



Ridgeburn, Morven Ferry Road

Ecological Impact Assessment

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Cover photo: Vegetation and habitats present within the proposed Ridgeburn development area, photograph taken 3 November 2025.

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TABLE OF CONTENTS

Statement of Qualifications and Experience	1
Executive Summary	2
1 Introduction.....	4
1.1 Background.....	4
1.2 Assessment Scope	5
2 Methodology	6
2.1 Overview	6
2.2 Terrestrial Ecology.....	6
2.3 Lizard survey.....	6
2.4 Freshwater Ecology	6
2.5 Ecological Impact Assessment.....	7
3 Site Description.....	9
3.1 Site Context	9
3.2 Terrestrial Ecology.....	11
3.3 Lizard habitat.....	13
3.4 Avifauna habitat	17
3.5 Freshwater Ecology	18
4 Assessment of Ecological Effects	25
4.1 Proposal.....	25
4.2 Impact on Terrestrial Ecology.....	25
4.3 Impact on Freshwater Ecology	32
4.4 Level of effect.....	38
5 Summary and Recommendations.....	40
References	41

List of Tables

Table 1. Criteria for describing the level of effects (from Roper-Lindsay et al. 2018).	8
Table 2. Lizards recorded within 10 km of the site	14
Table 3. Native birds expected to be present within the site.	17
Table 4. Fish species potentially present in the Kawarau River.	18
Table 5. Level of effect of proposed works on ecological values.	39

List of Figures

Figure 1. Ridgeburn development site boundaries.	4
Figure 2. Ridgeburn - key ecological features in and around the site.....	10
Figure 3. Exotic vegetation within the site.	11
Figure 4. a) Pines on the river terrace escarpment and b) abundant gorse around the pines.....	12
Figure 5. Paddocks in the site were either grazed or cut for hay.	12
Figure 6. a) Morven Hill with patchy scrub present and b) mixed native and exotic scrub on the hill.....	13
Figure 7. Lizard habitat within the site including a) abandoned quarry with loose rock and b) exposed, creviced bedrock.	15

Figure 8. Lizard survey results	16
Figure 9. Intermittent waterway a) 1, b) 2 with pond ii in the background, c) 3, and d) 4 with deer wallows.....	20
Figure 10. a) Typical reach of the water race within the site and b) aqueduct conveying water over wetland B.....	21
Figure 11. Wetlands a) A, b) B, c) C and d) D.....	23
Figure 12. Ponds a) ii, b) iii, c) iv within wetland B and d) v with vi in the background.....	24
Figure 13. Proposed development activities on site, shown in relation to key ecological features.....	27
Figure 14. Lizard habitat, lizard records and proposed release locations.....	30

List of Appendices

Appendix A	Historic aerial images
Appendix B	Draft Pest Animal Management Plan
Appendix C	Draft Lizard Management Plan
Appendix D	Draft Fish Management Plan

STATEMENT OF QUALIFICATIONS AND EXPERIENCE

Annabelle Coates (Author)

I am a Senior Ecologist at Viridis. Viridis is a small consultancy specialising in ecology and environmental science. I have been employed at Viridis since February 2023.

I hold the qualifications of Bachelor of Science, which I completed in 2010 and a Master of Science in Environmental Science from the University of Canterbury, which I completed in 2013. I am a full member of the Environmental Institute of Australia and New Zealand and am a Certified Environmental Practitioner (CEnvP).

I have more than 12 years of professional experience in the ecological consulting field, including roles such as ecologist roles at Biosearches Group Limited and Opus International Consultants Limited (now WSP New Zealand Limited). My experience includes conducting freshwater, terrestrial and coastal ecological impact assessments for both urban and rural developments, as well as ecological restoration and monitoring. I have provided ecological input—such as reporting and reviewing—for projects approved under the COVID-19 Recovery (Fast-track Consenting) Act 2020, and for projects currently undergoing assessment under the Fast Track Approvals Act (2024). Additionally, I have been involved in reporting and reviewing for various land development projects spanning Otago, West Coast, Canterbury, Wellington, Hawke's Bay, Waikato, Auckland and Northland.

I confirm that, in my capacity as author of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

Mark Delaney (Reviewer)

I am a Director and Lead Ecologist at Viridis Limited (Viridis). Viridis is a small consultancy specialising in ecology and environmental science. I have been employed at Viridis since December 2022.

I hold the qualification of a Master of Science in Ecology and Conservation from Massey University, which I completed in 2007. I am a full member of the Environmental Institute of Australia and New Zealand and the New Zealand Freshwater Sciences Society.

I have 15 years of professional experience in the field of ecology, including roles such as Senior Ecologist at Biosearches Group Limited and Ecology Research Technician at Massey University. My experience includes conducting freshwater and terrestrial ecological impact assessments for both urban and rural developments, as well as ecological restoration and monitoring. I have served as the lead project ecologist for several approved projects under the COVID-19 Recovery (Fast-track Consenting) Act 2020, including the Auckland Surf Park Community, Beachlands housing development, Botanic Riverhead development, Brickfields Scott Road development, Melia Place development, Unitec Residential Development – Wairaka Stage 1, and the Te Whenua Haa Ora, Wellsford North, Verran Mews development, Delmore and Milldale - Stages 4C and 10 to 13. Additionally, I am involved in project currently going through Fast Track Approvals Act consenting.

I confirm that, in my capacity as reviewer of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

EXECUTIVE SUMMARY

The Project is a master-planned residential and mixed-use development on an approximately 212-hectare site at 122 Morven Ferry Road, between Arrowtown and the Kawarau River in the Queenstown Lakes District. The development incorporates a mix of uses within a commercial village hub, including retail, shared working space, a daycare, and community facilities. Ridgeburn has been designed to integrate with a network of open space reserves and walking and cycling trails. Each neighbourhood includes access to local amenities and open space. Ridgeburn will be fully supported by on-site three waters infrastructure.

Multiple site visits throughout 2025 were undertaken within the site to understand ecological values currently and potentially present within the site. The site currently operates as a working farm with stock present and pasture managed for grazing and hay making.

Vegetation was largely limited to exotic pasture, mature exotic trees and common agricultural weeds. Occasional native species were present throughout the site including porcupine shrub (*Melicytus alpinus*) and the At Risk – Naturally Uncommon *Anthosachne aprica*. On Morven Hill, vegetation included mixed exotic and native scrubby vegetation interspersed with open areas of pasture. Pest species including rabbits and deer were present with rabbits very abundant. Limited birds were noted during the site visits. The community is expected to be dominated by common native and exotic species, though At Risk – Declining falcon (*Falco novaeseelandiae*) and pipit (*Anthus novaeseelandiae*) are likely to be present. Lizard habitat was present within the site including on rocky outcrops, rock piles, woody debris, under vegetation, and in areas of long grass. A survey of the site identified the presence of large numbers of the Not Threatened McCann's skink (*Oligosoma maccanni*), small numbers of At Risk – Declining mountain beech gecko (*Woodworthia* "south-western") on Morven Hill, and the likely presence of tussock skink (*Oligosoma chionocholes*) around wet areas.

Freshwater features including four low value intermittent streams, four low value wetlands and an artificial irrigation water race were identified within the site. Wetland and stream values were limited by the lack of native vegetation, modification as part of the rural environment, and free access by stock. The high value Kawarau River formed the southern boundary of the site.

Works to develop the residential subdivision have the potential to result in significant detrimental effects, if works occur inappropriately. Vegetation clearance is necessary, however, 103 ha of native shrubland and tussockland revegetation will occur on Morven Hill, the river escarpment, and the river terrace. Once established, it will constitute one of the largest areas of lower elevation native vegetation in the ecological district. Direct and indirect effects on birds and lizards will be mitigated through management practices. Vegetation will not be cleared within the bird breeding season unless a suitably qualified ecologist confirms no native birds are utilising it for breeding. Lizards will be managed through salvage and relocation, releasing them to tussockland habitat on Morven Hill and the river escarpment. Areas of higher value lizard habitat within the development area (e.g. rocky outcrops and exposed bedrock) have been excluded from development and will be retained unaltered.

The artificial water race through the site will be piped. The race presents limited habitat opportunities and its loss as surface water will not result in a loss of water resources for terrestrial fauna due to the presence of the wetlands, streams and Kawarau River, as well as the creation of various stormwater ponds as part of the development. Two intermittent streams will undergo minor realignments. There will be a net gain of 36 lineal metres and 454 m² of intermittent stream habitat as part of the works.

Works within all wetlands have been avoided. Minor earthworks and vegetation clearance are required within 10 m of wetlands A, B and D. No significant changes in wetland catchment size will occur. A 10% increase in flow within wetland B post development will be mitigated through stormwater basins and controlled discharge of water. All streams and wetlands will be subject to enhancement planting appropriate for their location and nature. No detrimental effects on streams or wetlands are expected at the conclusion of works. Constructed ponds will be reclaimed. Fish are unlikely to be present however a fish management plan will be in place in case water is present during works.

Treated wastewater will be discharged at various locations in the site, including within the revegetation on Morven Hill. While irrigation of areas that are currently considered to be dryland has the potential to change the nature of the site, irrigation rates are not high and all areas will not be subject to irrigation every day. The species selected for revegetation are not dryland only species. They are capable of persisting in areas that receive naturally variable precipitation levels. Species performance will be monitored as part of planting maintenance and any species not performing well will be replaced. The application of wastewater will not limit the development and persistence of the revegetation areas. Wastewater will not be discharged within 10 m of any wetland or intermittent stream.

A groundwater take will be established on the river terrace. A hydrological connection exists between the Kawarau River and the aquifer where water will be abstracted. The abstraction volumes will have a negligible effect on water levels in the Kawarau River. The abstraction will not impact on wetland persistence.

Overall, the proposed works will have a low level of impact on ecological values within the site. Lizards present the most significant ecological value currently present within the site. They will be managed through salvage and relocation within the site. The relocation areas will be protected by consent notices and will be subject to habitat enhancement and pest plant and animal control. The lizard population and habitat within the site is not unusual or unique and they are relatively widespread throughout the ecological district. The most abundant lizard within the site (McCann's skink) is widespread and common in the South Island.

The significant revegetation that will occur as part of the development will result in a very large ecological gain. It will provide habitat for species not currently supported within the site or wider area, particularly birds. It will provide linkages to other habitats around the Queenstown area and wider Central Otago. Once established, the revegetation will provide a significant seed source allowing natural successional spread of native vegetation in the surrounding areas. The revegetation, coupled with pest animal and plant control represent a significant local and regional ecological benefit.

1 INTRODUCTION

1.1 Background

The Project is a master-planned residential and mixed-use development on an approximately 212-hectare site at 122 Morven Ferry Road, between Arrowtown and the Kawarau River in the Queenstown Lakes District ('the site'; Figure 1). The development incorporates a mix of uses within a commercial village hub, including retail, shared working space, a daycare, and community facilities. Ridgeburn has been designed to integrate with a network of open space reserves and walking and cycling trails. Each neighbourhood includes access to local amenities and open space. Ridgeburn will be fully supported by on-site three waters infrastructure.

The project will be delivered over a six-year timeframe in six development phases and comprises:

- A total of 1,210 residential units across the site, including 180 affordable units;
- a commercial precinct located at the north-eastern corner of the site, providing approximately 17,420 m² commercial, retail, community and accommodation activities, including a supermarket, daycare, community hall/gym, workspace and retail uses, hospitality (woolshed bar and pizzeria), a pump station, and visitor accommodation/ workers accommodation;
- an estimated 6,554 full-time equivalent (FTE) job-years generated over the development period; and
- approximately 32 hectares of reserve area, 103 hectares of Morven Hill and Kawarau Escarpment Native Restoration, green links and a mix of active and passive recreation areas.

This application seeks consent for the land use, built development and subdivision of the project site to establish Ridgeburn, including all siteworks and consents, and the operational three water servicing.

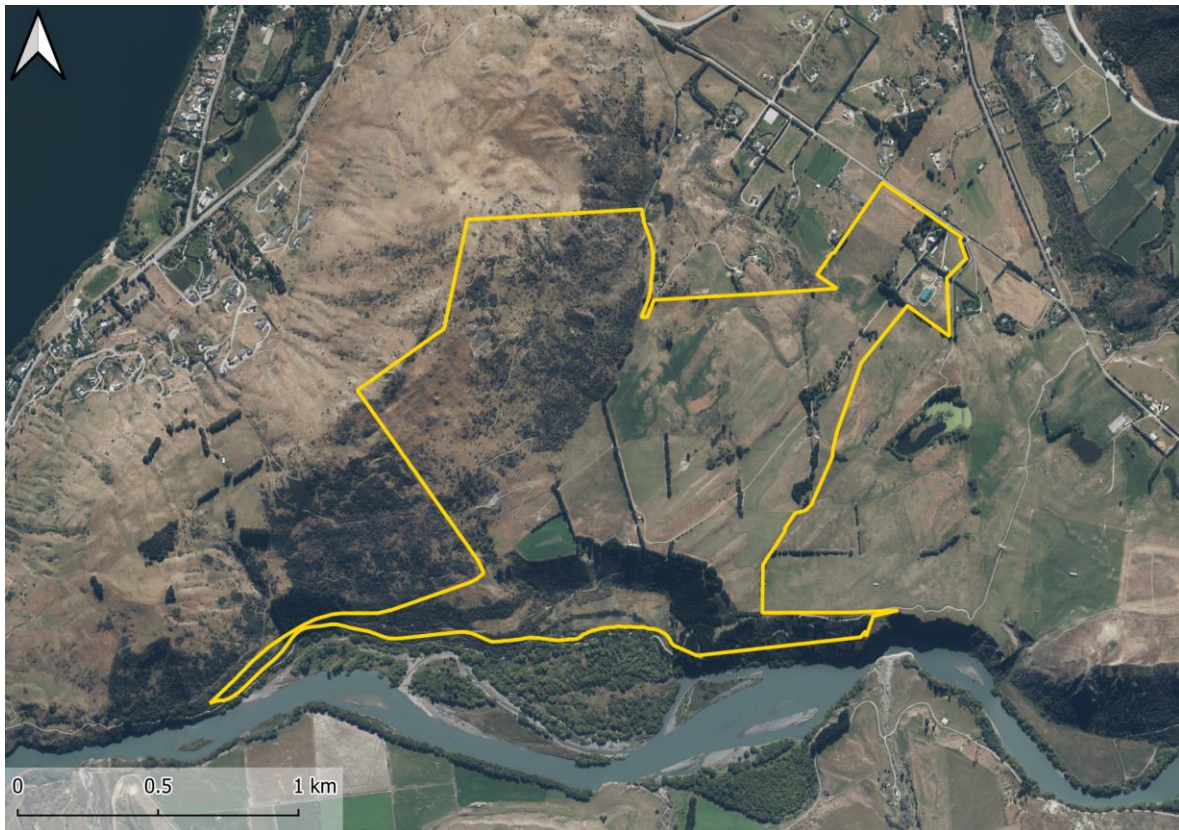


Figure 1. Ridgeburn development site boundaries.

1.2 Assessment Scope

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

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

The assessment has been informed by relevant regulations, including the Otago Regional Council (ORC) and Queenstown Lakes District Council (QLDC) planning documents, the National Policy Statement for Freshwater Management 2020 (NPS-FM), the National Environmental Standards for Freshwater 2020 (NES-F) and the National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB).

2 METHODOLOGY

2.1 Overview

The assessment included a desktop review and various site visits, undertaken by a suitably qualified freshwater ecologist. The desktop review involved an examination of current and historical aerial imagery of the site, during which factors such as changes in vegetation and surface water were noted. A review of data on ORC and QLDC GIS was also undertaken.

Site assessments were undertaken in March and November 2025, during which the presence and extent of freshwater and terrestrial features within the property and surrounding area were recorded and the quality of associated habitat (if any) was visually assessed, in accordance with the methodology detailed in Sections 2.2 through 2.3, below.

2.2 Terrestrial Ecology

The vegetation within the property was assessed during the site visit. The botanical value of both exotic and native vegetation was recorded, and the quality, extent and connectivity of vegetation was considered. Terrestrial fauna habitat was assessed qualitatively, in conjunction with database reviews (e.g., Department of Conservation's ARDs, Bioweb, eBird and iNaturalist) and considered indigenous lizards, birds, and bats. A desktop review of local bat and herpetofauna records from specific databases was undertaken. Opportunistic sightings of avifauna were recorded, and the conservation status of the species, as defined in Robertson et. al. (2021), was noted.

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

2.3 Lizard survey

A formal lizard survey of the site was conducted by e3 Scientific. The survey consisted of 100 baited gee's minnow traps installed across six different areas within the site. The sites were selected to cover the range of habitats present within the site. Traps were installed on 18 November, 2025. Checks of the traps were undertaken on 19, 20, 21, 23, 24 and 25 November. Traps were unset for the nights of 21 and 22 November due to weather conditions being unsuitable for survey. Hand searching accompanying the trapping, including in areas where no traps were set but suitable habitat was present. Hand searched areas including rocky outcrops and rock piles. Captured lizards were identified and their capture location recorded.

2.4 Freshwater Ecology

During the site assessment, the presence and extent of streams and wetlands on site (if any) were noted and the quality of any freshwater habitat was visually assessed. Watercourses were classified as per the ORC Regional Plan: Water for Otago definitions to determine the ephemeral, intermittent or permanent status of the watercourse. Freshwater habitat was assessed, noting ecological aspects such as channel modification, hydrological heterogeneity, riparian vegetation extent, substrate type and any fish or macroinvertebrate habitat observed. Riparian and catchment information was also reviewed and the NIWA New Zealand Freshwater Fish Database (NZFFD) was examined for fish species potentially present within the site.

Where appropriate, potential wetland areas were assessed in accordance with wetland delineation protocols (MfE 2022, Clarkson 2014), to determine if an area met the regulatory definition of 'natural inland wetland' (NPS-FM 2020). Potential wetland areas were assessed based on the prevalence of certain vegetation species and their indicator status ratings, as defined in Clarkson et. al. (2021):

- Obligate wetland (OBL) vegetation, which almost always is a hydrophyte (a plant which only grows in wet environments), rarely found in uplands (non-wetland areas).
- Facultative wetland (FACW) vegetation, which usually is a hydrophyte but can occasionally be found in uplands.
- Facultative (FAC) vegetation, which is commonly either a hydrophyte or non-hydrophyte.
- Facultative upland (FACU) vegetation, which is occasionally a hydrophyte but is usually found in uplands.
- Upland (UPL) vegetation, which is rarely a hydrophyte and is almost always found in uplands.

Where the dominance or prevalence tests showed unclear results, hydric soils and hydrology tests were undertaken in accordance with methodology outlined in MfE (2022) and Clarkson (2014).

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

The ecological values of freshwater features were determined in accordance with the methodology prescribed in the EIANZ guidelines (refer Section 2.4).

2.5 Ecological Impact Assessment

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

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

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

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

Magnitude of Effect	Ecological Value				
	Very High	High	Moderate	Low	Negligible
Very High	<i>Very High</i>	<i>Very High</i>	<i>High</i>	<i>Moderate</i>	Low
High	<i>Very High</i>	<i>Very High</i>	<i>Moderate</i>	Low	Very Low
Moderate	<i>High</i>	<i>High</i>	<i>Moderate</i>	Low	Very Low
Low	<i>Moderate</i>	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

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

3 SITE DESCRIPTION

3.1 Site Context

3.1.1 Ecological District

The site is located on the boundary of the Shotover and Remarkables Ecological Districts (ED) of the Lakes Region. The Shotover ED is characterised steep topography with deeply incised canyons. Winters are cold, and summers are hot, with a generally dry climate. Vegetation includes remnant beech forest, extensive bracken fernland, some scrubland and tussockland, including above the treeline. Snow tussockland is extensive where forest and scrub is absent. Exotic forests have established over time.

The Remarkables ED is characterised by rugged, steep, glaciated mountains up to approximately 2,300 m above sea level. Winters are cold, and summers are hot, with a generally dry climate as a result of the Main Divide rain shadow. Forest in the district is limited and mainly consists of small patches in valleys. Elsewhere, scrub is present with abundant tussock.

As the site is mostly on flat or rolling topography, at altitudes below 500 m above sea level, it is more akin to the Shotover ED.

Fauna habitat would have degraded and reduced over time as agricultural and urban development expanded. Notably, the Shotover district currently provides habitat for falcon (*Falco novaeseelandiae*; At Risk), which are relatively widespread in the wider region. Various dabbling water birds including scaup (*Aythya novaeseelandiae*; Not Threatened) are present on larger waterbodies. Lake Hayes provides habitat for one of the largest populations of Australasian coot (*Fulica atra australis*; At Risk) in New Zealand.

3.1.2 Local context

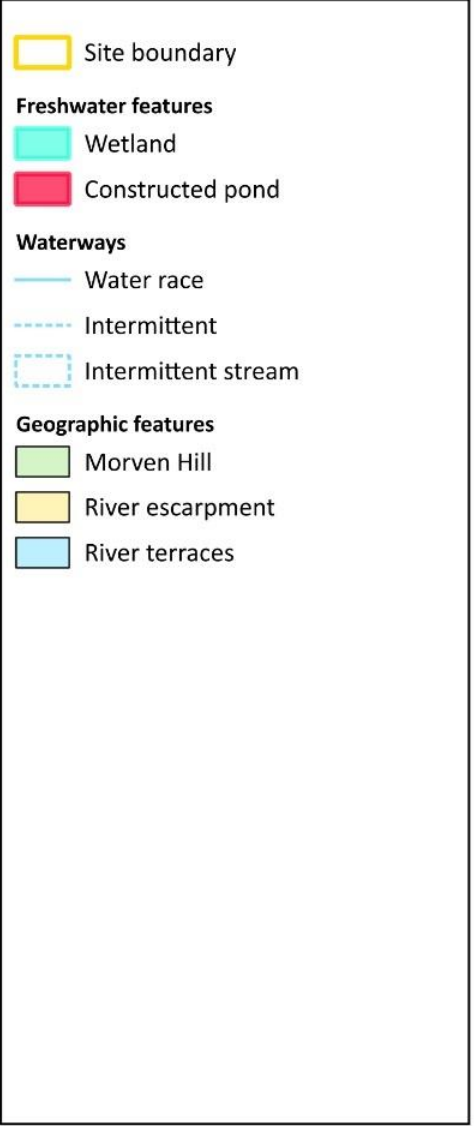
The site represents a highly modified area of the ecological district. While not currently urbanised, the site and surrounding land have been developed for agricultural purposes over time and little native vegetation now remains. The site is on the banks of the Kawarau River, and also in close proximity to Lake Hayes (approximately 1,800 m to the west of the development area). The Arrow Irrigation race meanders through the site. The topography of the land varies from flat, to rolling hills, with the moderately steep Morven Hill rising to approximately 750 m above sea level on the site's western boundary. The site contains two residential dwellings, with various agricultural outbuildings. The entire site is under pasture or fodder crop (lucerne) and is currently lightly grazed with grass also cut for hay. It has been set up for deer with deer fences throughout. Natural wetlands are present, associated with a gully. Various constructed ponds are present throughout the site, including ponds constructed within the wetland system. The surrounding landuses are mostly agricultural and residential lifestyle. Low to moderate density development is present around Lake Hayes, to the west, and further afield is the township of Arrowtown and the Shotover Country development.

Historically (pre-human) the site likely comprised of beech forest with scrub and/or tussockland in exposed areas. A review of historical aerial imagery shows the site was well established as farmland by the earliest available aerial image, dated 1958 (Appendix A). However, the wider area has been farmed since the 1860s and therefore it is likely it has been devoid of any significant native vegetation for more than 150 years.

The key ecological features on site and the surrounding landscape are presented in Figure 2 and discussed in more detail in Sections 3.2 and 3.3, below.



Figure 2 - Ridgeburn - key ecological features in and around the site



SOURCES	
Nearmap.com 2025	
DISCLAIMER: This map/plan is not an engineering draft. This map/plan is illustrative only and all information should be independently verified on site before taking any action.	
SCALE	1:6,500 @ A3
PROJECT NO.	10339
DRAWN BY:	AJC
MAP NO.	10339-Map2-5
DATE:	21/01/2026



3.2 Terrestrial Ecology

3.2.1 Exotic vegetation

The botanical value of the exotic vegetation within the site was considered to be low.

Vegetation within the site was mostly limited area shelterbelts, small areas of woodland, and an area of pine trees. Shelterbelts were present along various paddocks and were predominantly pine (*Pinus* sp.). The pines were mature with several showing evidence of damage from strong wind prior to the November site visit (e.g. broken branches and some fallen individuals). The shelterbelts were generally long and thin (one or two trees wide) and were heavily influenced by edge effects. Pine needles under the pines generally prevented establishment of other species.

Small areas of woodland were located mostly on the flats, along the main laneway and around the dwellings (Figure 3). Species present included poplar (*Populus* sp.), oak (*Quercus* sp.), gum (*Eucalyptus* sp.), walnut (*Juglans* sp.), chestnut (*Castanea* sp.) and common alder (*Sambucus nigra*). Vegetation under these trees was generally pasture, however large areas of the common weed hemlock (*Conium maculatum*) were also present. The woodland areas were generally relatively narrow, and were influenced by edge effects, though not to the same degree as the shelterbelts.

On part of the terrace separating the main part of the site from the flood flats of the Kawarau River was an area of plantation pine (Figure 4a). Gorse (*Ulex europaeus*) was abundant around the edges of the area of pines (Figure 4b). Some of the pines had been recently cleared and were dominated by establishing weeds such as hemlock, thistles (*Cirsium arvense*), and gorse, however some areas had been managed with evidence of spraying.

a)



b)



Figure 3. Exotic vegetation within the site.

