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 6

Sensitivity: General

Plot number	Rapid test	Dominance Test	Prevalence Test	Pasture Test	Hydric Soils	Hydrology*	Constructed	Historic wetland?	Normal circumstances?	Classification	Wetland name
14c	No	No	No (3.7)	Yes	Yes	Yes (1A)	Yes	Yes - fen	No - grazed and drained	Non-wetland	
14d	No	Yes	Yes (2.7)	No	Yes	Yes (1A)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 6
15a	No	No	Yes (3.0)	Yes	Yes	NA	Yes	Yes - fen	No – within constructed drain	Constructed wetland	
16a	No	Yes	Yes (2.6)	No	Yes	Yes (1A)	No	Yes - fen	No - grazed and drained	Natural wetland	Wetland 7
17a	NA	NA	NA	NA	Yes	NA	Yes	Yes	No – within constructed drain	Constructed wetland	
18a	No	No	No	Yes	Yes	No	No	Uncertain	No - grazed and drained	Non-wetland	
19a	No	Yes	Yes (2.6)	Yes	Yes	Yes (3F, 4B)	No	Uncertain	No - grazed and drained	Natural wetland	Wetland 8
19b	No	Yes	Yes (2.2)	No	Yes	Yes (3F, 4B)	No	Uncertain	No - grazed and drained	Natural wetland	Wetland 8
20a	NA	NA	NA	NA	No	No	No	Yes - fen	No - earthworked and drained	Non-wetland	