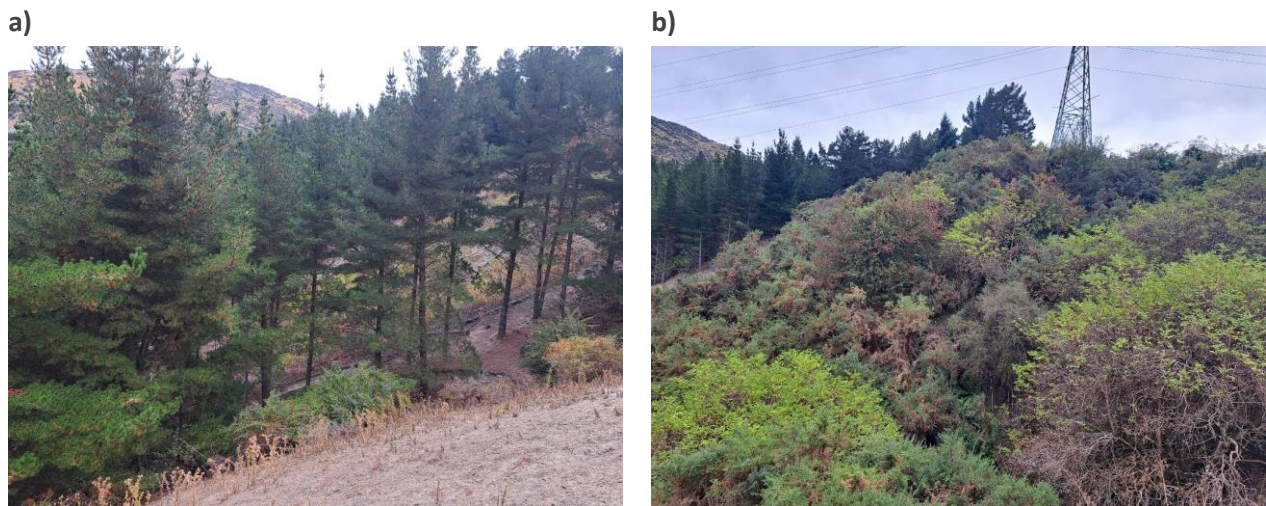


Figure 4. a) Pines on the river terrace escarpment and b) abundant gorse around the pines.

3.2.2 Paddocks

The botanical value of the paddocks was considered to be negligible.

Paddocks formed the dominant vegetation type within the site. Each paddock generally consisted of one main pasture type such as ryegrass (*Lolium perenne*) or sweet vernal (*Anthoxanthum odoratum*). Various other species were present, in lesser amounts, including white clover (*Trifolium repens*), Yorkshire fog (*Holcus lanatus*), brown top (*Agrostis capillaris*), brome (*Bromus* sp.) and common pasture associated weeds. Grass was of varying length, depending on the time since grazing or cutting. During the March site visit, grass was short, reflective of the drier time of year and recent hay making.

At least one paddock had been cultivated for lucerne (*Medicago sativa*) though lucerne and oat (*Avena sativa*) plants were observed beyond the cultivated paddock suggesting rotational cultivation practices. Rotating fodder crops and pasture is a common agricultural practice.

A small number of the At Risk – Naturally Uncommon *Anthosachne aprica* were identified in the gully containing wetland B. *Anthosachne aprica* is a grassland species found in Central Otago within tussock grasslands at elevations of 150–200 m. While not believed to be threatened, it occupies a very narrowly defined range that is vulnerable to loss of habitat.

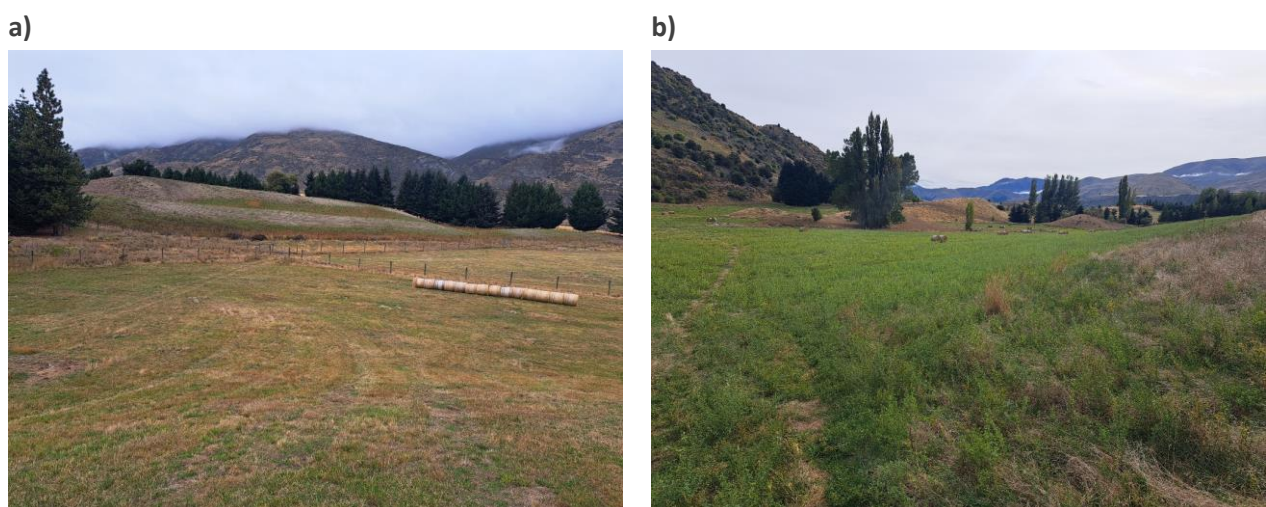


Figure 5. Paddocks in the site were either grazed or cut for hay.

3.2.3 Morven Hill

The botanical value of the vegetation on Morven hill (not subject to residential development) was considered to be low-moderate.

The hill in the western part of the site was dominated by scrub, though there were large areas of pasture, and pasture was also present underneath the scrub (Figure 6a). Pasture species were a combination of those observed in the paddocks. Scrub was a combination of native and exotic species and included the native matagouri (*Discaria toumatou*) and porcupine scrub (*Melicactus alpinus*) and the exotic briar (*Rosa rubiginosa*), hawthorn (*Crataegus monogyna*), broom (*Cytisus scoparius*), and elder (*Sambucus nigra*) (Figure 6b). Despite being present in the wider site, gorse was not identified in the hill area, though it is likely present in isolated pockets.

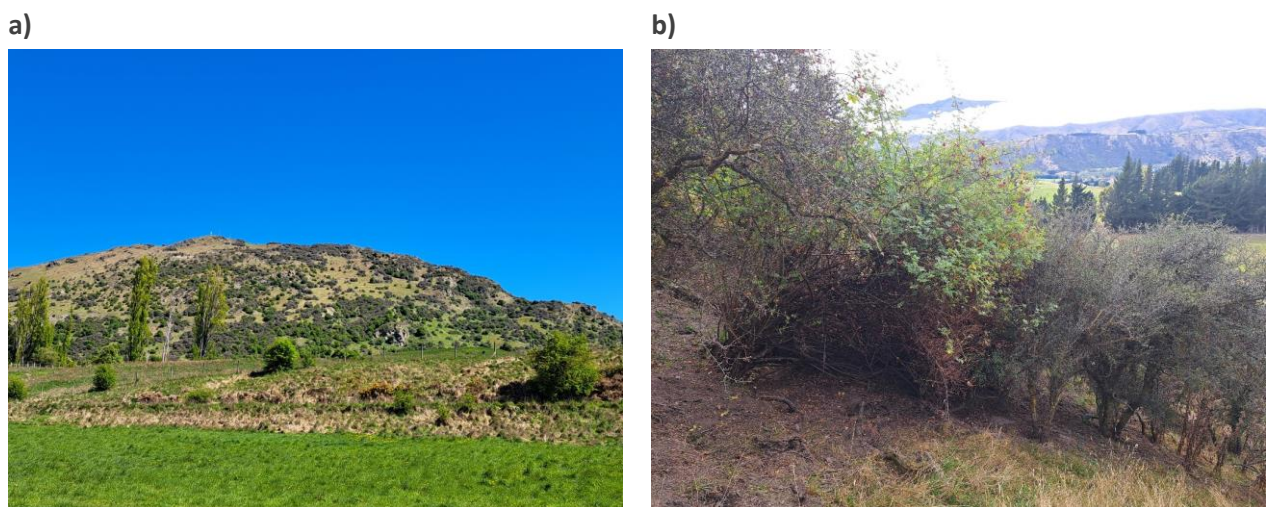


Figure 6. a) Morven Hill with patchy scrub present and b) mixed native and exotic scrub on the hill.

3.3 Lizard habitat

The ecological value of the site where lizard habitat was present was considered to be moderate to high, while it was considered to be low in the remainder of the site.

Eleven species of lizard have been recorded within 10 km of the site (Table 2). Due to the highly variable habitats present within 10 km of the site, many of the species are unlikely to be present in the site itself. It is worth noting the species identification and naming of lizards is rapidly evolving and therefore the list provided in Table 2 may not reflect current species lists or names. Species either known to be present, or expected to be present within the site include McCann's skink (*Oligosoma maccanni*), tussock skink (*Oligosoma chionocholescens*), and mountain beech gecko (*Woodworthia* "south-western").

Various areas of lizard habitat were present throughout the site (Figure 2). Habitat was mostly characterised by areas piles of rock (Figure 7a) or exposed bedrock (Figure 7b), and areas under shelterbelts, treeland and amenity planting. Exposed bedrock was present in a number of locations within the area to be developed, including on the edges of the gully containing the wetland. Where the bedrock was creviced, a small number of skinks were observed within the crevices.

A lizard survey was undertaken by e3 Scientific in November 2025. One hundred baited gee minnow traps were distributed throughout the site, in six main areas (Figure 8). The areas were focused around areas where lizard habitat values were considered to be good. A total of 78 McCann's skink were captured in traps and by hand search during the survey. An additional 22 were either observed or

captured by hand within the survey area. Figure 8 shows where lizards were captured, including from traps and from hand searching. No McCann's skink were captured in the trap line on Morven Hill, however they have been observed on the hill, and the habitat present is suitable for them. Manual searching of exposed rock areas on the hill identified the presence of a small number of mountain beech gecko. No tussock skink were observed or captured, however the habitat along the wetlands and intermittent streams, particularly along wetland B, is suitable for them. It is considered likely they are present in areas of suitable habitat, at least in small numbers.

The hill block contains a significant pest population including mice, rats and mustelids which are known to predate on lizards, and rabbits and deer which browse on vegetation limiting habitat quality. As a result, the lizard population on the hill block is not expected to be at carrying capacity, unless pests are controlled.

Beyond the areas of identified lizard habitat, the paddocks provided low quality habitat for native lizards. The current grazed nature of the site, coupled with the current and historical practices of grazing and hay making, mean habitat within the grazed paddocks was limited. Grass was generally not long enough to provide suitable skink habitat, and the exotic vegetation on the flats and in the paddocks was not suitable for geckos. Areas of longer grass were associated with the wetlands where steeper slopes prevented hay making.

Table 2. Lizards recorded within 10 km of the site .

Common name	Species name	Conservation status	Likelihood of presence on site
Cryptic skink	<i>Oligosoma inconspicuum</i>	At Risk - Declining	Low
Kawarau gecko	<i>Woodworthia</i> "Cromwell"	At Risk - Declining	Low-moderate*
Korero gecko	<i>Woodworthia</i> "Otago/Southland large"	At Risk - Declining	Low-moderate*
Lakes skink	<i>Oligosoma</i> aff. <i>chloronoton</i> "West Otago"	Threatened – Nationally Vulnerable	Low
McCann's skink	<i>Oligosoma maccanni</i>	Not Threatened	Known to be present
Pallid skink	<i>Oligosoma</i> aff. <i>inconspicuum</i> "pallid"	At Risk - Declining	Low
Roys Peak gecko	<i>Mokopirirakau</i> "Roys Peak"	At Risk - Declining	Very low
Short toed gecko	<i>Woodworthia</i> "southern mini"	At Risk - Declining	Very low
Southern grass skink	<i>Oligosoma</i> aff. <i>polychroma</i> Clade 5	At Risk - Declining	Low
Tussock skink	<i>Oligosoma chionocholescens</i>	At Risk - Declining	High [#]
Mountain beech gecko	<i>Woodworthia</i> "south-western"	At Risk - Declining	Known to be present*

Notes: * suitable habitat present on the hill area only. # suitable habitat in close proximity to streams/wetland only.

a)



b)



Figure 7. Lizard habitat within the site including a) abandoned quarry with loose rock and b) exposed, creviced bedrock.

Figure 8 - Lizard survey results

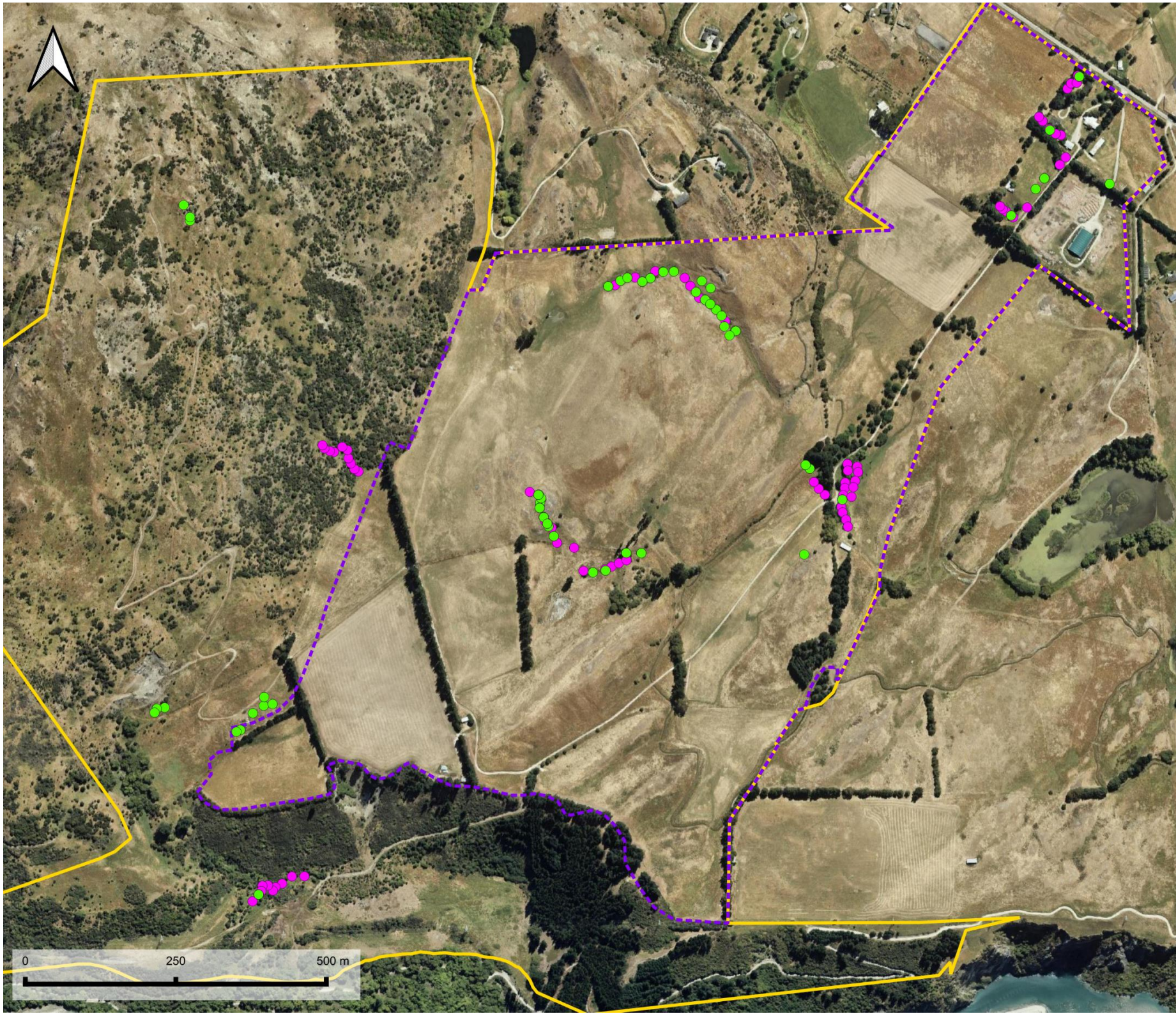
-  Site boundary
-  Development area
-  Trap locations
-  Lizard observations

SOURCES
Nearmap.com 2025

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SCALE **1:8,000 @ A4**

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DATE: 21/12/2025



3.4 Avifauna habitat

The value of the site for avifauna, including as their habitat, was conservatively considered to be moderate, due to the potential for Threatened and At Risk species to be present. A high value has not been prescribed due to the modified nature of the site and high incidence of pests and grazed nature of the site.

While no formal bird survey was undertaken, all birds observed during the two site visits were recorded. The bird community was heavily dominated by common exotic species with very few native species observed. Table 3 provides a list of native species observed on site, as well as species likely to be present based on review of records for nearby areas and habitat present on site. At Risk – Declining falcon and pipit are likely to be present. Both species have been recorded in the immediate vicinity, and widely recorded in the wider area. Habitat within the site is suitable for both species, including suitable nesting habitat (both are ground nesting species). As the site is grazed, or cut for hay, nesting habitat is not as abundant as it could be. The proximity of the site to the Kawarau River means there is the potential for braided river birds to utilise the area for nesting, roosting or foraging. Both the development area and the river terraces are too vegetated (with grass, and scrub on the terraces) to provide habitat suitable for nesting and roosting. Braided river birds utilise areas of open, exposed gravels where there is line of site to approaching predators. They may periodically forage within the site, however the site does not constitute a significant foraging habitat, particularly given the proximity to areas such as Lake Hayes and Lake Wakatipu.

There are various native species present in the wider Queenstown that are unlikely to be present due to the lack of habitat. These include tui, rifleman, tomtit and brown creeper. It is expected they would be present if suitable native vegetation was present within the site.

Habitat present within the site was generally limited to the shelterbelts and exotic woodland, with some provided by the larger scrub on the hill area. These provided some nesting and roosting habitat and would also provide foraging habitat for insectivorous species around the vegetation. The paddock areas, where protected from stock grazing, may also provide habitat for ground nesting species including harrier and falcon. Habitat such as this was very common in the wider area.

Table 3. Native birds expected to be present within the site.

Common name	Species name	Conservation status	Observed on site
Australasian harrier	<i>Circus approximans</i>	Not Threatened	✓
Pipit	<i>Anthus novaeseelandiae novaeseelandiae</i>	At Risk - Declining	
Paradise shelduck	<i>Tadorna variegata</i>	Not Threatened	✓
Bellbird	<i>Anthornis melanura melanura</i>	Not Threatened	
Falcon	<i>Falco novaeseelandiae</i>	Threatened – Nationally Vulnerable	
Spur winged plover	<i>Vanellus miles novaehollandiae</i>	Not Threatened	✓
Fantail	<i>Rhipidura fuliginosa fuliginosa</i>	Not Threatened	
Black backed gull	<i>Larus dominicanus dominicanus</i>	Not Threatened	✓
Welcome swallow	<i>Hirundo neoxena neoxena</i>	Not Threatened	✓

Grey warbler	<i>Gerygone igata</i>	Not Threatened	
Pied stilt	<i>Himantopus himantopus leucocephalus</i>	Not Threatened	

3.5 Freshwater Ecology

Figure 2 shows the freshwater features present within the site.

3.5.1 Kawarau River

The ecological value of the Kawarau River was considered to be high-very high.

The Kawarau River forms the sites southern boundary, however, due to the semi braided nature of the river at this point, there is at least 70 m between the property boundary and flowing water. The river flows out of Lake Wakatipu and also receives water from the Shotover River. It continues to flow generally eastwards, through a gorge, before flowing into Lake Dunstan near Cromwell. Ultimately, water discharged to the coast near Balclutha, via the Clutha River. The river is subject to a Water Conservation Order (WCO) for various reasons including ecological and natural values.

Adjacent to the site, the Kawarau River active channel ranges between 100 and 200 m in width. Water is mostly contained within one main braid, with occasional minor braids in the wider areas. Substrates are gravel and riparian vegetation is dominated by exotic species, namely willow (*Salix* sp.). There is limited ecological monitoring data for the river, likely due to the depth of the channels making sampling difficult. LAWA.org.nz includes one monitoring site just downstream of the site, however only two macroinvertebrate samples are recorded (2022 and 2023). These results suggest moderate to high water and habitat quality. Water quality parameters measured also show high water quality. The only exception to this is clarity, however the dynamic nature of the wider area and the inputs from Lake Wakatipu mean variable water clarity is not unexpected.

There are limited records in the NZFFD for the Kawarau River, also likely to be due to the size of the river making sampling difficult. Species that have been recorded in the river itself, but also in the wider catchment, are listed in Table 4. It is possible that any of the species listed could be present adjacent to the site.

Table 4. Fish species potentially present in the Kawarau River.

Common name	Species name	Conservation status
Longfin eel	<i>Anguilla dieffenbachii</i>	At Risk – Declining
Brown trout	<i>Salmo trutta</i>	Introduced and Naturalised
Perch	<i>Perca fluviatilis</i>	Introduced and Naturalised
Common bully	<i>Gobiomorphus cotidianus</i>	Not Threatened
Rainbow trout	<i>Oncorhynchus mykiss</i>	Introduced and Naturalised
Koaro	<i>Galaxias brevipinnis</i>	At Risk – Declining
Shortfin eel	<i>Anguilla australis</i>	Not Threatened

3.5.2 Intermittent waterways

The ecological value of the intermittent waterways was considered to be low.

Four intermittent streams were identified within the site. Waterway 1 (~220 m in length) formed the outlet point for wetland B (discussed further in section 3.5.5). It contained water during the November site visit, but not during the March site visit (Figure 9a). The upper and mid reaches of waterway 1 contained moderate flow during the November site visit. Substrates were dominated by compacted sediment/soil, not loose sediment/soil, further supporting the intermittent classification. The channel was approximately 0.5 m wide, and water was generally less than 0.3 m deep. The channel was well shaded by exotic vegetation, namely hawthorn trees. The lower reaches of the channel gradually reduced in size until no channel or water was observable. Review of aerial images suggests the channel would have continued north, before veering northwest at approximately the location of the northern most constructed pond. The channel has likely been modified over time and no longer flows continuously.

Instream habitat was considered to be of low quality, largely due to the intermittent nature of the flow. It is expected the stream only flows during the wetter periods of the year. The week prior to the November site visit, Queenstown had received significant rain and approximately 10 cm of snow. As a result, the area was considered to be close to saturated. It is unlikely the stream supports any fish due to both the intermittent nature and the lack of connectivity to its lower catchment.

Waterway 2 (~150 m in length) was located close to the site's eastern boundary. It drained a small, shallow gully area and discharged into a constructed pond (Figure 9b). Review of historical aerial images does not suggest a channel was present in this location, however the topography, and the fact a small amount of flowing water was present during the November site visit means an intermittent classification was considered appropriate. While portions of the channel were vegetated with pasture grass, other reaches did not contain terrestrial vegetation, and exposed soil formed the substrate. It is expected waterway 2 only flows for relatively short periods of time during wetter periods. No fish are expected to be present at any time, due to the very small amount of water present when flowing and lack of connection to other surface water habitats.

Waterway 3 was a short reach (~75 m) discharging from wetland D. It was not flowing during the March site visit and contained moderate flow during the November site visit (Figure 9c). Like waterway 1, substrates were compacted sediment, and it flowed through an area of exotic trees (poplars and willows). It ultimately flowed into the Morven Ferry water race through a diffuse type discharge. No fish are expected to be present due to the intermittent nature and expected lack of fish in the water race (discussed below).

Waterway 4 was located near the sites southwestern corner. There was no obvious receiving environment for this stream, and it appeared to flow subsurface at its terminus. The stream had been highly trampled by wallowing deer and large pools of mud were present (Figure 9d) which also made it difficult to determine natural length, channel width and shape. Approximately 150 m of channel was able to be identified. Hydrologic heterogeneity was limited and it is expected no fish will be present due to the lack of connection to other surface water. No riparian vegetation was present.



Figure 9. Intermittent waterway a) 1, b) 2 with pond ii in the background, c) 3, and d) 4 with deer wallows.

3.5.3 Morven Ferry water race

The ecological value of the Morven Ferry water race was considered to be low.

The Morven Ferry water race flows through the site (Figure 10a). It entered the site on the northern boundary and then meandered largely southwards through the site before it flowed out on the site's eastern boundary. The race is artificial and has clearly been constructed. Water is sourced from the Arrow River, near Arrowtown and enters the race network via a weir and intake. It is then transported through a 5.5km pipe before entering the open channels. It did not follow natural contours and in one location it flowed, via an aqueduct, over a natural wetland (Figure 10b). There are no records in the NZFFD for the race. Observations on site did not yield any fish (bullies are usually observable). It is possible fish may be present within the race, depending on connections to other surface water (i.e., if fish barriers are present), however, given the steep discharge to the Kawarau River, movement of fish from the river into the race is considered limited. The only fish potentially present will be species with climbing ability such as eels or koaro. Fish habitat within the race was limited, with no undercut banks, instream vegetation or hydraulic heterogeneity. The race does not discharge to any other surface waters, and therefore does not provide fish passage pathways to any natural waterways.

Artificial water races are not inherently low value just due to their artificial nature. In some areas, they represent a significant source of water for terrestrial species, and aquatic habitat, and they can behave in a somewhat natural manner (i.e. subject to flow variation, habitat variation). However, the wider area is not characteristically 'dry' due to the presence of the Kawarau River, plus Lake Hayes, Lake Wakatipu and various large and small waterways. The water race therefore is not considered to provide important water sources for the area.

A low ecological value has been prescribed despite the potential for At Risk species to be present. The race is entirely artificial. It contains no natural reaches, and the source of the water is flow diverted artificially into it. Within the site there was essentially no riparian vegetation meaning water temperatures are likely to be elevated significantly during summer. Fish habitat was lacking and habitat heterogeneity was lacking. It was fully accessible to stock. It is considered possible, but unlikely fish would be able to enter the race given the artificial water source and steep discharge point to the receiving waters (Kawarau River). For these reasons, a low value is considered appropriate.

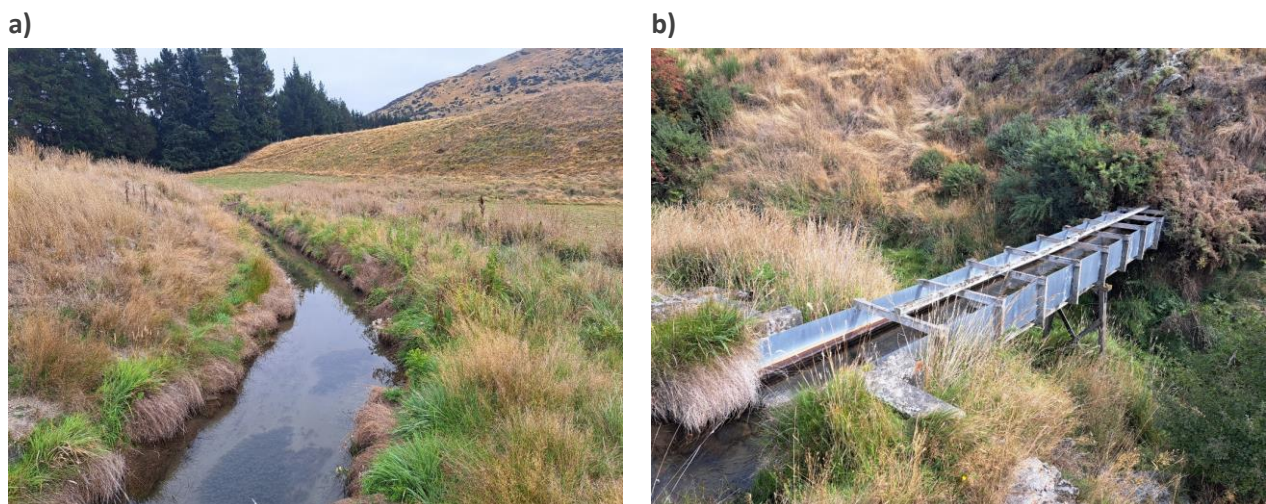


Figure 10. a) Typical reach of the water race within the site and b) aqueduct conveying water over wetland B.

3.5.4 Artificial drains

The ecological value of the artificial drain was considered to be negligible.

One constructed drain was identified within the site, near the site's eastern boundary. It was unnaturally straight and consisted of two main channels connected by an approximately 90° corner. The channel flowing northwest-southeast was constructed along a fence line.

No water was present in the majority of the drain during either site visit. A small amount of pooled water was present at the downstream extent during the November site visit. No outlet or receiving environment was identified and there was no evidence of these channels being present on historical aerial images. The lack of water meant aquatic values were essentially non-existent.

3.5.5 Wetlands

The ecological value of the wetlands within the site, in their current form, was considered to be low, due to the dominance of exotic species and lack of structural complexity.

Four natural inland wetlands were identified within the site. Wetland A was a small wetland, located near the northern portion of the site. It was within a small fenced off area near existing deer yards

(Figure 11a). The area was dominated by *Carex secta* (OBL) with lesser amounts of creeping bent (*Agrostis stolonifera*; FACW), Yorkshire fog (FAC) and hemlock (*Conium maculatum*; FAC), thus passing the rapid test. There was no apparent inlet or outlet for the wetland, though it is noted that this area is close to the lowest point in the site and likely acts as a receiving area for overland flow.

Wetland B was a large wetland located within a gully (Figure 11b). The area was dominated by exotic, had relatively low diversity, and lacked structural tiers. Dominant species were the exotic pastures creeping bent and Yorkshire fog, with occasional marsh foxtail (*Alopecurus geniculatus*; FACW). Other species present in smaller amounts included *Glyceria* (OBL), *Carex* (FACW), watercress (*Nasturtium officinale*; OBL) and *Juncus articulatus* (FACW). Upland species including white clover (FACU) and perennial ryegrass (FACU) were present within the wetland boundaries on areas that were slightly elevated. Shallow water and damp soil were intermittently present and these areas generally contained *Glyceria* and watercress. The boundaries of the wetland were delineated based on clear changes in vegetation (i.e. where vegetation moved from being dominated by OBL and FACW species to FACU and UPL species) and clear changes in topography and hydrology. The wetland was well contained within the gully base.

It was considered likely the gully contained more streamlike characteristics historically. The introduction of grazing animals has likely trampled and widened the area allowing a stream to spread out and wetland conditions to form. Wetland B discharged through intermittent waterway 1. It is considered the characteristics of waterway 1 was likely what was historically present within wetland B.

Wetland C was moderately sized wetland located just south of the wetland B. This wetland was characterised by a sparsely vegetated concave surface vegetated mostly with creeping bent and a small amount of *J. articulatus*, though this species was not present during the November site visit (Figure 11c). Surface water, however, was present during the November site visit. This wetland was considered to be ephemeral.

Wetland D was similar in nature to wetland B containing the same vegetation species and being heavily dominated by creeping bent. It was located in a small gully, with the gully bottom containing the wetland (Figure 11d). Vegetation included a higher proportion of upland plants, however ponded surface water was present and soil was saturated. The area was conservatively considered to be a natural inland wetland, with the boundaries clearly delineated by the topography of the gully base.

Tadpole shrimp (*Lepidurus apus viridis*; Threatened – Nationally Endangered) can reside in temporary shallow ponds and wetlands. They are not found in deeper water and only rarely found in permanent water. Wetland and constructed pond habitat on site has the potential to support tadpole shrimp. However, their presence is considered unlikely in Wetlands A and B, due to the lack of water and permanent water, respectively. Their presence in Wetlands C and D is also considered unlikely due to the access by stock and associated pugging and compaction of the soil. It is possible, but unlikely tadpole shrimp are present within the wetlands.

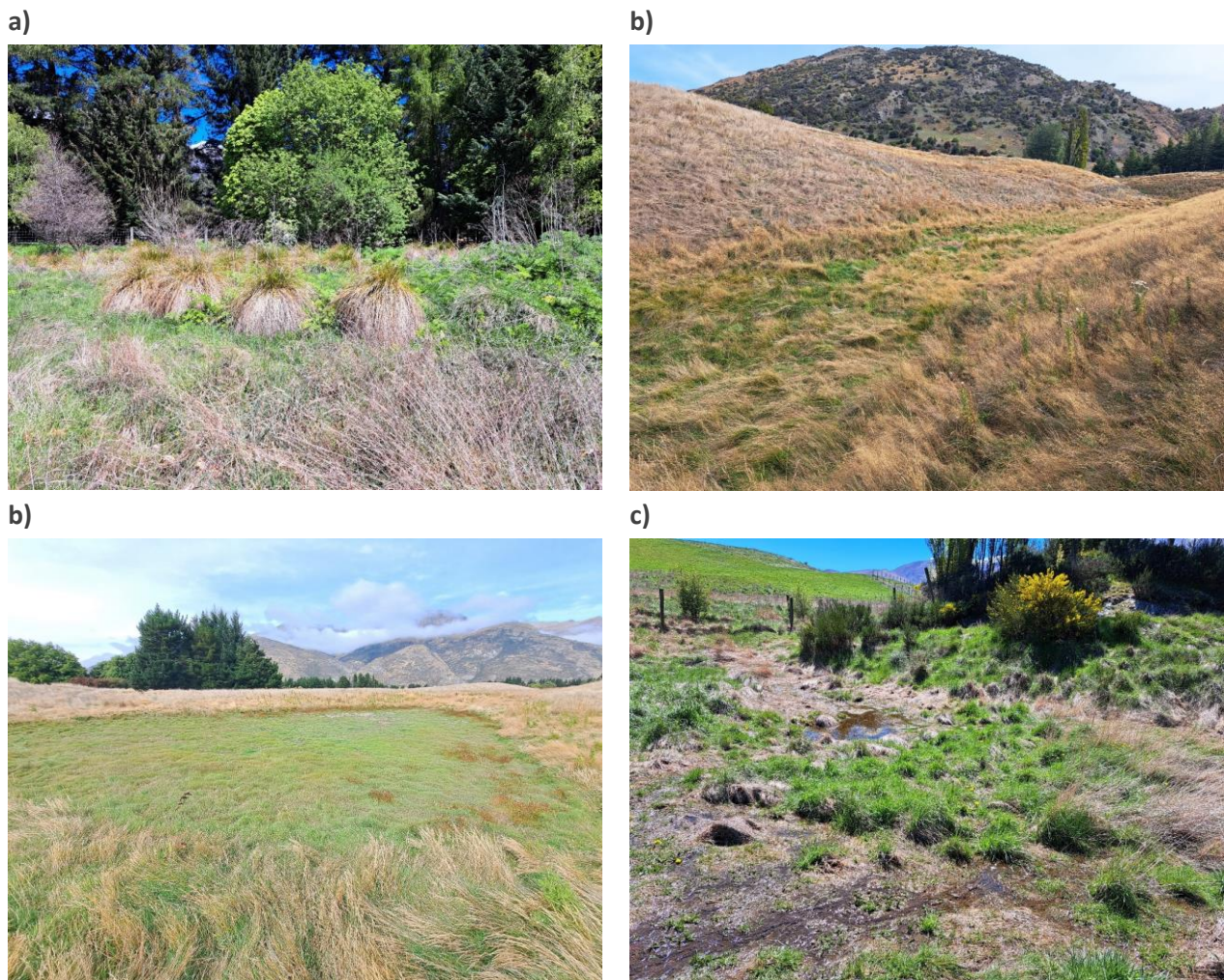


Figure 11. Wetlands a) A, b) B, c) C and d) D.

3.5.6 Constructed ponds

The ecological values of the constructed ponds were considered to be low when water is present, and negligible when dry.

Seven constructed ponds were identified within the site. All ponds were artificial in nature and have been likely constructed as a source of stockwater. Pond i was located in the norther part of the site. It did not contain water during either of the site visits however aerial images suggest water is intermittently present. The pond appeared to be constructed on what would have been the flow path of intermittent waterway 1. The pond discharges through a constructed channel to the west of the site.

Pond ii acted as the receiving environment for intermittent waterway 2. It did not contain water during either of the site visits however soil was damp during the November site visit. Hydrophytic vegetation was present in the pond (creeping bent and marsh foxtail) however, as it is clearly constructed, it does not meet the definition of a natural inland wetland under the NPS-FM.

Pond iii was located adjacent to an area of exotic treeland. It had no clear inlets or outlets. It was dry in March, but contained water during the November site visit. It was roughly rectangular in shape and contained no vegetation during either site visit.

Pond iv was located within wetland B. A bund was located at the downstream end suggesting the gully had been excavated and dammed, likely to provide a more consistent source of stockwater. The pond

contained hydrophytic vegetation including *Glyceria* and watercress. It was entirely surrounded by natural inland wetland and wetland conditions were likely present prior to pond construction.

Ponds v, vi and vii were located on the flow path that forms the upper catchment of wetland B. All three ponds had been clearly excavated and bunds were present on the downstream ends. Ponds v and vii were dry during the March site visit. All ponds contained a small amount of water during November, however this was considered to be due to the significant rainfall that had occurred in the preceding week. No formal outlets were observed though ponds v and vi were connected by a short, shallow channel. They are not visible in historical aerial images and it is considered likely they were constructed to trap and store runoff to provide a more consistent source of stock water.

Tadpole shrimp are considered unlikely to be present in the constructed ponds mostly due to the access to all ponds by stock, significantly reducing the quality of the habitat through trampling, pugging and introduction of contaminants such as faecal coliforms.

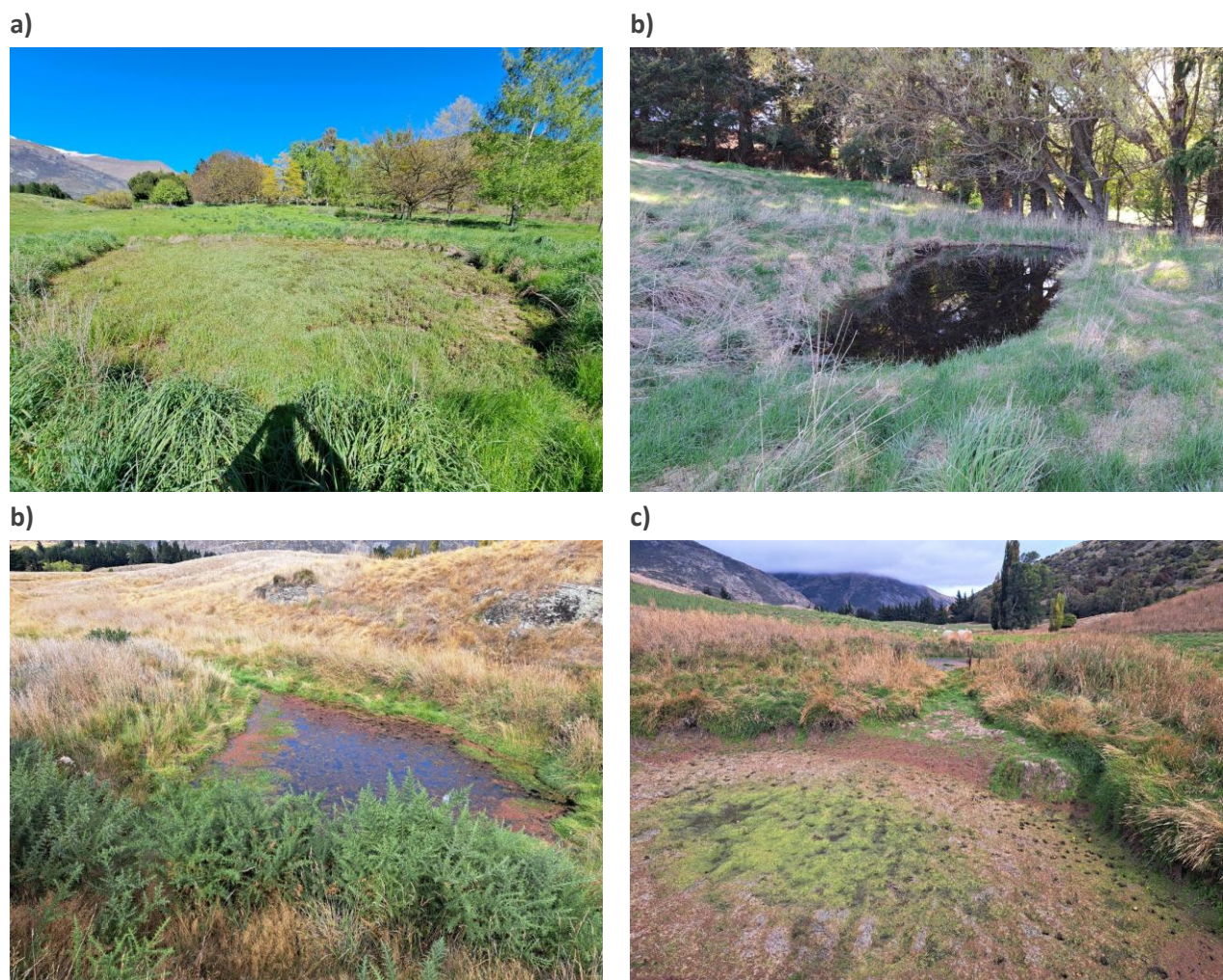


Figure 12. Ponds a) ii, b) iii, c) iv within wetland B and d) v with vi in the background.

4 ASSESSMENT OF ECOLOGICAL EFFECTS

4.1 Proposal

To facilitate the development of Ridgeburn subdivision, it is proposed to:

- Undertake bulk earthworks across the site, including within 10 m and 100 m of natural inland wetlands;
- Remove vegetation;
- Discharge stormwater;
- Discharge wastewater to land;
- Abstract groundwater; and
- Undertake extensive revegetation.

Figure 13 presents the footprint of these activities in relation to the key ecological features in and around the site. The magnitude and level of effect that these activities have been assessed in Sections 4.2 and 4.3 below.

4.2 Impact on Terrestrial Ecology

4.2.1 Vegetation removal

The magnitude of effect of removal of vegetation from the site is considered to be moderate, mitigated to positive.

The majority of the vegetation within the earthworks boundary, including pasture, exotic trees and pines on the river escarpment, will be removed to facilitate bulk earthworks and construction activities. Some mature exotic trees are planned to be retained in the northern portion of the site. The Naturally Uncommon *Anthosachne aprica* within the wetland B gully will be unimpacted as works will not occur in this area. The species is also included in the tussock planting mix for the site revegetation (RMM 2026).

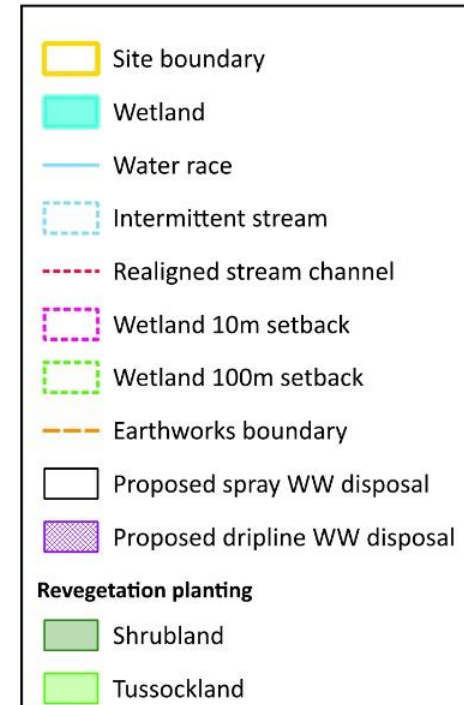
Significant revegetation and amenity planting will occur throughout the site (Figure 13). Approximately 11 ha of planting within open and shared spaces is proposed as part of the development as well as approximately 5 ha of riparian and wetland planting and 6 ha of slope planting. An additional approximately 68 ha of shrubland revegetation planting will occur on Morven Hill and the river escarpment, and an additional approximately 35 ha of tussockland planting on Morven Hill and the Kawarau River terrace. A total of 103 ha of ecological revegetation is proposed as part of the site development. This will be complemented by control of pest plant and animal species within all plantings on Morven Hill, the escarpment and the river terrace. The plantings on the hill will provide a significant area of native planting and represent one of the largest areas of native vegetation in the wider Queenstown-Arrowtown area. The addition of tussockland planting on the hill and the river terrace allows the continuation of open habitat that is currently present, albeit with a shift from exotic grassland to native tussockland. Weed and pest control will significantly enhance ecological values within the open habitat. A draft Pest Animal Management Plan is provided in Appendix B. The planting on the escarpment will replace what is currently plantation pines. It will act as a buffer between the development and the Kawarau River, and will provide opportunities for linkages along the river corridor. If neighbouring properties are developed over time, a corridor of native vegetation along the river could potentially extend from the Shotover confluence through to Gibbston Valley. The native revegetation will have a considerably positive impact on ecological values both locally, and regionally.

Native shrubland/forest is an incredibly rare ecosystem in the Otago area east of the Southern Alps. Establishment of any portions of native shrubland/forest that are self sustaining (large enough to resist significant weed invasion, adverse effects of inclement weather, provide seed sources for natural regeneration) represent a significant ecological gain to both the ecological district and region. Once established, the revegetation area will represent one of the largest areas of native shrubland, moving towards forest, in the ecological district, and wider region. The area will act as a seed source, providing for the potential expansion of native vegetation into surrounding areas. Tussockland has also been greatly reduced in the area with the proliferation of farming in the area over time.

The revegetation will achieve similar outcomes to the ongoing Project Tohu, currently being undertaken by QLDC. Project Tohu involves native revegetation of a former plantation forest on the south facing slopes of Coronet Peak. The two revegetation projects (Project Tohu and the Ridgeburn revegetation) will be very complimentary. Project Tohu is located approximately 8.5 km from the Ridgeburn revegetation area, with Lake Hayes in between, meaning birds are likely to be able to move between to the two sites, as well as the habitat around Lake Hayes, very easily.



Figure 13 - Proposed development activities on site, in relation to key ecological features



SOURCES
Nearmap.com 2025

DISCLAIMER: This map/plan is not an engineering draft. This map/plan is illustrative only and all information should be independently verified on site before taking any action.

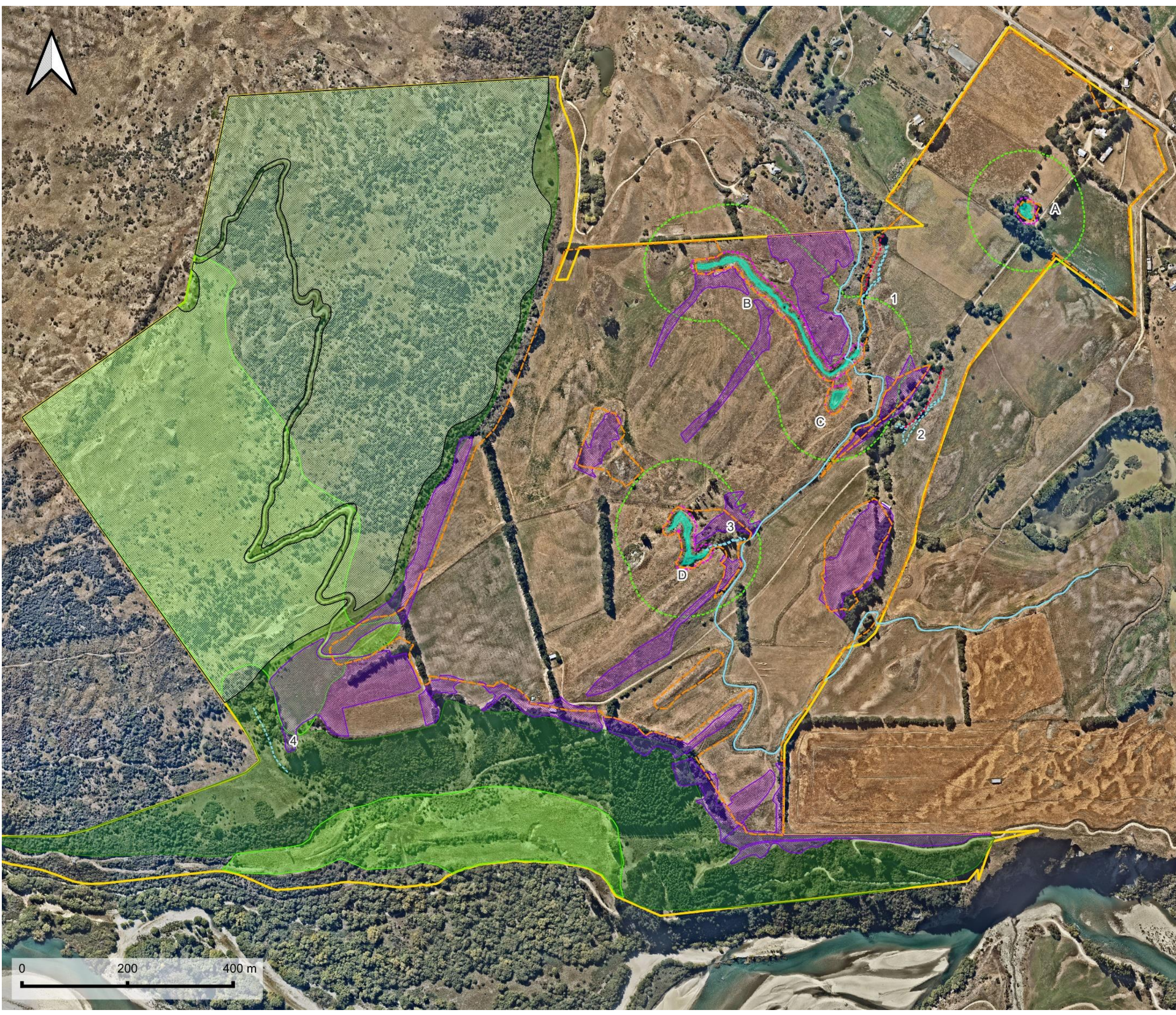
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PROJECT NO. 10339

DRAWN BY: AJC

MAP NO. 10339-Map5-2

DATE: 05/03/2026



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4.2.2 Impact on lizards

The magnitude of effect of the proposed works on lizards is considered to be moderate, mitigated to low.

Earthworks and construction activities in areas where lizards are known to be present have the potential to disturb and harm them. Various areas of lizard habitat were present within the site and skinks were identified within these areas.

As lizards are not considered to be highly mobile, they have limited ability to move quickly to safety. Works in areas they inhabit can result in death or injury. While some areas of known lizard habitat will be unimpacted by the proposed works, other areas will be subject to physical works including earthworks and vegetation clearance. Indirect effects on lizards include the loss of habitat as a result of works, associated construction activities and ongoing use of the site as a residential area. McCann's skink are expected to be the species most impacted by works as they are likely to be present anywhere within the site where habitat is suitable. While tussock skink are also potentially present, their habitat is limited to areas around streams and wetlands, which will mostly not be subject to works. Gecko presence will be limited to Morven Hill and to areas of exposed rock. These areas will not be subject to works.

Approximately 0.2 ha of high value rock piles and associated vegetation (the abandoned quarry), approximately 7.1 ha of moderate value mixed exotic tree/shrubland (shelterbelts, exotic treeland, amenity garden) and approximately 23 ha of low value grazed pasture, will be lost from the site. Approximately 55 ha pasture/cropland that is routinely grazed and cut for hay will also be lost, however the length of vegetation in these areas and lack of refugia means the value of these areas is significantly limited. No areas of exposed rock will be lost.

In the first instance, works around most of the areas of higher value lizard habitat (e.g. the exposed rock features within the site), have been explicitly avoided (Figure 14). These features could be subject to earthworks to develop these areas into residential lots, however, they have not been included in the development boundary as they were identified early on as valuable lizard habitat.

As works in at least some of their habitats cannot be avoided during construction, it is recommended a lizard management plan (LMP) is prepared outlining how lizards will be managed during works. The LMP should include measures to capture native lizards from any suitable habitat within the site, and locations where they will be released. A draft LMP has been prepared in Appendix C. It is currently planned to relocate salvaged lizards to various locations within the site including the hill area where there is significant rocky habitat, and the elevated river terrace adjacent to the Kawarau River. There are plans for revegetation plantings, pest animal and weed control, and legal protection in these areas. Revegetation will increase the habitat available on the hill block allowing it to support higher densities of lizards due to an increased availability of refugia and food resources. Exotic pests including mustelids, rats and mice prey on, or compete with lizards for resources. Controlling predator numbers, ultimately leading to a significant reduction in predation pressure and competition, will have relatively rapid positive impacts on lizard populations. Longer term, sustained predator control will allow higher numbers of lizards to persist within the rehabilitated habitat. Pest control is not specific to lizard mitigation, rather it has been designed to cover all aspects of the site, including lizards. Additional, smaller relocation areas within the site are also proposed, focused around areas where no earthworks will occur and that will remain undeveloped.

Relocation sites A, B and C will also be subject to application of treated domestic wastewater. Relocation site D will not. There is little to no research pertaining to the effects of treated wastewater discharges on lizards and as a result, the physical impacts of the discharge on lizards remains somewhat of an unknown. However, drip and spray irrigation (of both wastewater and freshwater) is common throughout New Zealand at varying scales ranging from single house domestic wastewater irrigation to municipal wastewater discharge and large scale agricultural pivot irrigators. Skinks persist in these areas given appropriate habitat. Not all areas of the wastewater disposal fields will be used every day, with application depending on useage and weather. Therefore, application of wastewater will not occur continuously. Skinks will be preferentially relocated to area D, with areas A, B and C being used as necessary.