Sensitivity: General

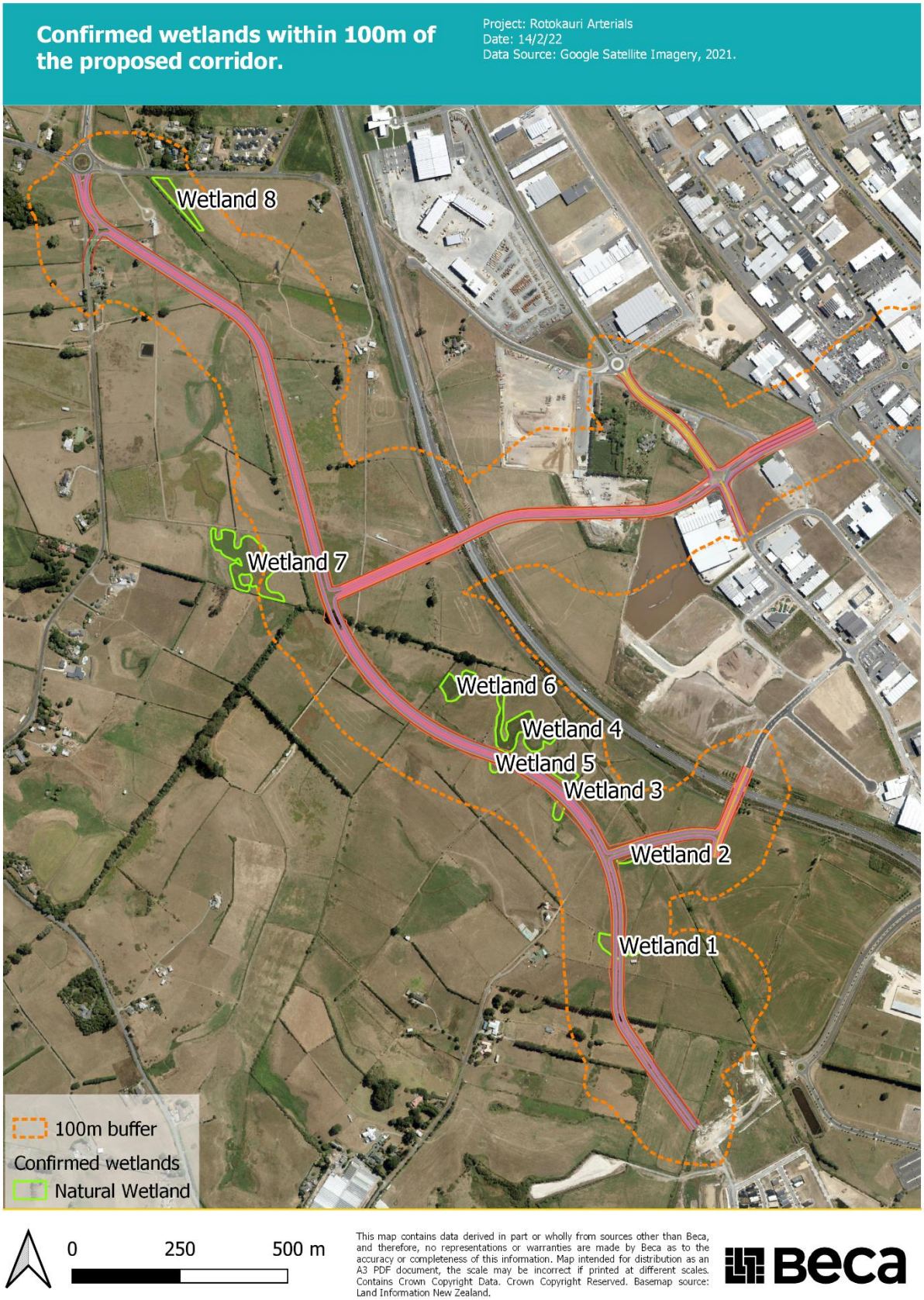


Figure 9. Confirmed wetlands located within 100m of the proposed Arterials corridor.

Sensitivity: General

5.1 Wetland 1

Wetland 1 is 3710m² and is located within grazed pasture at the toe of a slope. It is not fenced to exclude stock and is regularly grazed. Vegetation consists of soft rush (*Juncus effusus*), creeping buttercup (*Ranunculus repens*), and mercer grass (*Paspalum distichum*) with interspersed pasture species.

The site had less than 50% pasture species and failed the Rapid Test but passed the Dominance test and had a Prevalence Index (PI: 2.4). No primary indicators of wetland hydrology were observed, although two secondary indicators of wetland hydrology were noted (3F: Saturation visible on aerial imagery, and 4B geomorphic position).

This site is mapped as part of a large historic fen wetland according to Freshwater Ecosystems of New Zealand Historic Wetlands Typology (Leathwick et al., 2010).

According to SMap, the soil type in this area is a combination of Porchester_10a.1 (Area: 50%; Confidence: Low), Temuka_76a.1 (Area: 20%; Confidence: Low, and Morrinsville_7a.1 (Area: 30%; Confidence: Low) soils (Manaaki Whenua, 2021). Porchester_10a.1 belongs to the Brown soil order of the New Zealand soil classification. Generally the soil is imperfectly drained with moderate vulnerability of water logging in non-irrigated conditions, and has moderate soil water holding capacity (Manaaki Whenua, 2021). Temuka_76a.1 belongs to the Gley soil order of the New Zealand soil classification. Gley soils are strongly affected by waterlogging, have been chemically reduced, have light grey subsoils, and usually have reddish brown or brown mottles. Waterlogging occurs in winter and spring, and some soils remain wet all year (Manaaki Whenua, 2021). Morrinsville_7a.1 belongs to the Granular soil order of the New Zealand soil classification. Generally the soil is moderately well drained with low vulnerability of water logging in non-irrigated conditions, and has high soil water holding capacity (Manaaki Whenua, 2021). This area is considered likely to have hydric soils.

This area is classified as a highly degraded natural wetland.

Sensitivity: General

5.2 Wetland 2

Wetland 2 is 2217m² and is located within grazed pasture at the toe of a slope in a shallow concave depression surrounding an artificial drain. It is not fenced to exclude stock and is regularly grazed.

Vegetation consists of soft rush (*Juncus effusus*), creeping buttercup (*Ranunculus repens*), mercer grass and (*Paspalum distichum*) and ryegrass (*Lolium perenne*), with other interspersed pasture species (*Plantago lanceolata, Trifolium repens*).

Two vegetation plots were completed in the area. Both failed the Rapid Test, but passed the Dominance Test. One plot (10a) had a prevalence index >3.0 (PI: 3.1) and consisted of more than 50% pasture species, while the other (10b) had a prevalence index <3.0 (PI: 2.6) and had less than 50% pasture species.