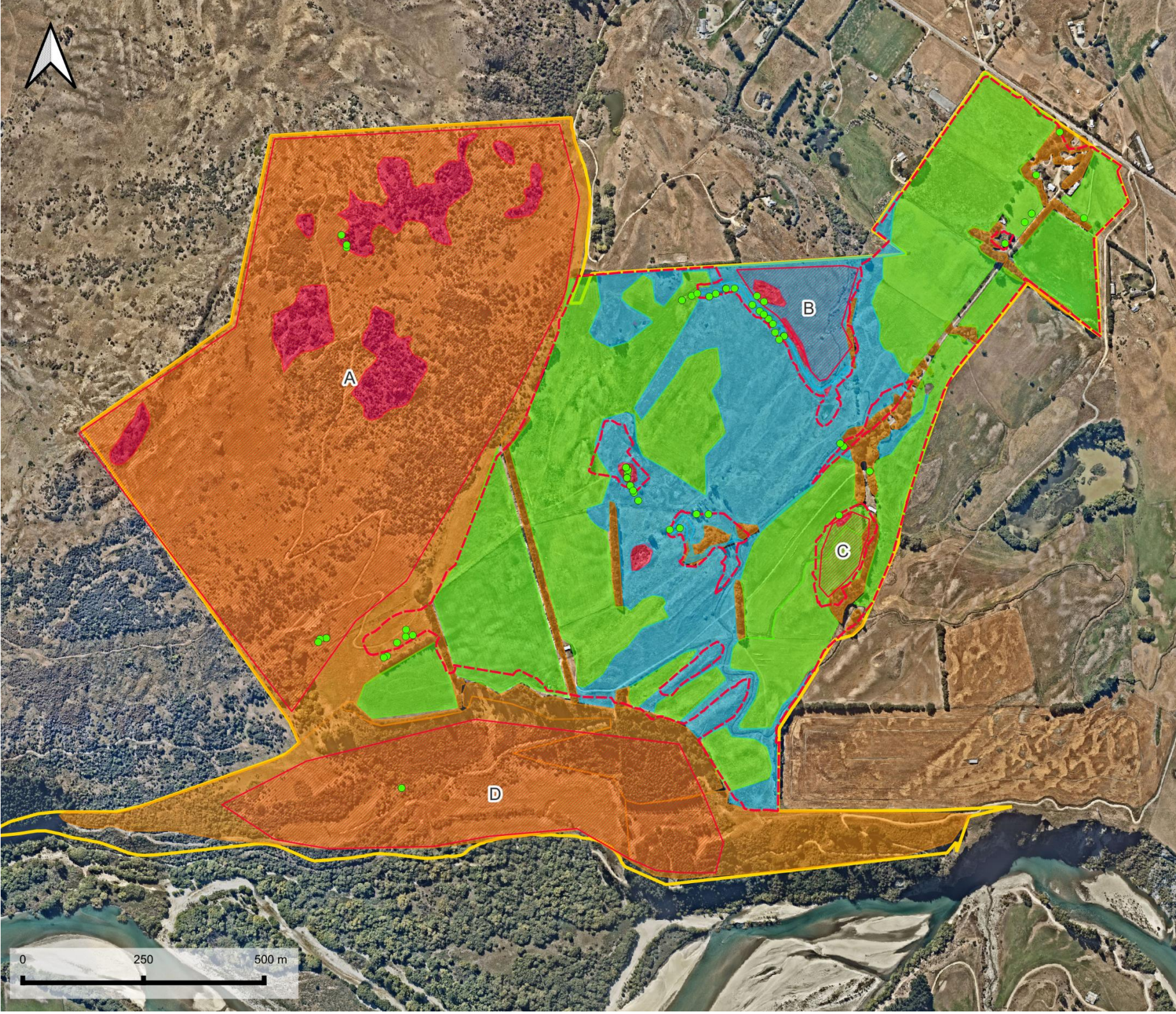
Revegetation on Morven Hill and the river escarpment and terrace will result in changes to the vegetation and therefore habitat that is currently present. It is proposed to have two types of planting – shrubland and tussockland. The shrubland will be focused around areas where there is existing exotic dominated scrub, while the tussockland planting will occur where pasture is the dominant current vegetation. As a result, no change in habitat availability in the revegetation sites is expected. Low stature vegetation will remain, providing basking habitat for skinks, while gecko habitat will be enhanced by native shrubland planting.

The application of wastewater has the potential to alter vegetation type through introduction of more water. The potential implications of this is discussed in section 4.3.5. Changes in vegetation as a result of wastewater application is not expected to impact lizards.

A Wildlife Act authority will be sought, allowing for lizard salvage and incidental killing.



Figure 13 - Lizard habitat, lizard records and proposed release locations



- Site boundary
- Earthworks boundary
- Lizard release sites
- Lizard observation

- Lizard habitat**
- High
- Moderate
- Low-moderate
- Low

SOURCES
Nearmap.com 2025

DISCLAIMER: This map/plan is not an engineering draft. This map/plan is illustrative only and all information should be independently verified on site before taking any action.

SCALE **1:10,000 @ A4**

PROJECT NO. 10339
DRAWN BY: AJC
DATE: 05/03/2026

4.2.3 Impact on birds

The magnitude of effect of the proposed works on birds is considered to be moderate, mitigated to low/positive.

While bird habitat within the site was limited, the works have the potential for both direct and indirect effects on the bird community. Birds are highly mobile, unless they are nesting, or have eggs or chicks in the nest. They can move over relatively large distances, depending on the species, to find suitable habitat as required. Clearance of trees and areas of ungrazed grass during the bird breeding season has the potential to result in direct mortality of birds, eggs and chicks. It is recommended that removal of any vegetation occurs outside of the bird nesting season (October to February, inclusive). If clearance is unable to occur outside of breeding season, it is recommended that a condition of consent requires an ecologist to inspect the affected vegetation within 24 hours of clearance. If active native bird nests are identified, a minimum 10 m buffer must be maintained around the nesting site until an ecologist deems it to be inactive.

The loss of, and disturbance to, habitat within the site is not expected to permanently displace the bird community, including from the development area itself, and the river terraces where some works will be required to install and operate water supply bore/s. There is significant unaffected similar habitat, as well as higher quality habitat, in the wider landscape. The habitat within the site is not unique or unusual. Habitat within the development area, Morven Hill, the escarpment and the river terraces is common in the immediate and wider vicinity. It is expected any birds present within the site will move away from the disturbed habitat while works are occurring and will recolonise the site once works have been completed.

The significant planting and revegetation that is proposed, including within the development area and on the hill and escarpment, will provide a large amount of high quality habitat for native birds. As discussed in section 3.4, there are various native bird species present in the wider Queenstown area for which there is currently no habitat within the site. The development of the hill and escarpment revegetation will introduce suitable habitat for these species, and it is expected they will ultimately colonise these areas. Once the revegetation plantings have established, it is expected the bird community diversity will markedly increase.

4.2.4 Increased domestic animals resulting from landuse change

The magnitude of effect the landuse change and associated increases in domestic and pest animals is considered to be moderate, mitigated to low.

Developing the site from rural land use to urban land use is expected to significantly increase human population density in the area, due to the current undeveloped nature of the site. An increase in human population density often brings an increase in rat and mice abundance, however there will be an increase in pest control where it is currently limited. Potentially significant increases in domestic cat numbers may occur due to the increase in residential development in an area where residential dwellings are not common. An increase in domestic dogs is also likely, however dog control bylaws are expected to limit the impact of dogs provided they are leashed and/or contained within properties. It is recommended signage is installed in reserves as well as on any access points to Morven Hill stating that dogs must be on leashes.

The establishment of the revegetation planting on Morven Hill and the river escarpment will increase habitat availability for possums, rats and mustelids. Pest control within these areas will occur on an

ongoing basis, mitigating the potential increase in population. Numbers of rabbits and hares are likely to decrease. Rabbits and hares were particularly abundant within the site, however the development of residential properties will drastically reduce available habitat within the site leading to a corresponding decrease in population.

Overall, it is considered that the development of the site will result in a negligible increase of pest animal effects, however the community composition of the pest population is expected to change.

4.3 Impact on Freshwater Ecology

4.3.1 Effects on intermittent streams

The magnitude of effect of the proposed works on intermittent streams is considered to be low.

Waterway 4 is not within the works boundary. Waterway 3 will not be subject to instream works. Waterways 1 and 2 will be subject to minor channel realignments to better accommodate infrastructure within the site (McKenzie and Co drawings 4048-0-4340 to 4347). A 92 m length (204 m² base area) of intermittent stream 1 will be realigned slightly to the west of the current alignment. The proposed new channel will be 126 m in length and have a base area of 629 m². A 135 m reach (813 m² base area) of intermittent stream 2 will be realigned slightly to the west. The new channel will be 137 m in length with a base area of 842 m². Overall, the realignments will result in an increase in intermittent stream within the site of 36 lineal metres and 454 m². There will be no vertical realignment of the streams, therefore they will maintain the same level of connectivity to groundwater.

Stream Ecological Valuations (SEVs) were not undertaken in the assessment of potential effects associated with the proposed stream realignments. SEVs were originally developed by Auckland Council as a tool to quantify stream ecological value and determine appropriate levels of offsetting through compensation ratios. While the methodology is sometimes used by councils outside of Auckland, no reference data has been published for the Otago region.

The proposed realignments will not result in any net loss of stream extent or area. The existing streams are considered to have low ecological value due to the absence of riparian vegetation, both current and historic impacts from stock access, and their likely modified state associated with long-term agricultural land use.

Ecological values will self-evidently improve as a direct result of the proposed works, primarily through the establishment of riparian planting. The potential value of the streams will not be adversely affected. Consequently, no significant adverse residual effects are anticipated, and offsetting or ecological compensation is not required. Potential effects associated with the realignments will be appropriately addressed through mitigation measures, including erosion sediment control, fauna management and the establishment of 10 m wide riparian planting along the affected reaches.

Accordingly, SEVs are not considered necessary for this assessment, as the calculation of compensation ratios is not required and there will no loss of stream extent or value. Both streams are intermittent and do not discharge to surface water, rather water contained within them infiltrates to ground at the downstream extents. The realignments will not alter the nature of the streams. Currently, the channels are freely accessible to stock, and as such, have been heavily trampled and the banks are not well defined. The new channels will be contained within clear, battered banks. The banks will be planted with the riparian mixes indicated in the landscape plans which will provide bank stability, as well as

increase ecological function through provision of shade, organic matter and fauna habitat. The development of the site as a whole will remove stock from the full site.

The intermittent nature of the streams means the new channels can be constructed simply offline, and connected to the original alignments during periods when they are not flowing. As such, no impact on fish habitat is expected, and channels will have time to stabilise prior to commissioning. The catchments of the streams are not large enough, and the gradients not steep enough to generate significant flow energy. It is considered the new channels will not present any more significant risk of scour or erosion than currently occurs. The risk may even be somewhat reduced through the development of riparian vegetation.

While minor works will occur within 10 m of the channels not subject to realignment, they will not impede on the channels themselves. The streams will be subject to a minimum of 10 m riparian enhancement planting on each bank as part of the site development. Stream 4 will be within the proposed Morven Hill revegetation area, thus subjected to significantly more planting. Provision of riparian planting will result in significant improvements to the value of the waterways through increased shading, filtration of overland flow and uptake of nutrients, bank stabilisation, organic matter inputs likely contribute to more variable instream habitat. Riparian planting has been designed to include stream side species on the wetted edge, extending to larger species on the upper banks. Planted streams represent a very large improvement from the current riparian and instream management.

4.3.2 Effects of pond reclamation

The magnitude of effects of reclamation of ponds i to iii, and v to vii is considered to be high, mitigated to low. Pond iv will not be impacted by proposed works as it is located within a natural inland wetland.

While the value of the ponds is limited, due to the fact they only occasionally contain water, their reclamation in their entirety means the habitat, albeit intermittent, will no longer be available. It is highly unlikely tadpole shrimp are present in the ponds. Retention of habitat they are potentially, but unlikely present in the wetlands means the bulk of the potential habitat on site is retained. It is recommended reclamation occur when the ponds are dry. If the ponds are dry, no fish will be present. If water is present, it is recommended dewatering is monitored by an ecologist who will be on site to capture and relocate any fish present. It is recommended this is included as a condition of consent. As it is considered highly unlikely fish will be present, a full fish management plan is not considered necessary for pond reclamation.

Once wider side development has been completed, various stormwater facilities will have been constructed. These will provide intermittent ponded habitat similar to what is currently present within the ponds, however the establishment of native planting around the stormwater features will mean they will provide wider habitat values, not just aquatic habitat.

4.3.3 Effects on wetlands

The magnitude of effect on wetlands is considered to be low.

Under the NES-F, the following regulations have been considered for proposed works within the site:

- Vegetation clearance within, or within a 10 m setback from a natural inland
- Earthworks or land disturbance within, or within a 10 m setback from a natural inland

- Earthworks or land disturbance outside a 10 m, but within a 100 m, setback from a natural inland wetland if it results in, or is likely to result in, the complete or partial drainage of all or part of the wetland
- The taking, use, damming, or diversion of water within, or within a 100 m setback from, a natural inland wetland if (there is a hydrological connection between the taking, use, damming, or diversion and the wetland; and if the taking, use, damming, or diversion will change, or is likely to change, the water level range or hydrological function of the wetland
- The discharge of water into water within, or within a 100 m setback from, a natural inland wetland if there is a hydrological connection between the discharge and the wetland; and if the discharge will enter the wetland; and if the discharge will change, or is likely to change, the water level range or hydrological function of the wetland

There are four natural inland wetlands within the earthworks boundary.

No works will occur within any of the wetlands. Earthworks, and therefore vegetation removal will occur within 10 m of wetlands A, B and D. Approximately 581 m² of earthworks and vegetation clearance will occur within 10 m of wetland A. Approximately 198 m² of earthworks and vegetation clearance will occur within 10 m of wetland B, limited to the upstream most part of the wetland. Approximately 408 m² of earthworks and vegetation clearance will occur within 10 m of wetland D. No works will occur within 10 m of wetland C. A 10 m planted buffer will be established around all wetlands and therefore any vegetation loss is temporary. The wetlands themselves will also be subject to enhancement planting.

The significant revegetation around the stream and wetlands, and within the wetlands, will result in a significant increase in ecological values for all wetlands through increasing buffering distances, filtration of runoff, uptake of nutrients, provision of habitat for both terrestrial and aquatic species, connectivity, and a general increase in diversity increasing the resilience of the system. Approximately five hectares of native planting will occur in and around the streams and wetlands. Species have been selected to be appropriate for the relatively dry environment and are not expected to take up water from the environment to the point where water levels change in the wetlands. RMM 2026 provides the planting palettes for the wetland enhancement. Species have been selected to reflect natural conditions of the area. Wetlands A and D are currently well vegetated in the riparian zone. Large trees are present throughout these wetland riparian areas and water persists despite this. Wetland B contains water year round and its location within a gully (i.e. a collecting point for water) and the steep sides of the gully will ensure water continues to enter and flow through the wetland, despite planting. Wetland C is more ephemeral and has been dry or mostly dry during some site visits. The riparian zone is currently pasture grass. It is proposed to replace this with lower stature plants only to minimise water requirements for the riparian zone.

It is recommended no large trees are planted within 10 m of the wetlands except around wetlands A and D where they will replace exotic trees. This is to reduce the likelihood of riparian vegetation utilising water from the wetlands and shallow groundwater, altering water levels in the wetland. To protect the ephemeral and low stature vegetation nature of wetland C, it is recommended flax is not planted in or around the wetland either.

Earthworks are required within 100 m of wetlands. The flow through the catchments for wetlands A, C and D will change by 5%, 0.5% and 0% respectively (McKenzie and Co drawing 4048-0-4251). These

changes are negligible and no change in water level range or hydrological function are expected to occur. Wetland B will increase by 10% (McKenzie and Co drawing 4048-0-4251). Upstream of wetland B, stormwater ponds will be constructed. These will act to slow down water discharged from the upper part of the catchment into wetland B, mitigating the effects of the slightly larger flow. As a result, no changes in water level range or hydrological function of wetland B are expected.

Stormwater and wastewater will be discharged within 100 m of all wetlands. Wastewater is discussed in more detail in section 4.3.5 below. The volumes of water discharged will not alter hydrological function or water level range as discharge rates are appropriate for slope and soils. Stormwater discharges will occur within 10 m of all wetlands. As discussed above, the catchment sizes and changes, or lack of, to stormwater volumes are limited or have been mitigated. Water discharged to the wetlands would have entered the wetlands via overland flow and infiltration regardless of the site development. The installation of outfalls formalises what would have occurred naturally, into point source discharges. The physical discharge of water has the potential to generate scour and erosion, detrimentally impacting wetlands. No outfalls will be located within the wetlands themselves. All outfalls will be appropriately engineered to reduce discharge energy and therefore the effect of erosion and scour will be mitigated.

As the wetlands themselves will not be impacted, no impact on the potential, but unlikely presence of tadpole shrimp is expected. Habitats available in the wetland C, the most likely habitat, will be unimpacted.

4.3.4 Effects of stormwater discharges

The magnitude of effect of the proposed stormwater discharges will be low.

Development of the site includes the installation of various stormwater management devices including wet and dry ponds, landscape ponds, wetland ponds and conveyance channels and vegetated swales. All stormwater management practices will be designed and implemented in accordance with QLDC COP and ORC guidelines. Stormwater generated from impervious and disturbed surfaces will be conveyed through swales and a wetland detention pond, which provide treatment through a combination of sedimentation, filtration, and biological uptake. Full details of stormwater management are provided in McKenzie and Co 2025.

The physical discharge of stormwater from outfalls has the potential to detrimentally impact receiving environments through erosion and scour. Effects of discharge on wetlands has been discussed above. No outfalls will discharge directly to the natural streams. Providing outfalls are designed to minimise discharge energy, no detrimental effects on ecological values are expected.

4.3.5 Effects of the wastewater discharge

The magnitude of effect of the wastewater discharge will be low.

Wastewater generated on site will be treated in a centralised wastewater treatment plant (WWTP) and discharged at various locations throughout the site. The WWTP will be a Sequencing Batch Reactor (SBR) system. The SBR process treats sewage in controlled batches through aeration, biological digestion, and settling within the same tank, producing high-quality effluent suitable for land irrigation or controlled discharge (McKenzie and Co 2025; WGA 2026).

Two methods of discharge are provided for in specific locations including trench, dripline and spray. Spray irrigation is proposed along most of Morven Hill and the escarpment. Dripline irrigation is proposed around various location within the site.

No irrigation or discharge of wastewater will occur within 10 m of a stream or wetland.

Wastewater will be treated to tertiary level, significantly reducing nutrient and faecal coliform levels. Application rates have been calculated to be appropriate for the soils and slope in each area and as such, no runoff is expected meaning no detrimental impacts on streams or wetlands. Additionally, vegetation present in the discharge areas will uptake both water and nutrients, improving growth and survival outcomes. The estimated level of nitrogen loading significantly less than the potential for interception, uptake, attenuation, and removal provided by the native planting strategy (WGA 2026). With appropriate plantings and irrigation management in place, negligible nitrate-nitrogen infiltration to groundwater is expected. Shallow groundwater within the development potentially discharging to on-site wetlands on a perennial or seasonal basis is therefore expected to have negligible nitrate-nitrogen impacts. Estimated phosphorus loading exceeds the expected potential annual native planting uptake rate (WGA 2026). However, phosphorus is less mobile than nitrogen and is expected to be attenuated through adsorption to soil particles and retention within soils and strata.

No effects are expected on nutrient loads in the Kawarau River due to the Morven Hill spray area being within the Arrow River catchment (WGA 2026).

The application of wastewater to the site, which is currently a dryland, relatively low productivity environment, has the potential to alter the natural soil moisture and nutrient conditions, potentially changing the vegetation community from what would occur naturally. The proposed micro-spray irrigation on Morven Hill uses low design hydraulic loading rates to minimise environmental impacts. The average loading rate across the whole area at the maximum daily volume is 2.3 mm/day (about 840 mm/year). The maximum design rate is 3.5 mm/day during winter (no evapotranspiration adjustment) and up to 6.5 mm/day in summer (including 3 mm/day conservative evapotranspiration allowance). These rates are applied across the constructable area of about 52.3 ha, targeting a maximum daily disposal of 1,196 m³/day, with redundancy (35 to 65% reserve area seasonally).

There is low annual rainfall (about 889 mm/year estimated at the site) onto vegetation/topsoil over silty sand, colluvium, and schist. The added 840 mm/year increases total water input to 1,729 mm/year. Average evapotranspiration at the site in its natural setting is estimated at 612 mm/year. The low rates align with guidelines (AS/NZS 1547:2012) for at least Category 4 soils, avoiding over-saturation as rates are designed be less than infiltration capacity. Overall, wastewater is expected to increase soil moisture. However, at the nominated low loading rates, it is not expected that water logging or a shift to anaerobic soil conditions will arise due to terrain steepness and infiltration capacity. The purpose of the design loading rates nominated based on site testing is for no discrete ponding or runoff to occur with the soil remaining aerobic, preserving dryland-like structure.

It is expected that the proposed irrigation will extend growing seasons. Nutrient levels and soil chemistry changes are to be expected. For example, the projected vegetation growth would lead to increased organic content in the topsoils and topsoil thickness. However, the risk of negative effects on soil structure is expected to be low. For Morven Hill, the proposed nitrogen loading is estimated at 54 kg N/ha/year and phosphorus at about 67 kg TP/ha/year. According to Meister (2022), who investigated interactions of treated municipal wastewater with native plant species, at significantly higher loading rates of 194 kg N/ha/year and 110 kg P/ha/year, soil nutrient levels increased but the loading led to no impairment of soil structure across the three-year study.

It is recommended any plants not thriving after application of wastewater commences, be replaced for an alternative species to be determined at the time. The application of wastewater will not prevent

native plants establishing and thriving and providing the associated habitat and ecological benefits. However, there may be some change in the nature of the habitat. Weed control will occur on an ongoing basis, preventing any weed species becoming dominant.

4.3.6 Effects of piping the water race

The magnitude of effect on the water race is considered to be very high, however the artificial nature and low value mean the overall level of effect of the proposed works will be low.

At the request of Arrow Irrigation, the irrigation race that currently runs through the site will be piped within the site boundaries. As a result there will be a complete loss of aquatic habitat within the race. While the race is an artificial habitat, water races can still provide ecological values such as instream habitat, riparian margins and water sources for terrestrial fauna. Races can be particularly important as a source of water to terrestrial fauna in naturally dry environments.

However, in the context of the site, the loss of the surface water associated with the race will not result in significant detrimental impacts to the habitats present. While the wider area is relatively dry, water is present within the wetlands, including a likely permanent presence in wetland B and prolonged presence in wetland D and the intermittent streams. The site is also in close proximity to the Kowarau River and Lake Hayes, providing water sources for more mobile species such as birds. The development of stormwater and amenity ponds will provide new permanent water sources within the site for less mobile species.

There is a possible hydrological connection between the water race and groundwater within the site (WGA 2026). However, it is not clear whether the irrigation race is losing water to the groundwater or vice versa, or both, depending on season and the reach of the water race. Currently, the race flows through an aqueduct over the lower reaches of wetland B. Water was observed leaking from the aqueduct and entering wetland B, which in turn, feeds intermittent stream 2. Piping of the race will remove this water source potentially reducing flow in the wetland and intermittent stream 2. The loss in flow will be mitigated by slight increase in flow through wetland B as a result of stormwater infrastructure development, as discussed in section 4.3.3. Intermittent stream 2 currently contains low values due to its intermittent nature and lack of connection to other surface waters. As a result, a slight decrease in flow is unlikely to change the values of the stream. It will continue to flow intermittently depending on seasonal and climatic conditions, and it will continue to infiltrate to land and cease flowing near the edge of the site.

Wetlands C and D are located upgradient of the water race, therefore the race is not within their contributing catchments and piping it will not change water contributions to wetlands C and D. Wetland A is located over 300 m from the race and is also likely not influenced by it.

While the race is unlikely to provide significant habitat for fish, it is recommended a fish management plan is prepared to manage the draining of the open channel and rescue any fish trapped within it as water recedes. A draft fish management plan is provided in Appendix D.

4.3.7 Effects of aquifer drawdown

The magnitude of effect of aquifer drawdown resulting from abstraction of groundwater for water supply is considered to be negligible.

It is currently proposed to abstract water to supply the development from a bore/s on the river terraces adjacent to the Kowarau River. Water supply trial bores were drilled on the river terrace and pumping

trials were conducted (WGA 2026). It was concluded the groundwater abstracted for supply purposes through bores BH04 and BH05 is likely to be primarily recharged through seepage flows from the Kawarau River. The wetlands and intermittent streams within the site are vertically separated from the river terraces and the Kawarau River by approximately 80 m in elevation. The abstraction points on the terraces are also not in the same catchment as the wetlands and intermittent streams as a high point exists at the top of the escarpment with water north of the escarpment flowing north away from the river. The groundwater drawdown cones generated by the proposed abstraction will not impact the groundwater system north of the escarpment. Therefore, no impact on wetlands or intermittent streams is expected.

4.3.8 Effects of groundwater take on the Kawarau River

The magnitude of effect of the proposed groundwater take on the Kawarau River is considered to be negligible.

While water supply will be from groundwater bores, there is a hydrological connection between the bores and the Kawarau River. WGA 2026 therefore concluded groundwater at the abstraction point is primarily recharged through seepage flows from the Kawarau River. As a result, any abstraction has the potential to result in depletion of the Kawarau River.

The water demand for the Ridgeburn development will be 996 m³ per day (GWE 2025), which equates to less than 0.01 cumecs. The average annual flow of the Kawarau River is over 200 cumecs, with a seven day mean annual low flow of approximately 84 cumecs. While there is a hydrological connection, not all of the abstracted water will result in direct depletion of the river. Even if it did, and the river was flowing at less than 80 cumecs, the reduction in flow resulting from the abstraction would be immeasurable. There would be no associated impact on the habitats within the river, or on biota utilising those habitat. The water supply abstraction will not impact the ecological values of the Kawarau River.