No primary indicators of wetland hydrology were observed, although two secondary indicators of wetland hydrology were noted (3F: Saturation visible on aerial imagery, and 4B geomorphic position).

This site is mapped as part of a large historic fen wetland according to Freshwater Ecosystems of New Zealand Historic Wetlands Typology (Leathwick et al., 2010).

According to SMap, the soil type in this area is a combination of Utuhina_31a.2 (Area: 50%; Confidence: Medium) and Utuhina_31a.2 (Area: 50%; Confidence: Medium) soils (Manaaki Whenua, 2021). Both these soils belong to the Organic soil order of the New Zealand soil classification and consist of deep, poorly drained peat (Manaaki Whenua, 2021). These are typical hydric soils.

For the prevalence test Wentworth et al. (1988) cautioned that the vegetation assessment alone was not accurate between Prevalence Index values 2.5 to 3.5. As it is uncertain whether this area has hydric vegetation, but it does have wetland hydrology and hydric soils, it has been classified as a highly degraded natural wetland.

Sensitivity: General

5.3 Wetland 3

Wetland 3 is 2414m² and is located within grazed pasture in a shallow concave depression that was historically part of a larger fen wetland complex that ran through this area (Leathwick et al., 2010; Retrolens). It is not fenced to exclude stock and is regularly grazed. Drainage channels have also been dug into the area, modifying hydrology.

Vegetation consists of ryegrass (*Lolium perenne*), Yorkshire fog (*Holcus lanatus*), and soft rush (Juncus effusus), with creeping buttercup (*Ranunculus repens*), and pasture species (*Plantago lanceolata, Trifolium repens*) interspersed.

Two vegetation plots (11a, 11b) were completed in the area. Both failed the Rapid Test and the Dominance Test and had a Prevalence Index >3 (PI: 3.4). Both plots had more than 50% pasture species cover. However, these areas were not able to be classified as improved pasture as they had more permanent wetland hydrology. The site had primary indicators of wetland hydrology (1A) despite the construction of drainage channels nearby, and based on rainfall preceding the site visit (7.7mm of rainfall in the 7 days and 22.3mm in the 14 days preceding) the area had likely been inundated for at leave seven consecutive days during the growing season, and saturated at or near the surface for at least 14 consecutive days during the growing season (Ministry for the Environment, 2021).

According to SMap, the soil type in this area is a combination of Utuhina_31a.2 (Area: 50%; Confidence: Medium) and Utuhina_31a.2 (Area: 50%; Confidence: Medium) soils (Manaaki Whenua, 2021). Both these soils belong to the Organic soil order of the New Zealand soil classification and consist of deep, poorly drained peat (Manaaki Whenua, 2021). These are typical hydric soils.

For the prevalence test Wentworth et al. (1988) cautioned that the vegetation assessment alone was not accurate between Prevalence Index values 2.5 to 3.5. As it is uncertain whether this area has hydric vegetation, but it does have wetland hydrology and hydric soils, it has been classified as a highly degraded natural wetland.

5.4 Wetland 4

Wetland 4 is 8912m² and is located within grazed pasture in a shallow concave depression at the base of a slope that was historically part of a larger fen wetland complex that ran through this area (Leathwick et al., 2010; Retrolens). It is not fenced to exclude stock and drainage channels have also been dug into the area, modifying hydrology.

Vegetation consists of soft rush (*Juncus effusus*), wīwī (*Juncus australis*), creeping buttercup (*Ranunculus repens*), browntop (*Agrostis capillaris*), Yorkshire fog (*Holcus lanatus*), kikuyu (*Cenchrus clandestinus*), clover (*Trifolium repens*), ryegrass (*Lolium perenne*), plantain (*Plantago lanceolata*), and dock (*Rumex crispus*).

Four vegetation plots (12a-c, 14a) were completed in the area. All failed the Rapid Test but passed the Dominance Test. Only 12a had a prevalence index <3.0 (PI: 2.9), with the other sites having prevalence index scores >3.0 but <3.5 and thus the result was considered ‘uncertain’ (Wentworth et al. 1988).

Plot 14a was the only plot to have more than 50% pasture species cover. However, as above, this area was not able to be classified as improved pasture as they had more permanent wetland hydrology. The site had primary indicators of wetland hydrology (1B) despite the construction of drainage channels nearby, and based on rainfall preceding the site visit (7.7mm of rainfall in the 7 days and 22.3mm in the 14 days preceding) the area had likely been saturated at or near the surface for at least 14 consecutive days during the growing season (Ministry for the Environment, 2021). The other three plots (12A-12C) had one primary indicator of wetland hydrology (1A: inundation or ponding visible).

According to SMap, the majority of the wetland falls on a combination of Utuhina_31a.2 (Area: 50%; Confidence: Medium) and Utuhina_31a.2 (Area: 50%; Confidence: Medium) soils (Manaaki Whenua, 2021). Both these soils belong to the Organic soil order of the New Zealand soil classification and consist of deep, poorly drained peat (Manaaki Whenua, 2021). These are typical hydric soils.

The north western corner (14a) of the wetland falls on Temuka_57b.8 (Area: 70; Confidence: Low), and Airfield_7a.1 1 (Area: 30%; Confidence: Low) soils (Manaaki Whenua, 2021).Temuka_57b.8 belongs to the Gley soil order of the New Zealand soil classification. Gley soils are poorly drained with high vulnerability of water logging in non-irrigated conditions, and has high soil water holding capacity (Manaaki Whenua, 2021). Waterlogging occurs in winter and spring, and some soils remain wet all year (Manaaki Whenua, 2021).Airfield_7a.1 soil belongs to the Brown soil order of the New Zealand soil classification. Generally the soil is imperfectly drained with low vulnerability of water logging in non-irrigated conditions, and has moderate soil water holding capacity (Manaaki Whenua, 2021). This area is considered likely to have hydric soils.

As it is uncertain whether this area has hydric vegetation, but it does have wetland hydrology and hydric soils, it has been classified as a highly degraded natural wetland.

Sensitivity: General

5.5 Wetland 5

Wetland 5 is 955m² and is located within grazed pasture in a shallow depression that was historically part of a larger fen wetland complex that ran through this area (Leathwick et al., 2010; Retrolens). It is not fenced to exclude stock and had vehicle track marks running through it at the time of the site visit.

Vegetation consists of soft rush (*Juncus effusus*), creeping buttercup (*Ranunculus repens*), and ryegrass (*Lolium perenne*) with interspersed plantain (*Plantago lanceolata*) and Yorkshire fog (*Holcus lanatus*).

Vegetation failed the Rapid Test but passed the Dominance Test. Vegetation had a prevalence index >3.0 (PI: 3.1), but the result was considered ‘uncertain’ (Wentworth et al. 1988). The site did not have more than 50% pasture species cover and had primary indicators of wetland hydrology (1A) with 2-5cm of standing water present.

According to SMap, the soil type in this area is a combination of Porchester_10a.1 (Area: 50%; Confidence: Low), Temuka_76a.1 (Area: 20%; Confidence: Low, and Morrinsville_7a.1 (Area: 30%; Confidence: Low). Porchester_10a.1 belongs to the Brown soil order of the New Zealand soil classification. Generally the soil is imperfectly drained with moderate vulnerability of water logging in non-irrigated conditions, and has moderate soil water holding capacity (Manaaki Whenua, 2021). Temuka_76a.1 belongs to the Gley soil order of the New Zealand soil classification. Gley soils are strongly affected by waterlogging, have been chemically reduced, have light grey subsoils, and usually have reddish brown or brown mottles. Waterlogging occurs in winter and spring, and some soils remain wet all year (Manaaki Whenua, 2021). Morrinsville_7a.1 belongs to the Granular soil order of the New Zealand soil classification. Generally the soil is moderately well drained with low vulnerability of water logging in non-irrigated conditions, and has high soil water holding capacity (Manaaki Whenua, 2021). This area is considered likely to have hydric soils.