4.3.9 Effects of sediment on freshwater environments

The magnitude of effect of sediment on freshwater environments is considered to be moderate, mitigated to low.

Activities such as earthworks in proximity to freshwater environments has the potential to release fine sediment which can enter waterways and wetlands. Excess fine sediment in freshwater environments can reduce light penetration, smother food resources and refuges, and clog the gills of fish and invertebrates. All aquatic biota has some level of tolerance to excess fine sediment, as would be experienced during natural events such as high rainfall, however it is the chronic exposure to high sediment levels that has the most detrimental effects.

It is recommended works occur under an appropriately designed and an implemented erosion and sediment control plan. The plan should be in line with or current industry best practice. Providing measures works as intended, the effects of sediment are expected to be mitigated to low.

4.4 Level of effect

The overall level of effect of the proposed works it determined using the ecological value of a feature, and the magnitude of effect of the works on that feature, as per Table 1. Table 5 provides a summary of the overall level of effect expected for the project.

Providing recommending mitigations are in place, the project is expected to have an overall low level of effect on the ecological values of the site, largely due to the limited ecological values present in its current state. The significant area of revegetation will result in a large gain in ecological values through creation of an extensive area of native plantings incorporating both shrubland and tussockland. Once established, the shrubland will move through successional stages to form a functioning forested ecosystem. The tussockland will provide higher quality grassland type habitat, maintaining the nature of what is currently present and providing valuable habitat for skinks, while transitioning to a native dominated landscape. Once established, the revegetated areas will represent one of the larger areas of lower elevation native vegetation within the ecological district.

Table 5. Level of effect of proposed works on ecological values.

Effect	Ecological value	Magnitude of effect before mitigation	Magnitude of effect after mitigation	Level of effect
Terrestrial effects				
Effect of vegetation removal	Low	Moderate	Positive	Positive
Effects on lizards	High	Moderate	Low	Low
Effects on birds	Moderate	Moderate	Low/Positive	Low/Positive
Increased domestic animals resulting from landuse change	Moderate	Moderate	Low	Low
Freshwater effects				
Effects on intermittent streams	Low	Low	Low	Very low
Effects of pond reclamation	Negligible	High	Low	Very low
Effects on wetlands	Low	Low	Low/Positive	Low/Positive
Effects of stormwater discharges	Low	Low	Low	Very low
Effects of wastewater	Low	Low	Low	Very low
Effects of aquifer drawdown	Low	Low	Low	Very low
Effects of groundwater take on the Kowarau River	High-Very high	Negligible	Negligible	Low-Very low
Effects of sediment on freshwater environments	Low	Moderate	Low	Very low

5 SUMMARY AND RECOMMENDATIONS

Ridgeburn are intending to develop a residential subdivision on multiple lots at 122 Morven Ferry Road, Queenstown. This application seeks consent for the land use, built development and subdivision of the Project site to establish Ridgeburn, including all requisite siteworks and consents, and the operational three water servicing. Significant revegetation will occur on Morven Hill and on the escarpment and river terrace next to the Kawarau River. Riparian and wetland planting will occur within the development itself. Pest plant and animal control will occur as part of the revegetation.

An ecological assessment of the site revealed the presence of low value intermittent streams and natural inland wetlands, moderate value avifauna habitat, and areas of high value herpetofauna habitat. Lizards are present throughout the site where habitat is suitable. The proposed works are expected to have an overall low level of effect on ecological values provided recommended mitigations are enacted.

Recommended mitigation includes:

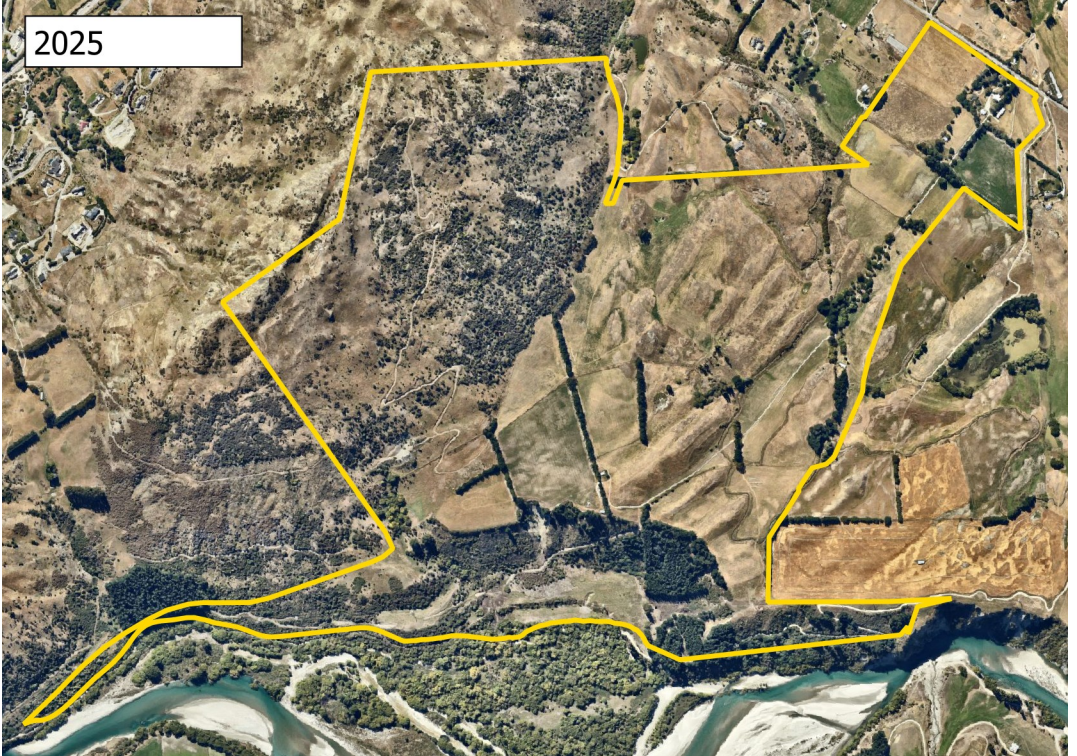
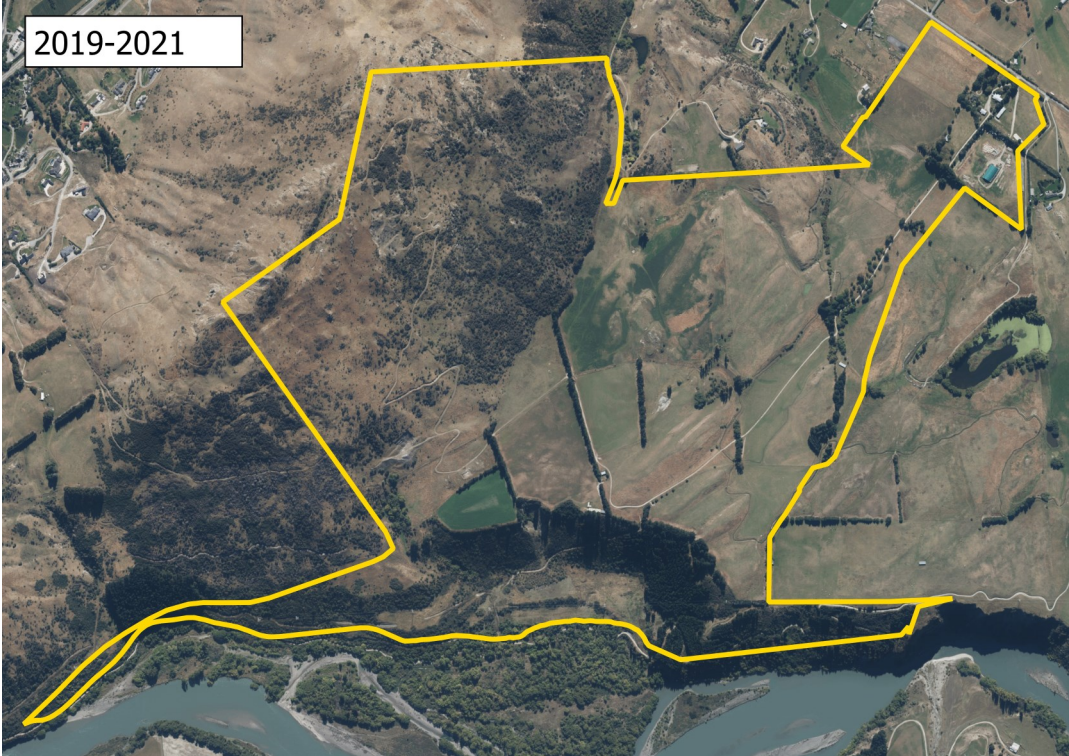
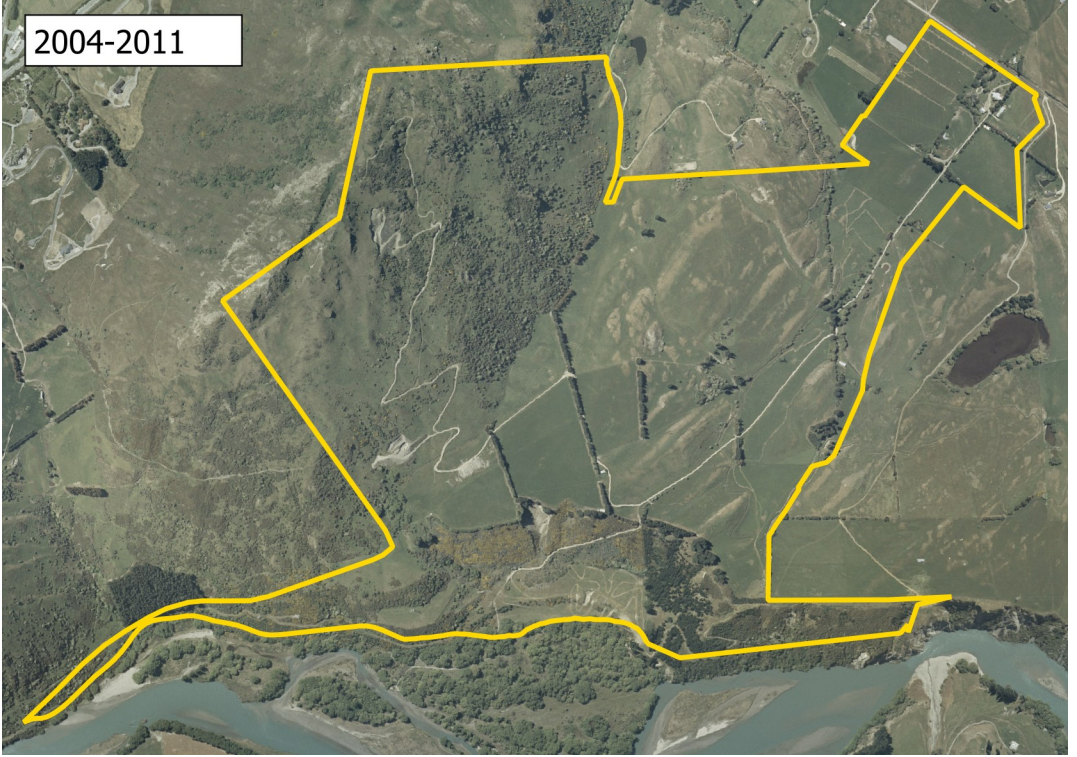
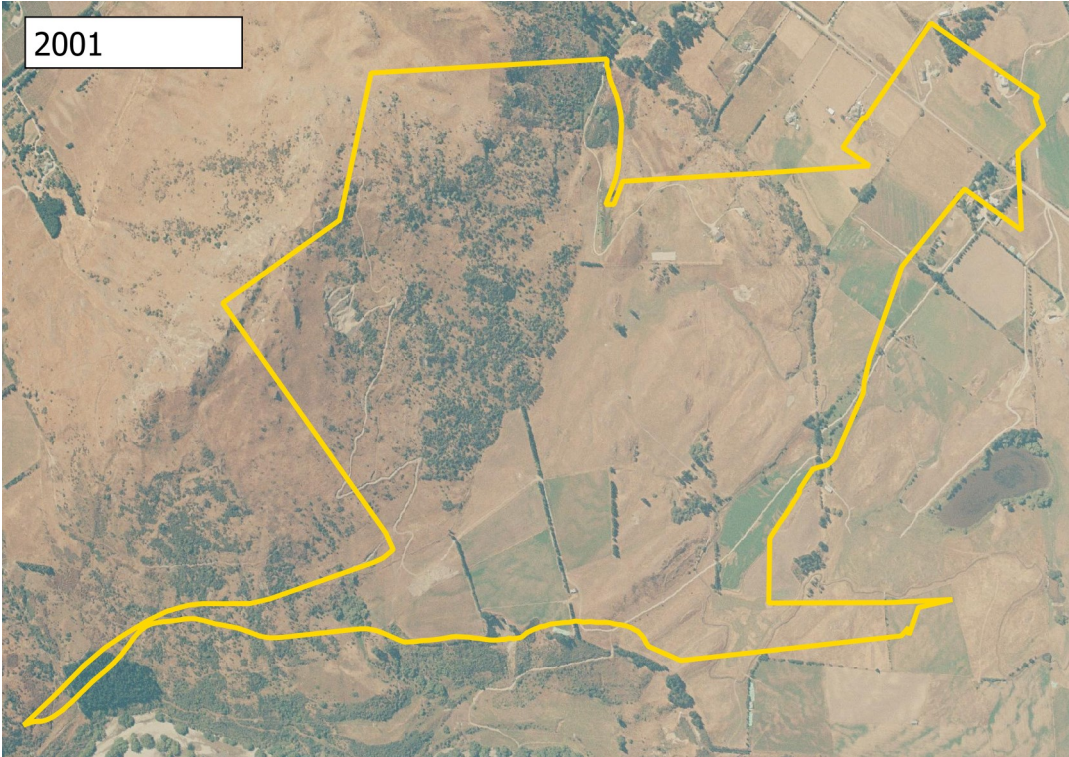
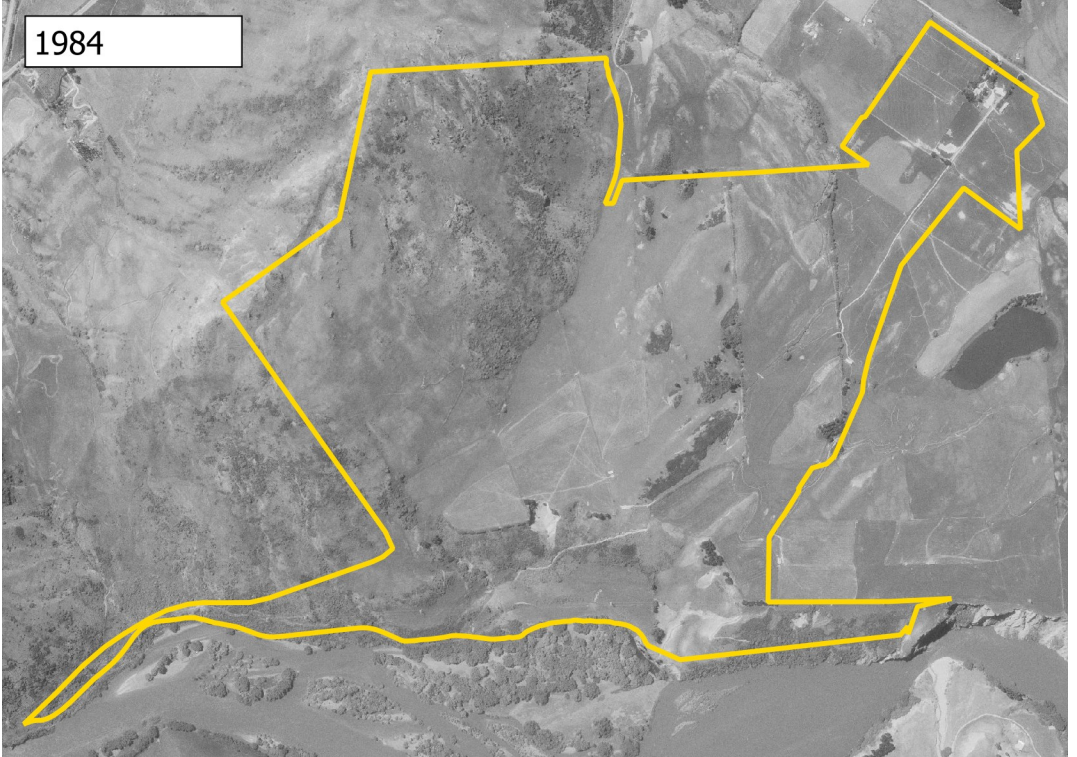
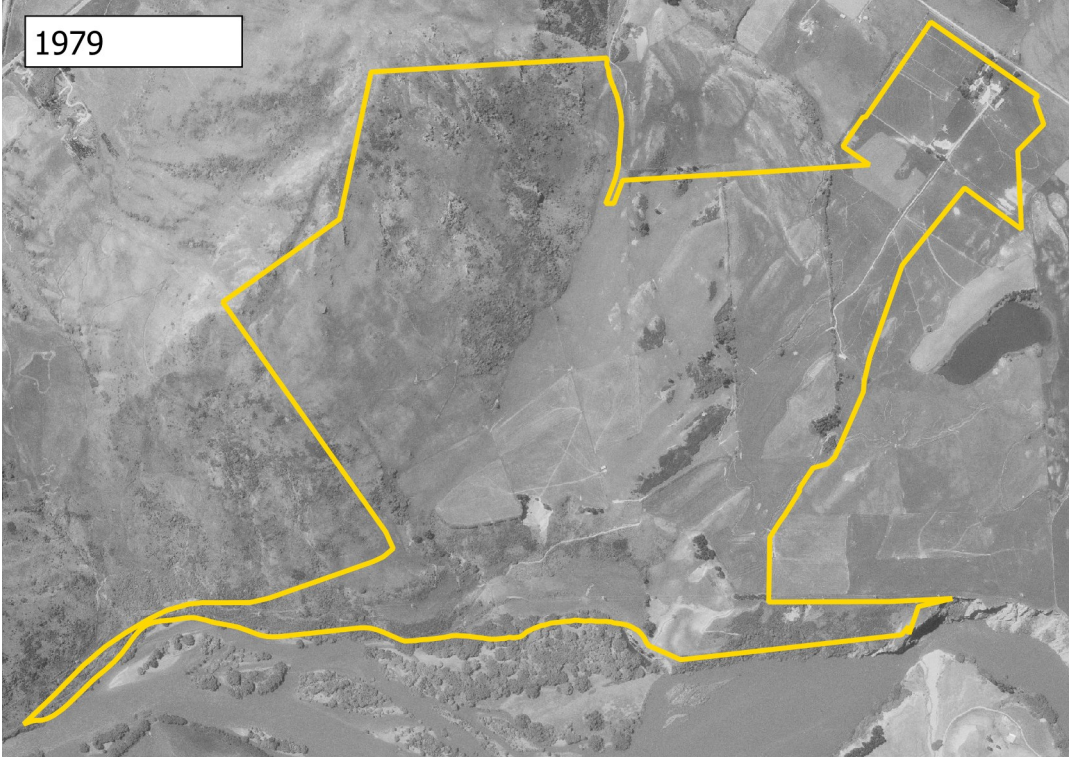
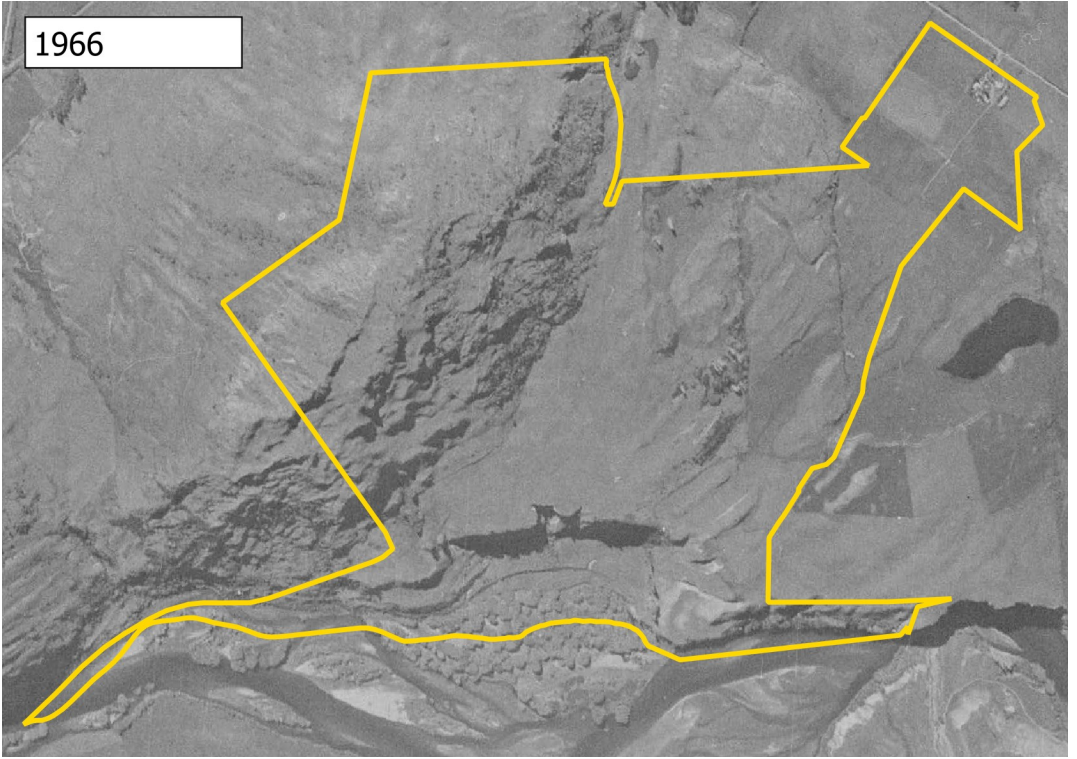
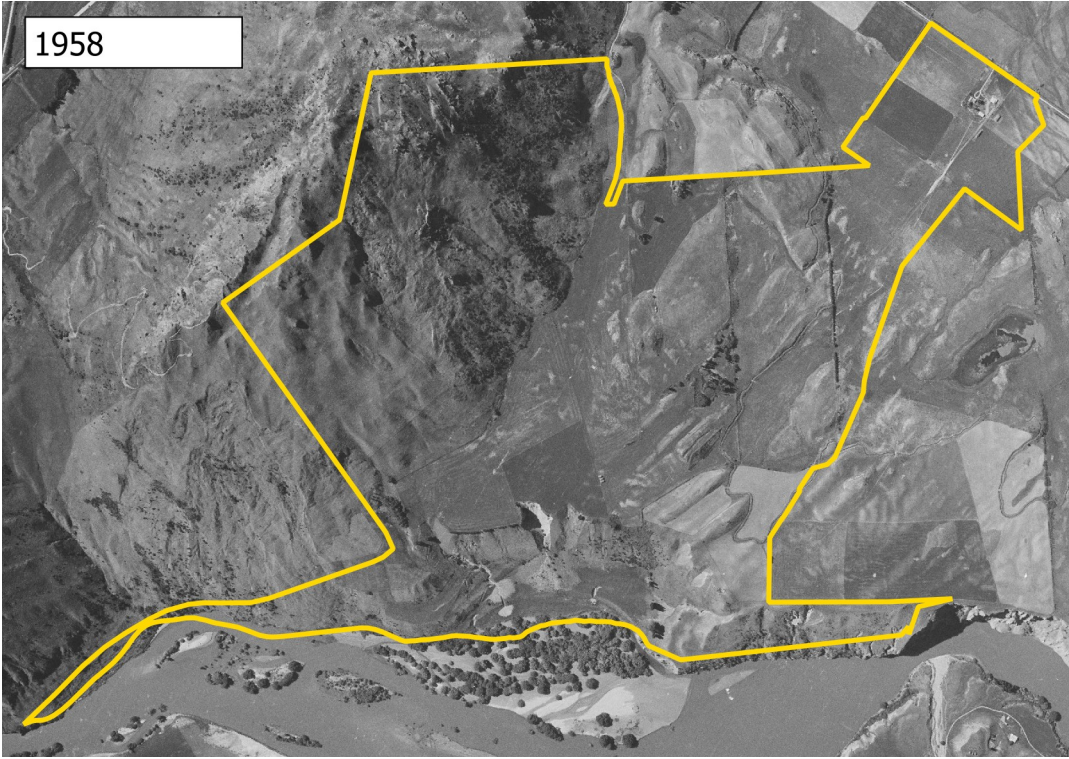
- Large trees should not be planted within 10 m of the wetlands, except where they replace exotic trees already present around wetlands A and D. Wetland C should be planted with low stature plants only to retain the ephemeral nature and the planting mix should not include flax.
- Vegetation clearance should occur outside the bird breeding season (October to February, inclusive). Alternatively, if clearance is required inside the bird breeding season, the vegetation must be inspected by suitably qualified ecologist to identify any active native bird nests. If an active native bird nest is identified, vegetation clearance with 10 m of the active nest must be delayed until the chicks have fledged.
- An erosion and sediment control plan prepared by an appropriately qualified person should be prepared according to current industry best practice. Regular inspections should occur with any faults remedied as soon as practicable.
- A LMP should be prepared outlining how lizards will be managed during works. The LMP should include measures to capture native lizards from any suitable habitat within the site, and locations where they will be released.
- A fish management plan should be prepared if works in the water race require works to occur 'in the dry.'
- Pond reclamation should occur when the ponds do not contain water. If water is present during reclamation, an appropriately qualified and experienced person should be onsite during dewatering to rescue and relocate any fish present in the ponds. Fish should be relocated to a nearby natural stream.
- It is recommended any plants in the revegetation areas not thriving after application of wastewater commences, be replaced for an alternative species to be determined at the time.
- Signage should be installed within and around the revegetation areas requiring dogs to be leashed at all times. This is necessary to protect ecological values, but also for dog safety as pest control will be occurring within the revegetation areas.

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Appendix A

Historic aerial images



Appendix B

Draft Pest Animal Management Plan



Ridgeburn, Queenstown

Pest Animal Management Plan

Prepared for: Ridgeburn Limited

March 2026



DOCUMENT CONTROL AND REVISION HISTORY

Document title	Ridgeburn, Queenstown
	Pest Animal Management Plan
Prepared for	Ridgeburn Limited
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Cover photo: Current vegetation and habitat within the Ridgeburn Development area

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TABLE OF CONTENTS

1	Introduction.....	4
1.1	Background.....	4
1.2	Objectives.....	4
1.3	Site description.....	4
2	Target Pest Animals	6
2.1	Rats.....	6
2.2	Mice.....	6
2.3	Mustelids.....	6
2.4	Possums.....	7
2.5	Hedgehogs.....	7
2.6	Lagomorphs.....	7
2.7	Deer	7
3	Pest Animal Control	8
3.1	Overview	8
3.2	Areas for pest animal management	8
3.3	Control Methods	10
3.4	Control Timing.....	12
3.5	Monitoring of trapping/baiting control efforts.....	12
3.6	Ungulates (deer, goats and pigs).....	13
4	Pest Animal Monitoring	14
4.1	Chew cards	14
4.2	Tracking tunnels	15
4.3	Monitoring targets	16
4.4	Reporting	16
4.5	Health and Safety	16
4.6	Roles and Responsibilities	17

List of Tables

Table 1. Recommended timing of pulsing and trap checks for target species	12
Table 2. Example of table recording implementation of pest animal control methods.	12
Table 3. Example of table record keeping for ungulate control.	13
Table 4. Management targets, thresholds for initiating additional control.....	16

List of Figures

Figure 1. Location of Ridgeburn	5
Figure 2. Proposed locations for pest control	9

List of Appendices

Appendix A	Pest Animal Control Placement
Appendix B	Pest Animal Monitoring Placement

1 INTRODUCTION

1.1 Background

Ridgeburn Limited has applied for resource consent through the Fast Track Approvals Act (2024) (FTAA) to develop a residential subdivision on the property at 122 Morven Ferry Road, Queenstown ('the site'). As part of the development, the client is proposing to undertake earthworks, remove vegetation and install associated stormwater and wastewater infrastructure on site. Significant revegetation will occur within the site, and lizards salvaged from the site will be released into these revegetation areas, as well as areas of targeted landscape enhancement.

Introduced mammalian predators have a considerable detrimental impact on populations of native flora and fauna. Reducing these impacts via pest animal control is known to result in substantial benefits for native biodiversity. The methods needed to achieve the appropriate levels of control are also well understood and widely used.

Pest animals are well established within the site including rats, mice, rabbits, hare, deer, mustelids and hedgehogs are also likely to be present. Pest animal control is a key component of the ecological mitigation strategy for the development. In particular, predator control will support the successful relocation and persistence of lizards salvaged from the development footprint by reducing predation pressure from introduced mammals. Control of herbivorous pest species such as rabbits, hares and deer will also improve the establishment and survival of native revegetation plantings. In turn, successful plant establishment will increase habitat complexity and food availability for indigenous fauna, including invertebrates and lizards. Maintaining low pest animal densities within revegetation areas and lizard release sites is therefore important to achieving the intended ecological outcomes of the project.

The purpose of this draft Pest Animal Control Plan is to describe the approach for the management of pest animals within the revegetation areas and parts of the landscaped areas (where lizards may be relocated to). The plan will provide information on target species, methods of control, monitoring and monitoring targets.

1.2 Objectives

The objective of this Pest Animal Control Plan are:

- To provide recommended management and control measures for pest animals expected to be present on the site.
- To aid in the successful establishment of native revegetation planting.
- To reduce predation pressure on resident and relocated lizards.
- To provide monitoring measure to determine pest numbers within the site

1.3 Site description

The site is located on the boundary of the Shotover and Remarkables Ecological Districts (ED) of the Lakes Region. The Shotover ED is characterised by steep topography with deeply incised canyons. Winters are cold, and summers are hot, with a generally dry climate. Vegetation includes remnant beech forest, extensive bracken fernland, and areas of scrubland and tussockland, including above the treeline. Snow tussockland is extensive where forest and scrub is absent. Exotic forests have established over time.

The Remarkables ED is characterised by rugged, steep, glaciated mountains up to approximately 2,300 m above sea level. Winters are cold, and summers are hot, with a generally dry climate as a result of the Main Divide rain shadow. Forest in the district is limited and mainly consists of small patches in valleys. Elsewhere, scrub is present with abundant tussock.

As the site is mostly on flat or rolling topography, at altitudes below 500 m above sea level, it is more akin to the Shotover ED. The site represents a highly modified area of the ecological district. While not currently urbanised, the site and surrounding land have been developed for agricultural purposes over time and little native vegetation now remains. The site is on the banks of the Kawarau River. The Arrow Irrigation Race meanders through the site. The topography of the land varies from flat, to rolling hills, with the moderately steep Morven Hill rising to approximately 750 m above sea level on the site's western boundary

Historically (pre-human) the site likely comprised of beech forest with scrub and/or tussockland in exposed areas. A review of historical aerial imagery shows the site was well established as farmland by the earliest available aerial image, dated 1958. However, the wider area has been farmed since the 1860s and therefore it is likely it has been devoid of any significant native vegetation for more than 150 years. The location of the site is shown in Figure 1.

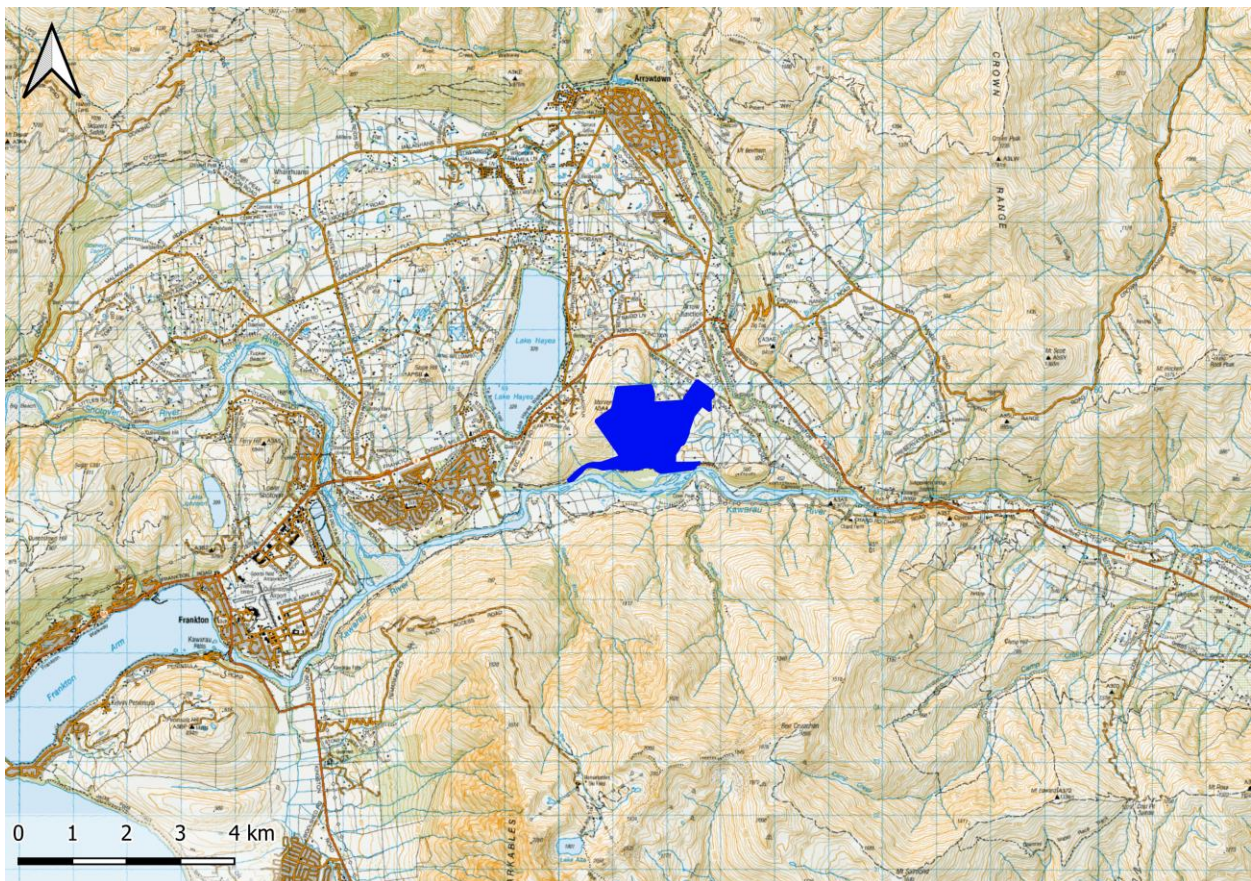


Figure 1. Location of Ridgeburn

2 TARGET PEST ANIMALS

2.1 Rats

Three exotic rat species are naturalised in New Zealand, with Norway rats (*Rattus norvegicus*) and ship rats (*R. rattus*) the most common. Rats are generalist omnivores and their diet includes seed, fruit, flowers, bird eggs and chicks, lizards and invertebrates. Removal of rats will reduce predation pressures on lizard and bird populations, and reduce pressures on plants as they establish. Norway rats are the largest of the rat species. As ground-dwellers, they pose significant threats to ground-inhabiting and nesting species. Ship rats are very agile and are frequent climbers, preferring to nest in trees and shrubs rather than on the ground. They can be distinguished from Norway rats by their tail which is longer than their body length and large ears that can fold down over their eyes. Rats will be controlled across the revegetation areas and other lizard release sites via intensive trapping and toxic baiting.

2.2 Mice

The effects of mice on native flora and fauna as predators and/or competitors is not well understood. There is some evidence to suggest mice are predators on native lizards, frogs, and invertebrates, and mouse populations may increase when larger predators (particularly rats, mustelids, and feral cats) are removed from an area, resulting in additional impacts on prey species. Unfortunately, there is no effective large-scale mouse control tool (either trap, toxic bait or otherwise) currently available. Mouse control will therefore be undertaken alongside rat control (using a combination of traps and baits), and their populations will be monitored via chew cards.

2.3 Mustelids

Three species of mustelids are present in New Zealand – stoats (*Mustela erminea*), ferrets (*M. furo*) and weasels (*M. nivalis vulgaris*). Stoats and ferrets are able to be controlled via trapping and use of some poisons, but there are currently few adequate control options for weasels (although some may be caught with the tools used for targeting rats and other mustelids). Each species has its own unique set of behavioural and morphological characteristics.

Stoats have typical characteristics many opportunistic species exhibit including a small body size, short life span and rapid reproductive cycle. Populations are typically unstable, and their abundance is strongly influenced by prey availability. Home range sizes vary significantly depending on a range of variables including sex, season, and food availability. Stoats can cover long distances, and dispersing juveniles may come from over 20 km away. Stoats can exhibit significant neophobia, or weariness of new objects in their environment, which must be factored into control strategies.

Ferrets can have very large home ranges although home ranges are smaller during the breeding season between August and February. Juvenile ferrets may only move small distances. Like stoats, ferrets are wary of new objects, which can pose an ongoing challenge to their control. This can be managed through use of large, fresh meat lures (preferably rabbit) and placing traps in locations within preferred ferret habitats.

Weasels generally have a patchy distribution and populations are also subject to fluctuations in numbers and extent due to predator-prey interactions. They can be found in farmland and scrub, on the margins between forest and open country. Birds, invertebrates and reptiles form a larger component of weasels' diets than in other countries, but they mostly they eat mice and insects.

2.4 Possums

Possums are a common pest species throughout New Zealand, mostly in areas of arboreal vegetation, though they are known to move along the ground as necessary. They are opportunistic omnivores that primarily feed on leaves, buds, flowers, and fruits, but also eat native birds, eggs, lizards and insects. A single possum can consume over 3.5kg of vegetation per night. Possums generally have relatively small home ranges (up to 4 ha in dense forests), however they can be present in suitable habitat in high densities, resulting in significant impacts to native biodiversity.

2.5 Hedgehogs

While hedgehogs are mainly insectivorous they have been proven to predate native lizards. Hedgehogs are commonly caught in traps targeting rats and mustelids, which also means that traps triggered by hedgehogs are no longer available to these target species until the trap is checked and cleared. Reducing the hedgehog population will consequently increase the effectiveness of the trap network as well as reducing predation pressure on ground-dwelling lizards.

2.6 Lagomorphs

Rabbits and hares are abundant in Central Otago and are a common pest generally associated with rural areas. Lagomorphs have a rapid breeding cycle with females capable of becoming pregnant within 24 hours of giving birth, meaning 3 to 4 litters can be produced over a breeding season. They browse on palatable plant species which can be destructive to newly planted vegetation. Providing food sources are available, population densities can be very high. Hares are generally solitary animals and live above ground, whereas rabbits live in large groups and usually nest underground. Both have very little natural predation pressure in New Zealand.

2.7 Deer

Feral deer can be incredibly harmful to native biodiversity. They browse palatable vegetation and can eat entire understories (smaller trees, shrubs, herbs and seedlings) of native bush. Their presence presents a large risk to the establishment and persistence of native plantings. Several species are known to be present around Queenstown including red, fallow, and white-tailed (not likely to be present) deer. In the area they are not generally present in high densities but can roam large distances when browsing.

3 PEST ANIMAL CONTROL

3.1 Overview

This section outlines control of pest animals within the revegetation areas and other areas where lizards may be released. Pest animal control will be undertaken in perpetuity as a condition of the consent.

Reducing numbers of mammalian pests such will assist with native regeneration, improve the establishment and survival of the revegetation planting, and enhance habitat values for indigenous fauna including birds, lizards and invertebrates.

Note: Always wear gloves when handling dead animals for protection against leptospirosis.

3.2 Areas for pest animal management

The areas that will be subject to pest control are illustrated in Figure 2 below. This includes approximately 107 ha of revegetation plantings that will also be potential release sites for salvaged lizards, and an additional approximately 4.3 ha of habitat where lizards may also be released to. The total area subject to pest animal control is approximately 111.3 ha. This area is entirely located within the site boundaries.



Figure 2 - areas to be subject to pest animal control

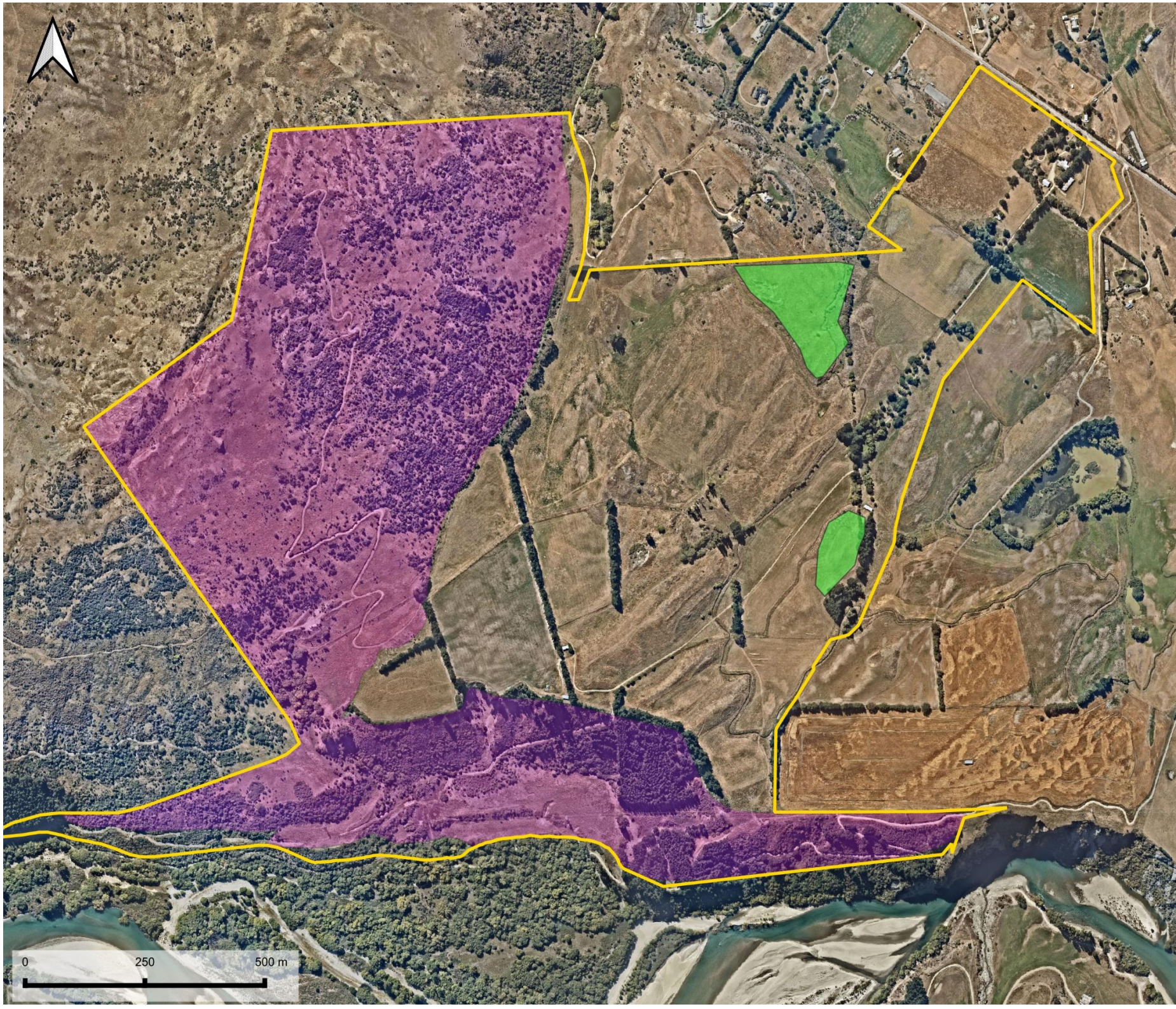
-  Site boundary
- Pest management areas**
-  Revegetation and lizard relocation
 -  Lizard relocation

SOURCES
Nearmap.com 2025

DISCLAIMER: This map/plan is not an engineering draft. This map/plan is illustrative only and all information should be independently verified on site before taking any action.

SCALE **1:10,000 @ A4**

PROJECT NO. 10339
DRAWN BY: AJC
DATE: 06/03/2026



0 250 500 m

3.3 Control Methods

3.3.1 Rats and mice

Four bait stations per hectare is recommended for sufficient control of rats while higher densities are generally needed for mice. Lockable (e.g., Philproof) or run through bait stations should be used where possible, these should be spaced 50 m apart in a location that are easily accessible (Appendix A). As plants establish, bait station locations should be revised and should be placed near any trees that produce large volumes of fruits.

Philproof stations have a pin fixture which bait blocks slot onto, to prevent rats from taking the bait and storing it rather than eating it. DoubleTap (diphacinone and cholecalciferol) bait is recommended for use in these stations as it is effective for rats, mice, and for possums.

3.3.2 Mustelids

One trap is recommended for every 20 hectares of land for mustelid control (i.e., stoats, weasels). DOC 200 traps inside wooden tunnels are recommended (Appendix A).

DOC 200s will also catch rodents and potentially small hedgehogs. Alternatively, a GoodNature A24 self-resetting trap may be used. Ensure the entrance and inside of the wooden tunnel are kept free of debris and cobwebs so it looks like other animals have used the tunnel. The tunnel should be embedded so the base is level with the ground surface.

Placing the trap under existing tree canopy is typically recommended wherever possible. However, vegetation on the site is currently limited to scrubby species which are unlikely to provide sufficient canopy cover. Traps should be placed on edges of features (e.g. tracks) where possible as these provide pathways mustelids are likely to utilise. Placement of traps may be refined once planting has established to take advantage of natural or prepared tracks, and establishing trees. Placing the trap near a possum trap may attract mustelids when a possum is caught.

DOC 200s require regular maintenance checks and servicing to ensure the trap is firing well.

It is recommended traps are baited with fresh rabbit meat or eggs. Alternatively, salted or freeze-dried rabbit, or egg may be used, however these may be less effective.

3.3.3 Possums

One trap per hectare is generally recommended for sufficient control of possums (Appendix A).

Flipping Timmy traps or Trapinator traps are recommended for simple and humane control of possums. Traps should be installed at least 1.5 m off the ground and attached firmly to a wooden surface (e.g., a wooden post) so they remain sturdy when sprung.

The traps should be baited with a food source that is not common in the area, such as a piece of freshly cut apple sprinkled with cinnamon in a Flipping Timmy trap or peanut butter in a Trapinator. Other possum lures may include citrus peel, carrots, or vegemite. Regularly alternating bait types may increase success rates as possums may learn to avoid certain lures over time. Due to the proximity to residential areas, the use of meats, fish or pet food as bait should be avoided to minimise the risk of non-target capture.

3.3.4 Hedgehogs

Hedgehogs will be controlled using the same methods as mustelids.

3.3.5 Lagomorphs

Due to the large size of the site, specific controls such as shooting and warren fumigation are not considered effective in the first instance. The most effective method for controlling rabbits over the large planting areas, over time, is through baits. Initial control of lagomorphs should occur via aerial application of pindone applied to appropriate bait (e.g. carrot, cereal). The aerial application of pindone bait will only be undertaken where all relevant regulatory approvals have been obtained. Any aerial application will:

- Be undertaken by a suitably qualified and experienced contractor with demonstrated experience in aerial pest control operations.
- Be carried out in accordance with all relevant legislation, regional pest management requirements, and manufacturer guidelines for pindone use.
- Be subject to any necessary permissions, permits or approvals required by the relevant regulatory authorities prior to implementation.
- Include notification to relevant authorities and potentially affected parties where required (e.g. Queenstown Lakes District Council, neighbouring landowners, or other stakeholders as required under applicable regulations).
- The pest control contractor will provide evidence of relevant qualifications, operational procedures and health and safety protocols prior to undertaking aerial control operations.

Operational details such as bait type, flight spacing, application timing and operational boundaries may be refined by the contractor based on site conditions, weather conditions, pest abundance and operational considerations at the time of application. Any such refinements will remain consistent with the objectives of this Pest Management Plan and relevant regulatory requirements. If aerial application is deemed inappropriate by the contractor, ground based application will be used (e.g. from motorbikes/all terrain vehicles/on foot), to achieve the same outcomes as provided below.

An application rate of 5 to 6 kg/ha should be applied. Two applications of bait should be applied 10 to 14 days apart. Application should concentrate the bait into 'feed lines' leaving gaps in-between e.g. a 90m swath, 110m flight spacing (20m gap) down to 20m swath, 80m flight spacing (60m gap). Aerial application should occur when food sources are naturally low, i.e. during late summer when grass forage has burnt off, or during winter.

Aerial baiting will be complemented by ongoing presence of bait stations (e.g. philproof or multifeeder or similar) within the site. Bait stations should be placed 50 m apart, and be baited with pindone laced baits (Appendix A). Locations of the stations can be adapted depending on the presence of burrows and warrens.

3.3.6 Deer

Control of deer will be achieved through targeted culling during late autumn and winter. Culling will occur annually in perpetuity. More frequent culling will occur if monitoring and maintenance associated with the revegetation areas identifies deer browse.

3.4 Control Timing

3.4.1 Pulsing

‘Pulsing’ refers to intermittent baiting and trapping efforts for pest animal control, as opposed to undertaking control year-round.

Pulsing is considered effective for kill rates and reducing the risk of target animals becoming ‘bait-shy’. Pulses are used to target the most vulnerable months of the year for indigenous fauna (e.g. breeding season) and are more efficient for the property owner through reducing labour involved as opposed to undertaking control year-round for all target species.

3.4.2 Timing of trap/station checks

Table 1 below recommends timing of pulses and associated trap/bait station checks and rebaiting efforts for each target species.

Table 1. Recommended timing of pulsing and trap checks for target species

Pest species	Control timing	Pulse length	Trap/station checks
Possums	Pulse in June & October (but can occur more frequently if kill rates high)	Two weeks	Once set, check twice during the first week and once during second week. Replace lure with each check and remove remaining lure after two weeks.
Rats	Pulse in January, April, August, November	Four weeks	Once set, refill bait (as required) on day 5 and 14. Remove all remaining bait on day 30.
Mustelids and hedgehogs	Fortnightly trap checks from October – April, and monthly from May – September	N/A	Check trap and replace bait with each check.
Lagomorphs	Pulse in March, May, June and August	Two weeks	Once set, replace bait/rebait two to three times with three to five days in between.

3.5 Monitoring of trapping/baiting control efforts

A record of pest animal control efforts for each target species should be kept. Information regarding the timing of control efforts, checks, bait take and kill successes as per the following example in Table 2.

Table 2. Example of table recording implementation of pest animal control methods.

Trap/station location	Date of initial control	Date of checks and/or rebaits	Trap catch rate/Bait uptake rate

3.6 Ungulates (deer, goats and pigs)

While only deer have been observed on the site, it is possible feral goats and pigs are also intermittently present. These will be controlled via culling in the same manner as deer.

Shooting is recommended as the primary control method. It is recommended that a professional contractor undertakes control annually if signs of wild ungulates are observed on site. However, control can also be undertaken by the landowner under a firearms license. If hunting dogs are used, they should be equipped with GPS collars to monitor both the coverage of the property and the locations of kills. Detailed records of all kills should be maintained.

Records in the form of cull numbers and notes each time a hunter takes an animal should be kept and reported as required.

Table 3. Example of table record keeping for ungulate control.

Pest species	Date	Number culled	Sex	Approximate weight (kg)	Location
Goat					
Deer					
Pigs					

Notes: Records of hunting efforts (i.e. date & location) should still be kept where no successful kills occurred.

4 PEST ANIMAL MONITORING

Ongoing monitoring and adaptive responses are key to effective pest animal management. Monitoring tools will be used to monitor pest animal presence and assess their densities against the intended targets, and to initiate further control if thresholds are exceeded. Monitoring of physical damage to plantings will occur as part of the plant maintenance schedule.

4.1 Chew cards

Chew cards are a common, cost-effective detection and monitoring tool for determining the presence of pest animals within an area. They can provide an indication of relative abundance of a range of pest animals, including rats, mice, possums, hedgehogs and mustelids. Chew cards have higher rates of detection for mice than tracking tunnels, and correlate to tracking tunnel rates for rats. Mice are a key competitor for lizards, with revegetation of the site forming a significant component of the mitigation necessary to address potential effects on lizards. The higher rates of detection for mice makes them a more suitable choice over tracking tunnels for this project.