As this area has wetland hydrology and hydric soils, it has been classified as a highly degraded natural wetland

Sensitivity: General

5.6 Wetland 6

Wetland 6 is 3120m² and is located within grazed pasture in a shallow concave depression surrounding an artificial drain which has modified the hydrology of the area. It is not fenced to exclude stock and is regularly grazed. Historically, it was part of a larger fen wetland complex that ran through this area (Leathwick et al., 2010; Retrolens).

Vegetation consists of soft rush (*Juncus effusus*), creeping buttercup (*Ranunculus repens*), ryegrass (*Lolium perenne*), Yorkshire fog (*Holcus lanatus*), catsear (*Hypochaeris radicata*) and plantain (*Plantago lanceolata*).

Two vegetation plots (14b and 14d) were completed in the area. Both failed the Rapid Test but passed the Dominance Test and had a prevalence index <3.0 (PI: 2.9 and 2.7 respectively).

The plots did not have more than 50% pasture species cover and had primary indicators of wetland hydrology (1A) with standing water present.

According to SMap, the wetland falls on Temuka_57b.8 (Area: 70; Confidence: Low), and Airfield_7a.1 1 (Area: 30%; Confidence: Low) soils (Manaaki Whenua, 2021).Temuka_57b.8 belongs to the Gley soil order of the New Zealand soil classification. Gley soils are poorly drained with high vulnerability of water logging in non-irrigated conditions, and has high soil water holding capacity (Manaaki Whenua, 2021). Waterlogging occurs in winter and spring, and some soils remain wet all year (Manaaki Whenua, 2021).Airfield_7a.1 soil belongs to the Brown soil order of the New Zealand soil classification. Generally the soil is imperfectly drained with low vulnerability of water logging in non-irrigated conditions, and has moderate soil water holding capacity (Manaaki Whenua, 2021). This area is considered likely to have hydric soils

As this area has hydric vegetation, wetland hydrology and hydric soils, it has been classified as a highly degraded natural wetland.

Sensitivity: General

5.7 Wetland 7

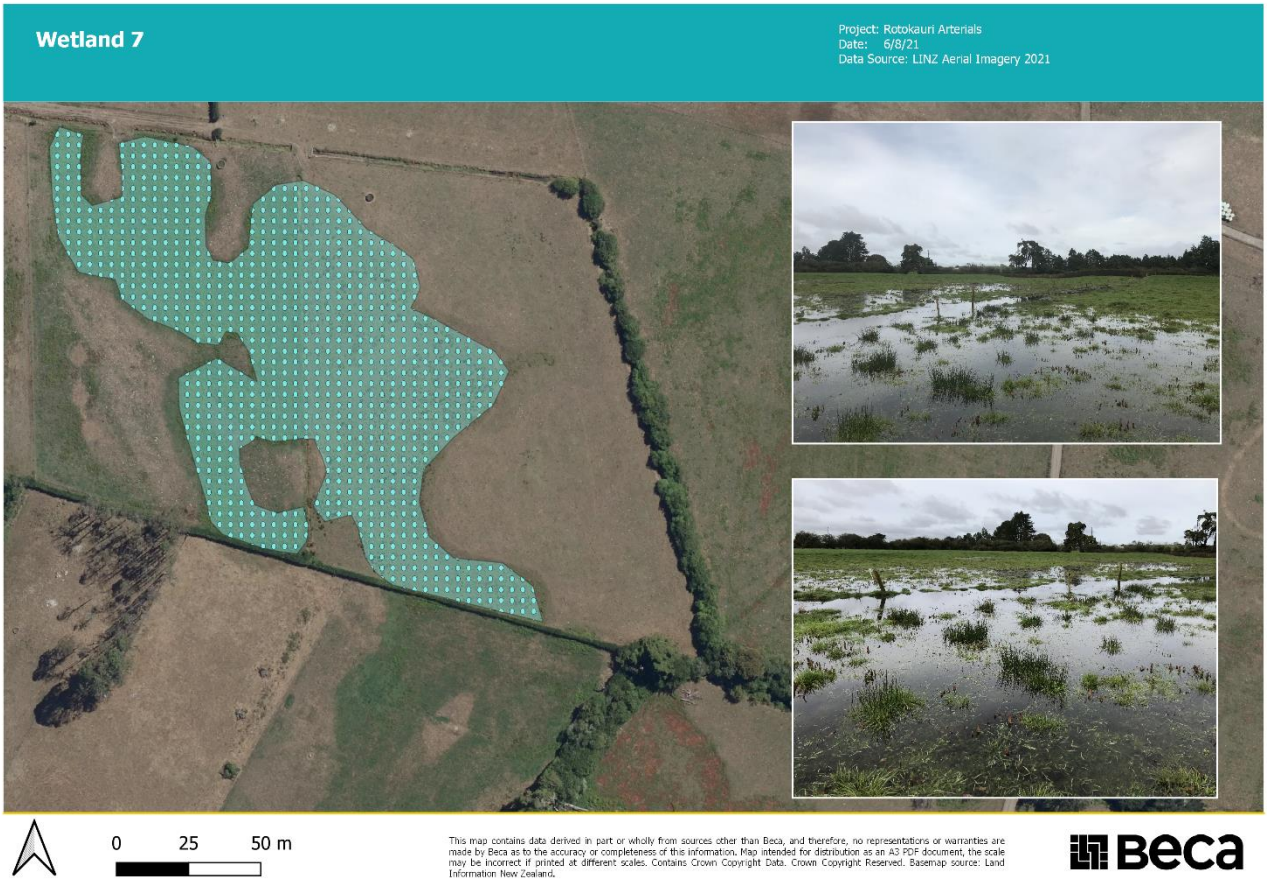
Wetland 7 is 12143m² (the majority of which falls outside the 100m buffer) and is located within grazed pasture in a shallow concave depression surrounding an artificial drain which has modified the hydrology of the area. The drain is partially fenced to exclude stock, but the surrounding wetland is regularly grazed. Historically, it was part of a larger fen wetland complex that ran through this area (Leathwick et al., 2010; Retrolens).