Chew card lines spaced 100 m apart will be utilised, with chew cards spaced 25 m apart along each line, in line with the best practice for rodents (Appendix B). There are various guidance documents regarding how to install chew cards and recommended spacing¹. In the absence of all encompassing guidelines for all species, a conservative approach has been taken with line and card recommended spacing aimed to observe all species. The lines will need to be ground-truthed to ensure chew card locations are appropriate and accessible, and contain habitat suitable for attaching chew cards. Chew cards are unlikely to work in areas where tussockland planting will occur due to the lack of vegetation suitable for attaching cards. In these areas, tracking tunnels will be used (discussed below). The same chew card line is to be used on an ongoing basis to allow trend monitoring and comparisons. Minor adjustments may occur as vegetation establishes, but they should remain in the same general area/alignment.

Chew card monitoring events will be repeated two times per year: November and July (to coincide with periods of high and low natural food resources). A three-night event is recommended. An additional monitoring event using chew cards may also be required if the threshold values of rats or mice are exceeded. The follow-up monitoring event should occur four weeks after the additional control measures to ensure the abundance of the target species has been successfully reduced to acceptable levels.

For each monitoring event, the following methodology should be employed:

- Deploy cards for three nights when a mostly fine forecast is expected (no heavy rain predicted), as per standard methodology for calculating the Chew Card Index (CCI).
- Fill the internal channels of the chew card material with peanut butter as a lure or use pre-filled cards (available from Connovation).
- Nail each card to the closest suitable tree trunk 30 cm above the ground. Trees can be permanently marked with trail markers or similar to ensure the card is installed in the same location for each monitoring event.

¹ National Pest Control Agencies, 2015. A1 possum population monitoring using the trap-catch, waxtag and chewcard methods. National Pest Control Agencies, Wellington.

- Label cards in permanent marker with the relevant information e.g. location, line number, card number, date of deployment
- Retrieve chew cards after the three-night period, then analyse bite marks. Any bite marks recorded on the chew cards need to be identified to species level and CCI needs to be calculated to gain an estimate of relative population abundance for each target species.
- To calculate the CCI count the total number of cards with bite marks of target species for each line. Divide the total number of cards with bite marks on each line by the total number of cards per line to get the proportion of cards with bite marks for each line. Calculate mean proportion of cards with bite marks for all lines for the site (i.e. the sum of the proportion of cards with bite marks of each target species). Multiply by 100 to get the CCI percentage. Calculate the standard error (SE). This is the standard deviation of the CCI / square root of the number of lines. Multiply the combined SE by 2 to calculate the approximate 95% confidence interval.

4.2 Tracking tunnels

Tracking tunnels are considered a more effective method for monitoring pest animal in areas where no vegetation is suitable for attachment of chew cards. Tracking tunnels specifically designed for tracking small mammals such as mice, rats and mustelids, and are also effective for hedgehogs. Tracking tunnels work by attracting pest animals, which walk through the tunnel over sticky ink. As they leave the tunnel, their footprints are left in ink on the tracking card^{2 3}.

Tunnel lines spaced 100 m apart will be utilised, with tunnels spaced 25 m apart along each line (Appendix B). While there are various 'best practice' documents outlining different spacings for tracking tunnels, a 25 m spacing is considered appropriate due to the high presence of mice and their known impact on lizards. The lines will need to be ground-truthed to ensure tunnel locations are appropriate and accessible. The same tunnel line is to be used on an ongoing basis to allow trend monitoring and comparisons. Minor adjustments may occur as vegetation establishes, but they should remain in the same general area/alignment.

Tracking tunnel monitoring events will be repeated two times per year: November and July (to coincide with periods of high and low natural food resources). A single night event is recommended, however if few/no tracks are picked up after one night, additional nights may be required at the discretion of the professional undertaking the monitoring. An additional monitoring event tunnels cards may also be required if the threshold values of rats or mice are exceeded. The follow-up monitoring event should occur four weeks after the additional control measures to ensure the abundance of the target species has been successfully reduced to acceptable levels.

For each monitoring event, the following methodology should be employed:

- Install empty tracking tunnels at on each line at least three weeks prior to planned monitoring. Tunnels can be left out for longer periods of time (i.e. years), but should be physically checked three weeks prior to planned monitoring to allow for damaged or missing ones to be replaced.

² Gillies, C.A.; Williams, D. 2013: DOC tracking tunnel guide v2.5.2: Using tracking tunnels to monitor rodents and mustelids. Department of Conservation, Science & Capability Group, Hamilton, New Zealand.

³ National Pest Control Agencies, 2018. A8 Pest mustelids monitoring and control. National Pest Control Agencies, Wellington.

- At time of baiting, remove any scat or detritus present around the tunnel. Install the pre-inked paper and bait with peanut butter. The inked paper should be labelled with the line, tunnel and date deployed.
- The day following installation, retrieve the tracking pads, remove any scat within the tunnel and clear the bait. Any bait still present should be removed entirely from the site. Any tracks recorded need to be identified to species level and CCI needs to be calculated to gain an estimate of relative population abundance for each target species. CCI calculation methods are described in the previous section.

4.3 Monitoring targets

Management targets in pest animal control relate to the maximum allowable residual pest animal abundance targets which allow native species to persist and recover. Management targets for each species are the outcome that the pest animal control activities aim to achieve (Table 1). The proposed targets, as well as the thresholds for initiating additional control measures, are based on the CCI.

If monitoring identifies that the targets are not met on any monitoring line, this will trigger a requirement for additional pest control. The type and intensity of additional control will be determined based on the species detected and the level by which thresholds have been exceeded. Additional control may include increasing the frequency of baiting pulses, increasing trap or bait station density within affected areas, undertaking targeted control in locations where pest activity is highest, or extending the duration of control operations. Follow-up monitoring will be undertaken approximately four weeks after the implementation of additional control measures to confirm that pest abundance has been reduced to acceptable levels.

Table 4. Management targets, thresholds for initiating additional control.

Pest species	Monitoring target	Monitoring threshold
Rats	≤ 5% CCI	≥ 10% CCI
Mice	≤ 5% CCI	≥ 10% CCI
Possums	≤ 5% CCI	≥ 10% CCI
Mustelids	≤ 3 detections	> 3 detections

4.4 Reporting

Results of each monitoring event will be reported to DoC, Queenstown Lakes District Council and/or Otago Regional Council within one month following completion of each monitoring event. The report should include a summary of the monitoring that occurred, results from chew cards and tracking tunnels, and comparison of CCI against targets and thresholds. The report will also detail any additional pest animal control or monitoring as required.

4.5 Health and Safety

All pest control and monitoring activities must be undertaken in accordance with relevant health and safety requirements and best practice procedures.

- Personnel undertaking pest control operations should:
- Follow appropriate health and safety procedures when handling traps, toxins or deceased animals.

- Wear appropriate personal protective equipment (PPE) when handling bait, traps or animal carcasses.
- Wear gloves when handling dead mammals to reduce the risk of disease transmission (e.g. leptospirosis).
- Ensure all traps and bait stations are installed and operated in a manner that minimises risks to people, pets and non-target wildlife.
- Ensure any toxins used are handled, stored and deployed in accordance with manufacturer instructions and relevant regulatory requirements.

Where pest control activities involve the use of firearms, aerial application of toxins, or other specialised methods, these must be undertaken by appropriately qualified and experienced personnel in accordance with relevant legislation.

4.6 Roles and Responsibilities

Responsibilities associated with implementation of the plan include:

4.6.1 Ridgeburn Limited / Landowner

- Ensure pest control and monitoring are implemented in accordance with this Pest Animal Management Plan and any relevant consent conditions.
- Engage suitably qualified contractors to undertake pest control and monitoring activities where required.
- Maintain records of pest control activities and monitoring results.

4.6.2 Pest Control Contractor

- Install and maintain traps, bait stations and monitoring devices in accordance with this plan and relevant best-practice guidelines.
- Undertake pest control operations safely and in compliance with relevant legislation and regulations.
- Maintain records of control activities, including trap catches, bait uptake and control effort.

4.6.3 Ecologist

- Provide technical oversight where required.
- Review monitoring results and recommend adaptive management responses where monitoring thresholds are exceeded.
- Assist with preparation of monitoring reports where required.

Appendix A

Pest Animal Control Placement



Recommended pst control
locations

 Site boundary

Pest management areas

 Revegetation and
lizard relocation

 Lizard relocation

Pest control

-  Rat, mice, rabbit
-  Rat, mice, rabbit,
possum
-  Rat, mice, rabbit,
possum, mustelid

SOURCES

Nearmap.com 2025

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0 250 500 m

Appendix B

Pest Animal Monitoring Placement



Recommended pst control
locations

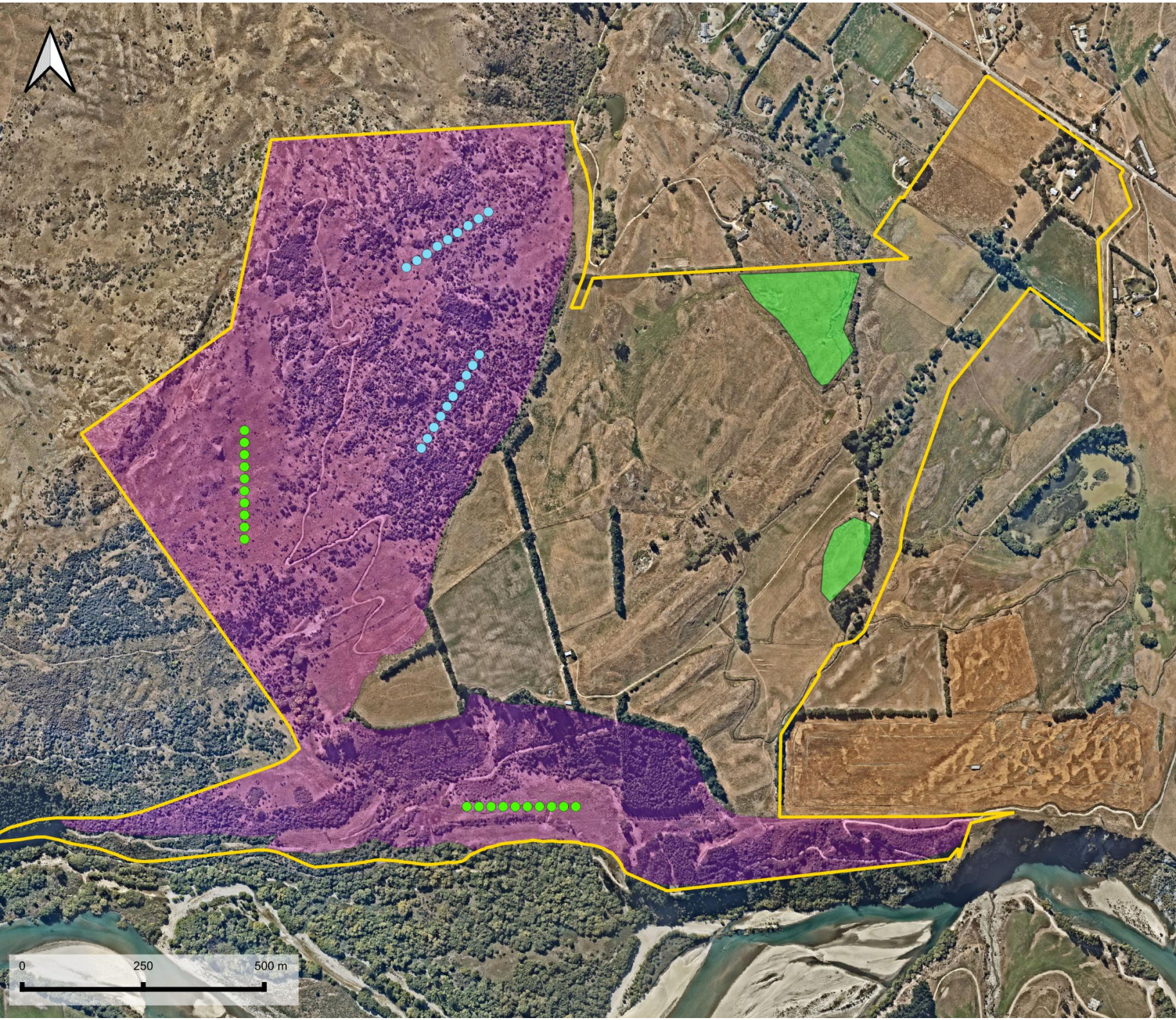
-  Site boundary
- Pest management areas**
 -  Revegetation and lizard relocation
 -  Lizard relocation
- Pest monitoring**
 -  Chew card
 -  Tracking tunnel

SOURCES
Nearmap.com 2025

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Appendix C

Draft Lizard Management Plan



Ridgeburn, Morven Ferry Road

Draft Lizard Management Plan

Prepared for: Ridgeburn Limited

March 2026



DOCUMENT CONTROL AND REVISION HISTORY

Document title	Ridgeburn, Morven Ferry Road
	Draft Lizard Management Plan
Prepared for	Ridgeburn Limited
Version	Draft B
Date	20 March 2026
Document number	10339-005-B

Version	Issue date	Document number
Draft A	21 January 2026	10339-005-A
Draft B	20 March 2025	10339-005-B

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	Lead Ecologist

Reference: Viridis 2025. Ridgeburn, Morven Ferry Road Draft Lizard Management Plan. A report prepared for Ridgeburn Limited by Viridis Limited. March 2026.

Cover photo: Pasture vegetation on site at 29 Annmarie Avenue, Flat Bush (photo source: Viridis 2024).

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TABLE OF CONTENTS

1	Introduction.....	1
2	Project Context	2
2.1	Site Description	2
2.2	Species Potentially Present	3
2.3	Lizard Habitat	4
2.4	Lizard Densities.....	4
2.5	Proposed Site Works	5
2.6	Description of Impacted Habitat	7
2.7	Potential Effects on Lizards	7
3	Herpetofauna Management	8
3.1	Objectives	8
3.2	Statutory Context	8
3.3	Project Herpetologist and Methodology Finalisation	9
3.4	Lizard Search and Capture Methodology	9
3.5	Release Site	12
3.6	Post release monitoring	15
3.7	Completion reporting.....	16
3.8	Checklist	16
	References	17

List of Tables

Table 1. Lizards recorded within 10 km of the site.	3
Table 2. Lizard Management Checklist.....	16

List of Figures

Figure 1. Site location as indicated by blue polygon (map source: LINZ NZ Topo 50).	2
Figure 2. Examples of potential lizard habitat within the proposed works area including rock piles, exposed bedrock and scrubby vegetation with long grass.	4
Figure 3 - Lizard survey results	6
Figure 4. Lizard habitat and lizard records	10
Figure 5. a) a funnel trap, b) an ACO.	11
Figure 6 - Proposed lizard release locations.....	14

1 INTRODUCTION

Ridgeburn Limited have applied for resource consent through the Fast Track Approvals Act (2024) (FTAA) to develop a residential subdivision on the property at 122 Morven Ferry Road, Queenstown. As part of the development the client is proposing to undertake earthworks, remove vegetation and install associated stormwater and wastewater infrastructure on site.

The purpose of this draft lizard management plan (LMP) is to identify and address the actual and potential adverse effects on native lizards associated with the proposed works and specify management measures required to minimise and mitigate anticipated adverse effects. The overall goal is to achieve no net loss of lizards at the site. The draft LMP will accompany the FTAA application, including a Wildlife Act Authority (WAA) to rescue and relocate lizards from within the works footprint, to areas where no works will occur. The draft LMP will be finalised during the FTAA and WAA process.

This LMP should be read in conjunction with the Ridgeburn Ecological Impact Assessment Report ('EclA')¹, which covers an assessment of the lizard values within the site, as well as an assessment of the effects of the proposed earthworks and vegetation clearance and mitigation measures.

¹ Viridis. 2026. Ridgeburn, Morven Ferry Road, Ecological Impact Assessment. Prepared for Ridgeburn Limited.

2 PROJECT CONTEXT

2.1 Site Description

The site is located on the boundary of the Shotover and Remarkables Ecological Districts (ED) of the Lakes Region. The Shotover ED is characterised steep topography with deeply incised canyons. Winters are cold, and summers are hot, with a generally dry climate. Vegetation includes remnant beech forest, extensive bracken fernland, some scrubland and tussockland, including above the treeline. Snow tussockland is extensive where forest and scrub is absent. Exotic forests have established over time.

The Remarkables ED is characterised by rugged, steep, glaciated mountains up to approximately 2,300 m above sea level. Winters are cold, and summers are hot, with a generally dry climate as a result of the Main Divide rain shadow. Forest in the district is limited and mainly consists of small patches in valleys. Elsewhere, scrub is present with abundant tussock.

As the site is mostly on flat or rolling topography, at altitudes below 500 m above sea level, it is more akin to the Shotover ED. The site represents a highly modified area of the ecological district. While not currently urbanised, the site and surrounding land have been developed for agricultural purposes over time and little native vegetation now remains. The site is on the banks of the Kawarau River. The Arrow Irrigation race meanders through the site. The topography of the land varies from flat, to rolling hills, with the moderately steep Morven Hill rising to approximately 750 m above sea level on the site's western boundary

Historically (pre-human) the site likely comprised of beech forest with scrub and/or tussockland in exposed areas. A review of historical aerial imagery shows the site was well established as farmland by the earliest available aerial image, dated 1958. However, the wider area has been farmed since the 1860s and therefore it is likely it has been devoid of any significant native vegetation for more than 150 years. The location of the site is shown in Figure 1.

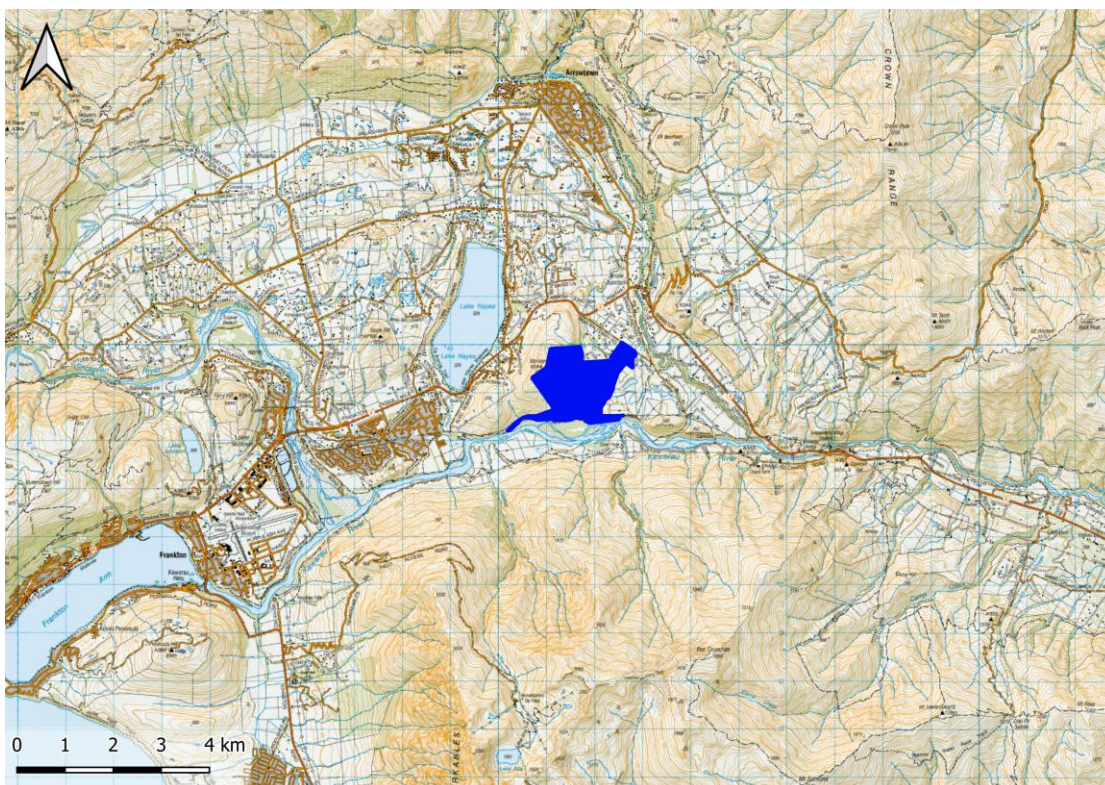


Figure 1. Site location as indicated by blue polygon (map source: LINZ NZ Topo 50).

2.2 Species Potentially Present

Viridis (2025) contains the results of a desktop review of lizard data, a site assessment to assess the presence of suitable habitat on the site, and results of a survey completed by e3 Scientific within the site. The results of the findings are summarised below.

Various areas of lizard habitat were present throughout the site. Habitat was mostly characterised by areas of exposed bedrock or piles of rock, with surrounding areas of vegetation.

A review of Department of Conservation's (DoC) Herpetofauna database (accessed November 2024) for records within 10 km of the site identified nine lizard species. These species are listed in Table 1 below, along with an assessment of the likelihood they are present on site. It is worth noting the species identification and naming of lizards is rapidly evolving and therefore the list provided in Table 1 may not reflect current species lists.

A survey conducted onsite identified the presence of McCann's skink only within the works footprint. However, the presence of tussock skink (*Oligosoma chionochoescens*) was also considered likely, despite records for the area not reflecting this. Two mountain beech gecko (*Woodworthia* "South-western") was also captured during hand searches of exposed rock cliff habitat on Morven Hill.

McCann's skink, tussock skink and mountain beech gecko are considered the target species for the site.

Table 1. Lizards recorded within 10 km of the site.

Common name	Species name	Conservation status	Likelihood of presence on site
Cryptic skink	<i>Oligosoma inconspicuum</i>	At Risk - Declining	Low
Kawarau gecko	<i>Woodworthia</i> "Cromwell"	At Risk - Declining	Low-moderate*
Korero gecko	<i>Woodworthia</i> "Otago/Southland large"	At Risk - Declining	Low-moderate*
Lakes skink	<i>Oligosoma</i> aff. <i>chloronoton</i> "West Otago"	Threatened – Nationally Vulnerable	Low
McCann's skink	<i>Oligosoma maccanni</i>	Not Threatened	Known to be present
Pallid skink	<i>Oligosoma</i> aff. <i>inconspicuum</i> "pallid"	At Risk - Declining	Low
Roys Peak gecko	<i>Mokopirirakau</i> "Roys Peak"	At Risk - Declining	Very low
Short toed gecko	<i>Woodworthia</i> "southern mini"	At Risk - Declining	Very low
Southern grass skink	<i>Oligosoma</i> aff. <i>polychroma</i> Clade 5	At Risk - Declining	Low
Tussock skink	<i>Oligosoma chionochoescens</i>	At Risk - Declining	High [#]
Mountain beech gecko	<i>Woodworthia</i> "south-western"	At Risk - Declining	Known to be present*

Notes: * suitable habitat present on the hill area only. [#] suitable habitat in close proximity to streams/wetland only.

2.3 Lizard Habitat

McCann's skink are likely to be present throughout the site where habitat is suitable. There is a moderate likelihood of tussock skink also being present, predominantly around the wetlands and intermittent streams. The site contained rock piles, scrubby vegetation and areas of long grass that provides good skink habitat. These areas were within a farm system which is subject to both grazing and hay making. Where grass is grazed/hayed, habitat values were low. Where lizard habitat was present, values were considered to be high.

Examples of these habitats present on the site are shown in Figure 2.



Figure 2. Examples of potential lizard habitat within the proposed works area including rock piles, exposed bedrock and scrubby vegetation with long grass.

2.4 Lizard Densities

Native lizard density estimates vary by habitat type and quality, and factors such as predation, historical site disturbance and population dynamics. It is not possible to reliably estimate population sizes and densities without detailed mark–recapture data. Given the very common nature of McCann's skink, the heavily dominant species within the site, mark and recapture was not considered necessary.

Regardless, densities of lizards expected to be present within the works footprint have been estimated based on existing information and based on the survey effort (number of traps, number of survey days) undertaken as part of the baseline survey of the site. Density estimates are available for McCann's skink (Wilson et al. 2017), and also for southern grass skink which has been used as a proxy for tussock skink given their very similar habitats and recent classification as two separate species. In high quality habitat,

Southern grass skink can reach up to ~9,200 skinks per ha while McCann's skink can reach up to ~2,250 skinks per ha.

The works area comprises approximately 0.2 ha of high value habitat (old quarry), approximately 6 ha of moderate value habitat (treeland, pines, garden) and approximately 21 ha of low-moderate (grazed, but not hayed, pasture).

Given the low to moderate habitat quality with no pest mammal management, a rough estimate of 50 skinks per ha could be expected across the site. This would equate to approximately 1,350 McCann's skinks in the project footprint and potentially affected by project works.

Tussock skink habitat is largely unimpacted. A conservative estimate of approximately 0.5 ha of tussocks skink habitat is within the earthworks footprint. Given the low to moderate habitat quality with no pest mammal management, and the limited detection during the survey, a rough estimate of 50 skinks per ha could be expected. This would equate to 25 tussock skink within the project footprint potentially affected by the works.

Density estimates of mountain beech gecko have not been formally published. Studies on similar species *Woodworthia* spp. have reported densities of tens of individuals per ha (Towns et al. 2007). Based on the low-moderate habitat within the site, and the avoidance of habitat typically occupied by mountain beech gecko, less than 10 are expected to be encountered across the project footprint, if any at all.

2.5 Proposed Site Works

The majority of the vegetation within the site is proposed to be removed. However, the bulk of the site comprises grazed or managed pasture, as part of active farming operations. Lizard habitat is concentrated around shelterbelts, treeland, amenity planting and areas of long grass such as those around the wetlands A, B and D. Figure 3 illustrates areas where lizards were detected during a targeted survey of the site.