Much of the area consisted of muddy substrate at the time of the site visit and was not vegetated. However, a vegetation plot (16a) was completed near the edge of the wetland where vegetation consists of soft rush (*Juncus effusus*), wild celery (*Apium graveolens*), dock (*Rumex crispus*), creeping buttercup (*Ranunculus repens*) and pasture grass. It failed the Rapid Test but passed the Dominance Test and had a prevalence index <3.0 (PI: 2.6). The plot did not have more than 50% pasture species cover and the wetland had primary indicators of wetland hydrology (1A) with 5-10cm of standing water present despite drainage.

According to SMap, the wetland falls on Temuka_57b.8 (Area: 70; Confidence: Low), and Airfield_7a.1 1 (Area: 30%; Confidence: Low) soils (Manaaki Whenua, 2021).Temuka_57b.8 belongs to the Gley soil order of the New Zealand soil classification. Gley soils are poorly drained with high vulnerability of water logging in non-irrigated conditions, and has high soil water holding capacity (Manaaki Whenua, 2021). Waterlogging occurs in winter and spring, and some soils remain wet all year (Manaaki Whenua, 2021).Airfield_7a.1 soil belongs to the Brown soil order of the New Zealand soil classification. Generally the soil is imperfectly drained with low vulnerability of water logging in non-irrigated conditions, and has moderate soil water holding capacity (Manaaki Whenua, 2021). This area is considered likely to have hydric soils

As this area has hydric vegetation, wetland hydrology and hydric soils, it has been classified as a highly degraded natural wetland.

Sensitivity: General



5.8 Wetland 8

Wetland 8 is 2888m² (the majority of which falls outside the 100m buffer) and is located within grazed pasture in a gentle, low-lying depression adjacent to a drain. It is unclear whether this area was historically a wetland, but it is not mapped as one on the FENZ estimated historic wetland extent layer.

Vegetation consists predominantly of soft rush (*Juncus effusus*), creeping buttercup (*Ranunculus repens*), and Yorkshire fog (*Holcus lanatus*).

Two vegetation plots (19a and 19b) were completed in the area. Both failed the Rapid Test but passed the Dominance Test and had a prevalence index <3.0 (PI: 2.6 and 2.2 respectively). One of the plots had more than 50% pasture species (19a). No primary indicators of wetland hydrology were observed; although two secondary indicators of wetland hydrology were noted (3F: Saturation visible on aerial imagery, and 4B geomorphic position).

According to SMap, the wetland falls on Temuka_57b.8 (Area: 70; Confidence: Low), and Airfield_7a.1 1 (Area: 30%; Confidence: Low) soils (Manaaki Whenua, 2021).Temuka_57b.8 belongs to the Gley soil order of the New Zealand soil classification. Gley soils are poorly drained with high vulnerability of water logging in non-irrigated conditions, and has high soil water holding capacity (Manaaki Whenua, 2021). Waterlogging occurs in winter and spring, and some soils remain wet all year (Manaaki Whenua, 2021).Airfield_7a.1 soil belongs to the Brown soil order of the New Zealand soil classification. Generally the soil is imperfectly drained with low vulnerability of water logging in non-irrigated conditions, and has moderate soil water holding capacity (Manaaki Whenua, 2021). This area is considered likely to have hydric soils

This area has been classified as a highly degraded natural wetland based on the presence of some areas of hydric vegetation, wetland hydrology, and hydric soils. However, as some parts of this area have more 50%

Sensitivity: General

pasture species, it is possible that it meets the NPS-FM ‘improved pasture’ exclusion criteria. To confirm this, the site would need to be reassessed with greater sampling effort.

6 Conclusion

Eight wetlands were identified within 100m of the proposed Arterial alignment. These wetlands were all in extremely degraded condition due to drainage and ongoing grazing, but nevertheless, retained enough characteristics to be classified as Natural Wetlands according to New Zealand wetland delineation protocols (Clarkson, 2018; Ministry for the Environment, 202, 2021) and the NPS-FM (2022).

Historically, the area likely comprised a mosaic of bog, fen and swamp wetlands (McEwen, 1987). It is expected that these eight wetlands are remnants of this larger complex that have retained wetland hydrology due to underlying hydric soils and geomorphic position despite significant modification.

As the classification of many of these areas was marginal, it is recommended that these sites are reassessed with greater sampling effort to support resource consenting prior to the commencement of works including specified infrastructure. This is likely to be some time away from the date of this report, and the wetland environments identified may change in community composition and therefore also their extents and classifications. An effects assessment of their current state is included in the Ecological Impact Assessment.

7 References

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8 Limitations

This report has been prepared by Beca Ltd (Beca) solely for Hamilton City Council (the Client). This report is prepared solely for the purpose of the classification of wetlands (Scope). The report has been prepared to support a Notice of Requirement application and may be used by the Client and others in subsequent processes to consider the application to which the assessment pertains. The contents of this report may not be used by the Client for any purpose other than in accordance with the stated Scope.

Unless specifically stated otherwise in this report, Beca has relied on the accuracy, completeness, currency and sufficiency of all information provided to it by, or on behalf of, the Client or any third party, including the information listed above, and has not independently verified the information provided. Beca accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the information provided.

The contents of this report are based upon our understanding and interpretation of current legislation and guidelines (“Standards”) as consulting professionals and should not be construed as legal opinions or advice. Unless special arrangements are made, this report will not be updated to take account of subsequent changes to any such Standards.

This report should be read in full, having regard to all stated assumptions, limitations and disclaimers

1

Appendix 1 – Site Investigation Photos

Sensitivity: General

Photographs of potential wetlands evaluated during the site visit.

Site 1

Site 2

Sensitivity: General

Site 3

Site 4

Sensitivity: General

Site 5

Site 6 & 7

Sensitivity: General

Site 8

Site 9

Site 10

Sensitivity: General

Site 11

Site 12

Sensitivity: General

Site 13

Site 14

Sensitivity: General

Site 15

Site 16

Site 17 & 18

Sensitivity: General

Site 19

Site 20

4

Appendix 4 – Avifauna List

Table 1: Avifauna recorded on eBird (2022) within the Project area. Conservation status assigned according to (Robertson, et al., 2016).

Common name	Scientific Name	Conservation Status	Present in habitat in corridor	NPS-IB Highly Mobile Fauna
Black shag	*Phalacrocorax carbo*	At Risk – Relict	Ponds and river margins	-
Little black shag	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	Ponds and river margins	-
Royal spoonbill	*Platalea regia*	At Risk - Naturally Uncommon	Larger drains, river margins, trees	-
Long-tailed cuckoo	*Eudynamys taitensis*	At Risk – Vulnerable	Forest	-
NZ Falcon	*Falco novaeseelandiae*	At Risk – Vulnerable	Open grasslands	yes
Pied shag	*Phalacrocorax varius*	At Risk – Recovering	Ponds and river margins	yes
Muscovy duck	*Cairina moschata (Domestic type)*	Introduced	Ponds and river margins, pasture	-
Rose-ringed parakeet	*Psittacula krameri*	Introduced	Open grasslands, ponds	-
Mynah	*Acridotheres tristis*	Introduced and Naturalised	Trees, shelterbelts and hedgerows	-
Skylark	*Alauda arvensis*	Introduced and Naturalised	Open pasture	-
Mallard	*Anas platyrhynchos*	Introduced and Naturalised	Larger drains, ponds and river margins	-
Canada goose	*Branta canadensis*	Introduced and Naturalised	Open pasture, Larger drains, ponds and river margins	-
Goldfinch	*Carduelis carduelis*	Introduced and Naturalised	Open grassland, hedgerows	-
European greenfinch	*Chloris chloris*	Introduced and Naturalised	Open grassland, hedgerows	-
Rock pigeon	*Columba livia*	Introduced and Naturalised	Forest and built environments	-
Yellowhammer	*Emberiza citrinella*	Introduced and Naturalised	Open grassland, hedgerows	-
Chaffinch	*Fringilla coelebs*	Introduced and Naturalised	Open grassland, hedgerows	-
Australian magpie	*Gymnorhina tibicen*	Introduced and Naturalised	Open grassland, hedgerows	-
House sparrow	*Passer domesticus*	Introduced and Naturalised	Open grassland, hedgerows	-
Common pheasant	*Phasianus colchicus*	Introduced and Naturalised	Open grassland, shelterbelts	-
Eastern rosella	*Platycercus eximius*	Introduced and Naturalised	Trees, shelterbelts and hedgerows	-
Dunnock	*Prunella modularis*	Introduced and Naturalised	Open grassland, hedgerows	-

Blackbird	*Turdus merula*	Introduced and Naturalised	Trees, shelterbelts and hedgerows	-
Song thrush	*Turdus philomelos*	Introduced and Naturalised	Trees, shelterbelts and hedgerows	-
Shining cuckoo	*Chrysococcyx lucidus*	Not Threatened	Forest	-
Swamp harrier	*Circus approximans*	Not Threatened	Open grasslands	-
Black swan	*Cygnus atratus*	Not Threatened	Lakes	-
White-faced heron	*Egretta novaehollandiae*	Not Threatened	Larger drains, ponds and river margins	-
Grey warbler	*Gerygone igata*	Not Threatened	River margins	-
Pied stilt	*Himantopus leucocephalus*	Not Threatened	Larger drains, ponds and river margins	-
Welcome swallow	*Hirundo neoxena*	Not Threatened	Open grasslands, lakes, larger drains and river margins	-
Little Shag	*Microcarbo melanoleucos*	Not Threatened	Larger drains, ponds and river margins	-
Pukeko	*Porphyrio melanotus*	Not Threatened	Larger drains, ponds and river margins	-
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	Forest and built environments	-
Fantail	*Rhipidura fuliginosa*	Not Threatened	Forests and built environments	-
Spotted dove	*Streptopelia chinensis*	Not Threatened	Open grasslands	-
Starling	*Sturnus vulgaris*	Not Threatened	Forest and built environments	-
Kōtare	*Todiramphus sanctus*	Not Threatened	Forest, Larger drains, ponds and river margins	-
Spur-winged plover	*Vanellus miles*	Not Threatened	Open grasslands	-
Silvereye	*Zosterops lateralis*	Not Threatened	Forest, open grasslands, riparian margins	-