Figure 3 - Lizard survey results

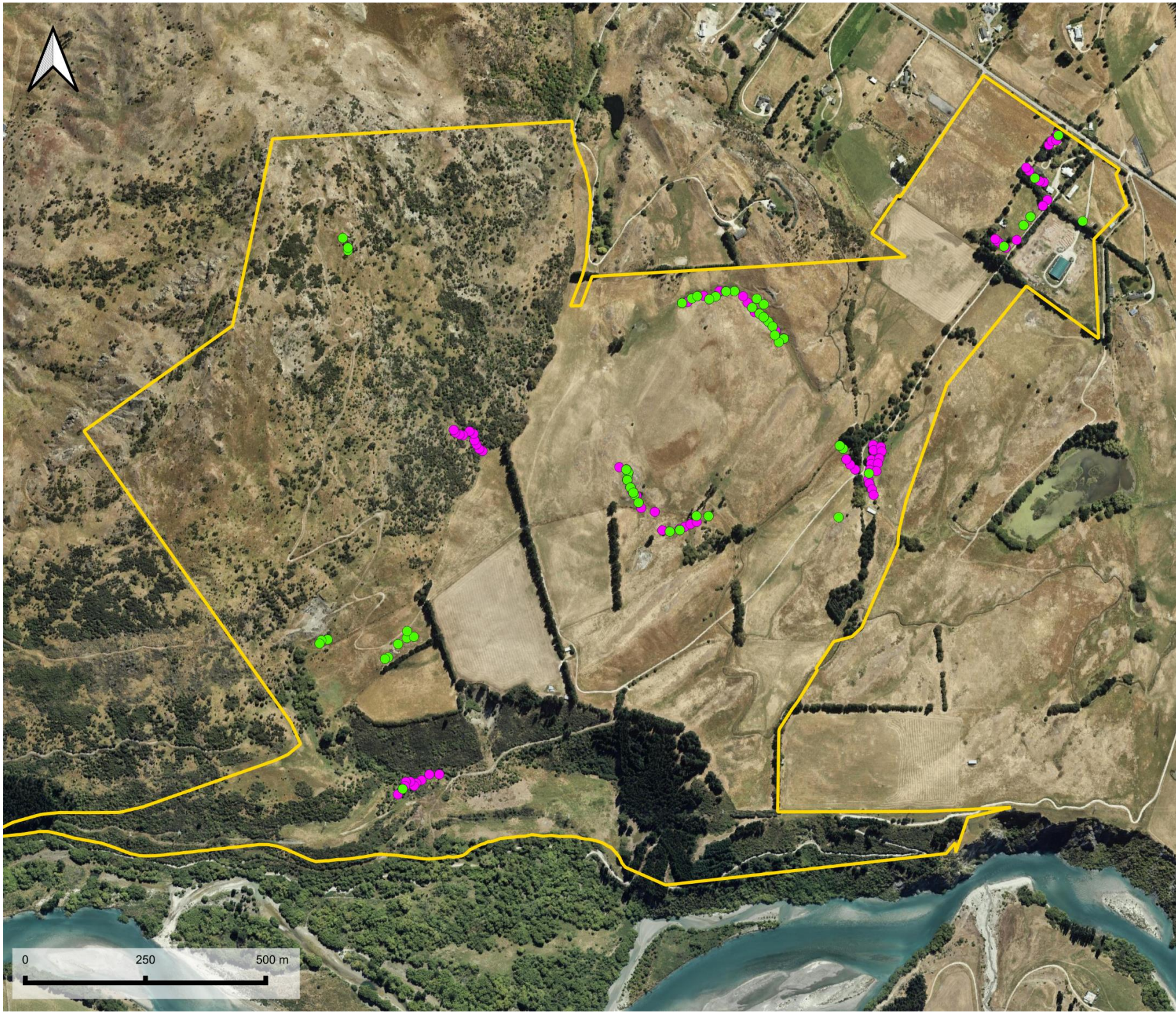
-  Site boundary
-  Trap locations
-  Lizard observations

SOURCES
Nearmap.com 2025

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2.6 Description of Impacted Habitat

The ecological values of the habitat on the site are assessed and in full described in Viridis (2025). The vegetation on the site affected by the proposed clearance is described as:

- Areas of piled loose rock, including an area where an old quarry was likely located.
- Non-grazed vegetation under exotic treeland, amenity planting and landscaping around the house, and under shelterbelts.
- Long, ungrazed or unmown grass, mostly around the wetlands.
- Areas of scrubby vegetation around the escarpment.

2.7 Potential Effects on Lizards

If indigenous lizards are present within the areas of vegetation clearance, potential adverse effects on lizards may include:

Direct effects:

- Mortality during vegetation clearance or habitat disturbance
- Injury during physical clearance works

Indirect effects:

- Loss of habitat
- Habitat fragmentation
- Temporary noise disturbance

Managing direct effects on lizards requires mitigation through a salvage and relocation programme. The riparian revegetation planting proposed as part of the development will help to mitigate for the loss of indigenous lizard habitat.

3 HERPETOFAUNA MANAGEMENT

3.1 Objectives

The objectives of the herpetofauna management measures proposed are to minimise potential adverse effects on native lizards within the construction footprint by way of capturing and relocating any native lizards prior to and during vegetation removal, and providing habitat enhancement and pest control, where appropriate. Further, the proposed herpetofauna management aims to achieve the following:

- The population of each species of native lizard present on the site at which works is to occur shall be maintained or enhanced on site; and
- The habitat(s) that lizards are transferred to on the site will support viable native lizard populations for all species present pre-development.

These objectives will be achieved by:

- a. Using current best practice to capture native lizards from vegetation and other potential habitats in the construction footprint prior to and during vegetation clearance, and relocate any captured individuals to safe and suitable habitats (avoid and minimise mortality of wildlife protected by the Wildlife Act);
- b. Setting out standard surveying and monitoring protocols that are to be followed, using the DoC Natural Heritage Management System's Herpetofauna Inventory & Monitoring Toolbox (DoC, undated) and/or using new advances in tools and techniques not yet incorporated into the toolbox;
- c. Meeting requirements of the Wildlife Act and Resource Management Act.

Section 3 of the LMP addresses the following:

- Lizard capture, vegetation clearance supervision and relocation methodologies;
- A summary of the recommended on site release site;
- Post works management and monitoring (where required).

3.2 Statutory Context

Herpetofauna (reptiles and amphibians) comprise a significant component of New Zealand's terrestrial fauna. There are currently 147 native herpetofauna taxa recognised in New Zealand (Hitchmough et al., 2021; Burns et al., 2024), 88% of which are considered 'Threatened' or 'At-Risk'. All indigenous reptiles and amphibians are legally protected under the Wildlife Act 1953, and vegetation and landscape features that provide significant habitat for native herpetofauna are protected by the Resource Management Act 1991.

Statutory obligations require management of resident reptile and amphibian populations where they or their habitats are threatened by disturbance or land development. This draft LMP is a site-specific plan prepared to avoid or minimise adverse construction effects and to ensure that all necessary measures for successful relocation of lizards are identified and implemented to protect and/or enhance their habitats.

Capture, handling and relocation of indigenous lizards may only be undertaken under a valid Wildlife Act Authorisation (WAA) issued by DoC.

3.3 Project Herpetologist and Methodology Finalisation

A suitably qualified herpetologist or ecologist ('project herpetologist') is required to implement this LMP, and a WAA to capture and relocate indigenous lizards is required. Prior to undertaking lizard relocation work, the project herpetologist will review (and amend if appropriate) the proposed lizard management methodologies within this LMP.

3.4 Lizard Search and Capture Methodology

3.4.1 Timing of activities

Revegetation activities should be completed prior to commencing lizard salvage activities. Pest control should be in place in all potential release sites prior to commencing lizard salvage activities.

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

All lizard management activities are required to be undertaken during fine, calm, and dry weather. If weather is marginal, the project herpetologist will have the ultimate say on whether management activities can occur on that day.

Trapping and day searches are to be undertaken in the fortnight leading up to vegetation removal, as well as destructive searches immediately prior to and during vegetation clearance.

3.4.2 Trapping and habitat searches

Salvage shall occur in all areas of moderate and high value lizard habitat within the earthworks footprint (Figure 4). Salvage in low-moderate areas will occur at the discretion of the project herpetologist depending on habitat values at the time. The low-moderate areas are currently subject to grazing, limiting the value of the habitat. Removal of stock will likely allow grass to grow longer, therefore increasing the likelihood of lizards being present throughout this area.

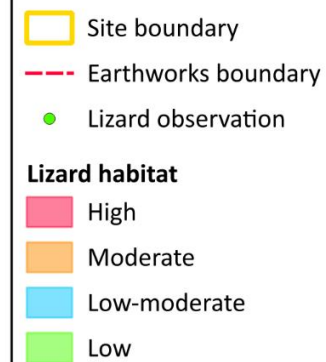
A minimum five-day intensive trapping period using a combination of artificial cover objects (ACOs), baited pitfall traps and/or baited funnel traps (Figure 5) will be undertaken prior to vegetation removal at a density deemed suitable by the project herpetologist. Additional trapping days may be required depending on numbers of lizards captured. Additional days will be undertaken at the discretion of the project herpetologist. Key points for this trapping are:

- All traps shall be embedded in and furnished with vegetation to protect any captured lizards from heat and exposure during confinement.
- ACOs and pitfall traps shall be installed at least four weeks prior to the commencement of trapping to allow them to 'bed in' to the environment.
- Each trap will be baited with fruit (e.g. canned pear).
- Traps are to be placed in shaded areas away from potential inundation with water and checked once per day while active to limit adverse effects on lizards (stress, desiccation, drowning, etc.).
- When not in use, all pitfall traps shall be deactivated (sealed closed or furnished to the upper rim so that lizards may escape).
- Captured lizards will be held temporarily (up to two hours) to allow traps to be cleared either in their entirety or in sections. Lizards will be stored as described in 3.4.4 below.
- All native lizards shall be released at the designated release sites following capture.

During trap checks, the project herpetologist shall hand search all vegetation, logs, rocks and debris to capture lizards and identify important areas that should be targeted for destructive searching.



Figure 4 - Lizard habitat and lizard records

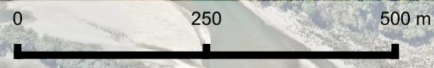


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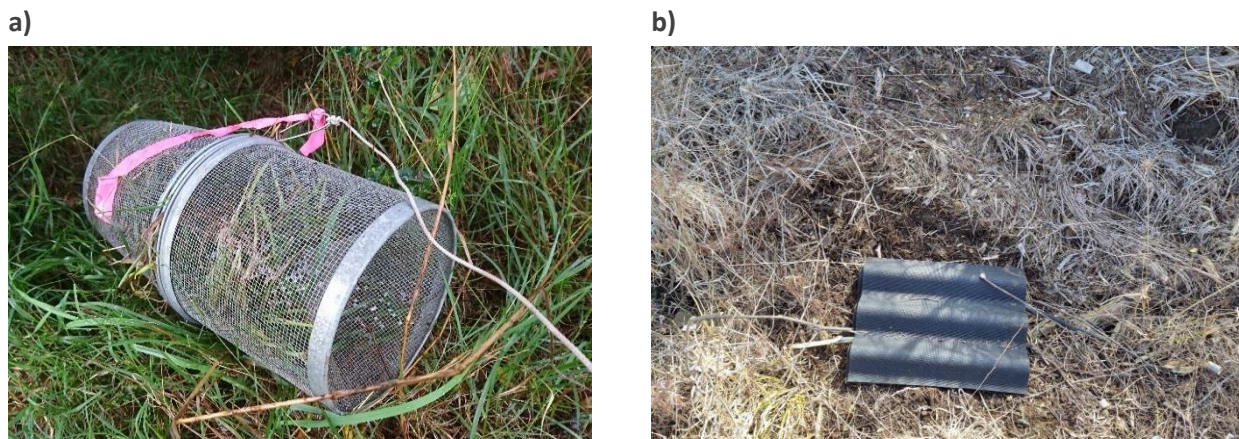


Figure 5. a) a funnel trap, b) an ACO.

3.4.3 Destructive habitat searches

After trapping and active searches are complete, destructive habitat searches will be carried out in conjunction with the vegetation clearance or works contractor. This will involve systematic manual searches of suitable habitat (e.g. rank grass) and destruction of habitat where practicable. Leaf litter, ground cover vegetation, and small debris may be hand-raked where practicable, and larger debris overturned to search for refuging lizards.

Where vegetation growth means an area cannot practically be searched by hand, machine-assisted searches will be undertaken. This involves the project herpetologist working alongside an excavator operator as the top layer of vegetation is scraped away to reveal bare soil underneath and expose concealed lizards. If possible, a toothed bucket will be used to improve scraping.

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

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

3.4.4 Lizard handling and containment

All lizards will be handled as specified by the methodologies within the New Zealand Lizard Conservation Toolkit (Anderson et al., 2012).

Native lizards will only be captured and handled by or under the supervision of the DoC-authorized, suitably qualified ecologist. Hands should be sterilised before and after handling lizards, along with all field equipment that indigenous lizards may come into contact with.

Lizards will be held individually in cloth bags in a secure, vented container or in temporary containment box(es) filled with vegetation matter and leaf litter and misted with water out of the sun. Lizards will be held temporarily for the period of the active searches or trap inspections and then transported to the release site as soon as possible.

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

3.4.5 Inadvertent lizard injury or death

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

- The project herpetologist would notify DoC as soon as possible (within 24 hours);
- Any lizard death of 'Threatened', 'At Risk' or 'Data Deficient' species shall be sent to Massey University Wildlife post-mortem service for necropsy. The body should be chilled if it can be delivered within 24 hours or frozen if delivery will take longer than 24 hours;
- Appropriate measures shall be undertaken to minimise further lizard deaths;
- Injured lizards found during salvage will be taken to a suitably qualified vet as soon as possible for assessment and treatment. Injured lizards will be kept in an appropriate portable enclosure (i.e., a clean, well-ventilated (plastic container) under the direction of the project herpetologist to ensure the lizard is handled appropriately until it can be treated;
- Lizards assessed by the vet or alternative specialist as uninjured or otherwise in suitable condition for release would be transported to the relocation site in the portable enclosure and released; and

Euthanasia of an injured lizard is only to be undertaken under the direction of DoC.

3.5 Release Site

3.5.1 Selection of release site

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

- It is important that the release site is an appropriate distance from the project footprint to prevent the lizards from re-entering the works area. However, the release site should be located as close as possible to the salvage site to ensure resemblance of microhabitats and environmental conditions.
- The habitat within the release site should be representative to or of higher ecological value than the salvage site.
- Areas with long-term protection should be favoured, such as reserves managed by DoC or Council, vegetation covenants or areas protected by regional and local council overlays.
- Potential existing species composition and density at the release site should be considered as far as practicable to limit potential adverse effects of intra- and inter-species competition at the release site.

3.5.2 Proposed release sites

Four release sites are proposed within the site (Figure 6). All sites have been selected as they meet the key criteria for a suitable lizard release area. The locations are sufficiently separated from the works area to minimise, as far as practicable, salvaged lizards from re-entering the construction footprint, while remaining close enough to provide comparable microhabitats and environmental conditions. Areas B and C are in closer proximity to the works areas. To ensure released lizards cannot move from the release areas into the works areas, temporary containment fences will be installed around the perimeter. The fences will consist of silt fencing, partially buried in the ground, held in place by

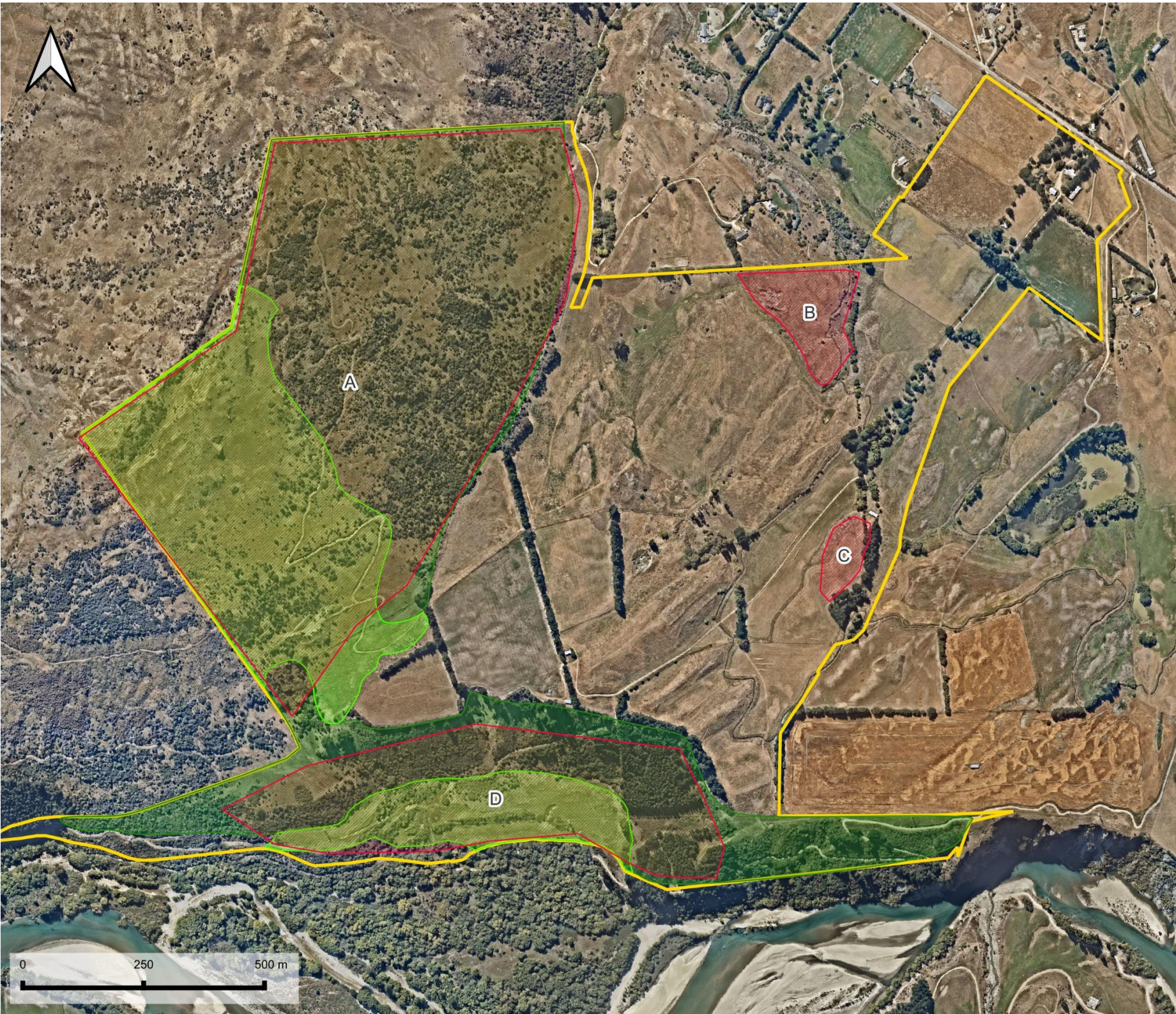
waratahs and wire. The fencing will be inspected weekly for the duration the fence is in place for, and any holes repaired as soon as identified. Fencing will only be removed once all works on site have been completed.

The habitat within the release areas is of equal or greater ecological value than the salvage site. In area A the vegetation is structurally complex, comprising ground cover and shrub species, areas of open grassland, and areas of exposed bedrock and cliffs. Collectively, these features create a habitat mosaic that is well suited to support a range of indigenous lizard species. Areas A and D will be subject to revegetation planting as part of the site development. A combination of shrubland and tussockland areas will be planted ensuring low stature areas remain present. Areas B and C are predominantly pasture with areas of exposed bedrock. Once works commence on the site, stock will be removed and the pasture will grow long and unmanaged.

Areas A, B and C will be subject to period irrigation of treated wastewater (area a – spray irrigation, areas b and c – driplines). Area D will be prioritised for lizard release, with the other areas used at the discretion of the project herpetologist depending on the numbers of lizards salvaged. Tussock skinks will be preferentially released to area B due to its proximity to wetland/stream environments.

Release locations will be protected in perpetuity via consent notices preventing additional development in these areas and requiring vegetation to be maintained and pest control.

Figure 6 - Proposed lizard release sites



-  Site boundary
 Lizard release sites
- Revegetation areas**
-  Shrubland
 Tussockland

SOURCES
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3.5.3 Habitat enhancement of release site

Introducing new individuals into an already occupied environment could lead to competition and/or resource availability issues. Displaced lizards have a lower likelihood of survival where the carrying capacity of adjacent habitats is stressed through increased competition for fewer resources. Further, displaced animals have a higher probability of risk of predation and a rapid increase in lizard numbers in a given area is likely to result in a corresponding increase in predators.

Revegetation of the hill block and river escarpment and terrace will be undertaken as part of the site development. Revegetation includes planting of the area identified in Figure 6 with various native species which will provide refugia and food resources for relocated lizards. Low stature open tussockland will be maintained on the hill and river escarpment to provide lower stature habitat. Rocks from the quarry will be relocated throughout the site, including on the hill block and in areas B, C and D, to provide refuges and basking habitat.

Pest plant and predator control will occur across the release areas including control of mice, rats, mustelids and possums. Deer and rabbits will also be managed as their presence will impact on establishment of plantings. Pest plant control methods will be provided in the project planting plan. Pest animal monitoring, targets and control will be provided in a pest management plan.

3.6 Post release monitoring

Post release monitoring of the lizard population in the release site is recommended if a substantial number of lizards (>100 McCann's skink or any other species) are salvaged from the works area. Monitoring is necessary to determine the success of the salvage and enhancement works at the release site. Monitoring will be carried out during the first season post salvage. If multiple salvages occur across seasons, the same triggers will apply, i.e. if two separate seasons salvage more than 100 lizards, monitoring will be required following both salvage seasons. The monitoring will be commissioned by Ridgeburn Limited, and completed by a suitably qualified herpetologist/s.

The monitoring of translocated lizards to measure survivorship and population establishment is difficult without physically marking the lizards as McCann's skink are very difficult to identify to an individual level as their markings are not distinctive enough between individuals. Methods such as toe clipping are effective, but are not widely used due to ethics. Post release monitoring will therefore be focused on determining if population/s of lizards are persisting in the release site/s following salvage and release.

Standard survey techniques (i.e. ACOs, baited pitfalls, baited gee's minnow traps) will be employed at all sites lizards are released to. The number and location of traps will be determined at the time depending on the number of lizards salvaged and which site/s they were released to. Traps will be checked every day for one week during appropriate weather between November and February when lizards are at their most active. All lizards captured will be measured (snout-vent, tail-vent length), sexed, photographed, and marked with an ID number using a non-toxic marker. Following the week of checks occupancy modelling can be conducted to estimate the size of the population, and trends of persistence over time. These results will provide an indication of how lizards are persisting in the release site/s.

The herpetologist undertaking the post-release survey may recommend additional monitoring if survey results do not indicate a healthy population. Reporting of results of the post release monitoring will specify this. The post release monitoring report, along with recommendations, will be provided to DoC. Additional habitat enhancement, pest control, or other measures may be recommended at the discretion of the project herpetologist.

3.7 Completion reporting

A completion report would be prepared by the project herpetologist and submitted to DoC/Queenstown Lakes District Council/Otago Regional Council within **one month** of the completion of all vegetation removal. The report should detail the number of lizards captured, the locations they were captured from and the release site/s. The report would also detail whether any post-release monitoring (and timing) is recommended based on the number of lizards salvaged. An Amphibian/Reptile Distribution Scheme (ARDS) Card will be sent to the Council and DoC.

3.8 Checklist

Table 2 contains a checklist summarising the responsibilities for lizard management within the site.

Table 2. Lizard Management Checklist

Task	Required of:	Completed
Project start-up		
Appointment of project herpetologist	Landholder	
Finalisation of lizard management techniques and LMP and submission to Council/DoC	Project herpetologist (and project ecologist where amendments to bat and bird methodologies are required)	
Approval of LMP	DoC	
Pre-works management prior to vegetation clearance		
Deployment of ACOs, pitfall traps and / or funnel traps	Project herpetologist	
Pre-works lizard capture	Project herpetologist	
Works lizard management		
Machine assisted lizard capture	Project herpetologist, clearance contractor	
Post works		
Works completion report to client, Council and DoC	Project herpetologist	
Post completion monitoring (where required)	Project herpetologist	

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Viridis 2026. Ridgeburn, Morven Ferry Road. Ecological Impact Assessment. A report prepared for Ridgeburn Limited by Viridis Limited.

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Appendix D

Draft Fish Management Plan

Ridgeburn, Morven Ferry Road

Draft Fish Management Plan

Prepared for: Ridgeburn Limited

January 2026



DOCUMENT CONTROL AND REVISION HISTORY

Document title	Ridgeburn, Morven Ferry Road
	Draft Fish Management Plan
Prepared for	Ridgeburn Limited
Version	Draft A
Date	21 January 2026
Document number	10339-006-A

Version	Issue date	Document number
Draft A	21 January 2026	10339-006-A

Author(s)	
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	Lead Ecologist Director

Reference: Viridis 2024. Ridgeburn, Morven Ferry Road Draft Fish Management Plan. A report prepared for Ridgeburn Limited by Viridis Limited. January 2026.

Cover photo: Upland bully (*Gobiomorphus breviceps*).

TABLE OF CONTENTS

1	Introduction.....	1
1.1	Background.....	1
1.2	Site description.....	2
2	Methodology	6
2.1	Timing.....	6
2.2	Exclusion devices	6
2.3	Fish capture	7
2.4	Handling of fish.....	8
2.5	Relocation site	9
2.6	Biosecurity.....	9
2.7	Adaptive Management.....	9
3	Reporting.....	11
4	Permits	11

List of Figures

Figure 1. Site location as indicated by blue polygon (map source: LINZ NZ Topo 50).	1
Figure 2. Intermittent streams a) 1 and b) 2.	2
Figure 3. Examples of the water race within the site.....	3
Figure 4. a) Pond v with vi in the background with no water present and b) pond iii with water present.	3
Figure 5. Freshwater features within Ridgeburn development area	5
Figure 6. Sketch showing fish barrier installed in a stream to prevent passage into or out of an area.	6
Figure 7. Proposed fish release sites	10

1 INTRODUCTION

1.1 Background

Ridgeburn Limited have applied for resource consent through the Fast Track Approvals Act (2024) (FTAA) to develop a residential subdivision on the property at 122 Morven Ferry Road, Queenstown. As part of the development constructed ponds will be reclaimed, two intermittent streams will be realigned, and an artificial irrigation race will be piped.

The purpose of this draft fish management plan (FMP) is to identify and address the actual and potential adverse effects on native fish as a result of the works. The draft FMP will accompany the FTAA application, to rescue and relocate fish from within the aquatic works areas, to areas where no works will occur. The draft FMP will be finalised during the FTAA process.

This FMP should be read in conjunction with the Ridgeburn Ecological Impact Assessment Report ('EclA')¹, which covers an assessment of the lizard values within the site, as well as an assessment of the effects of the proposed earthworks and vegetation clearance and mitigation measures.

The location of the site is shown in Figure 1.

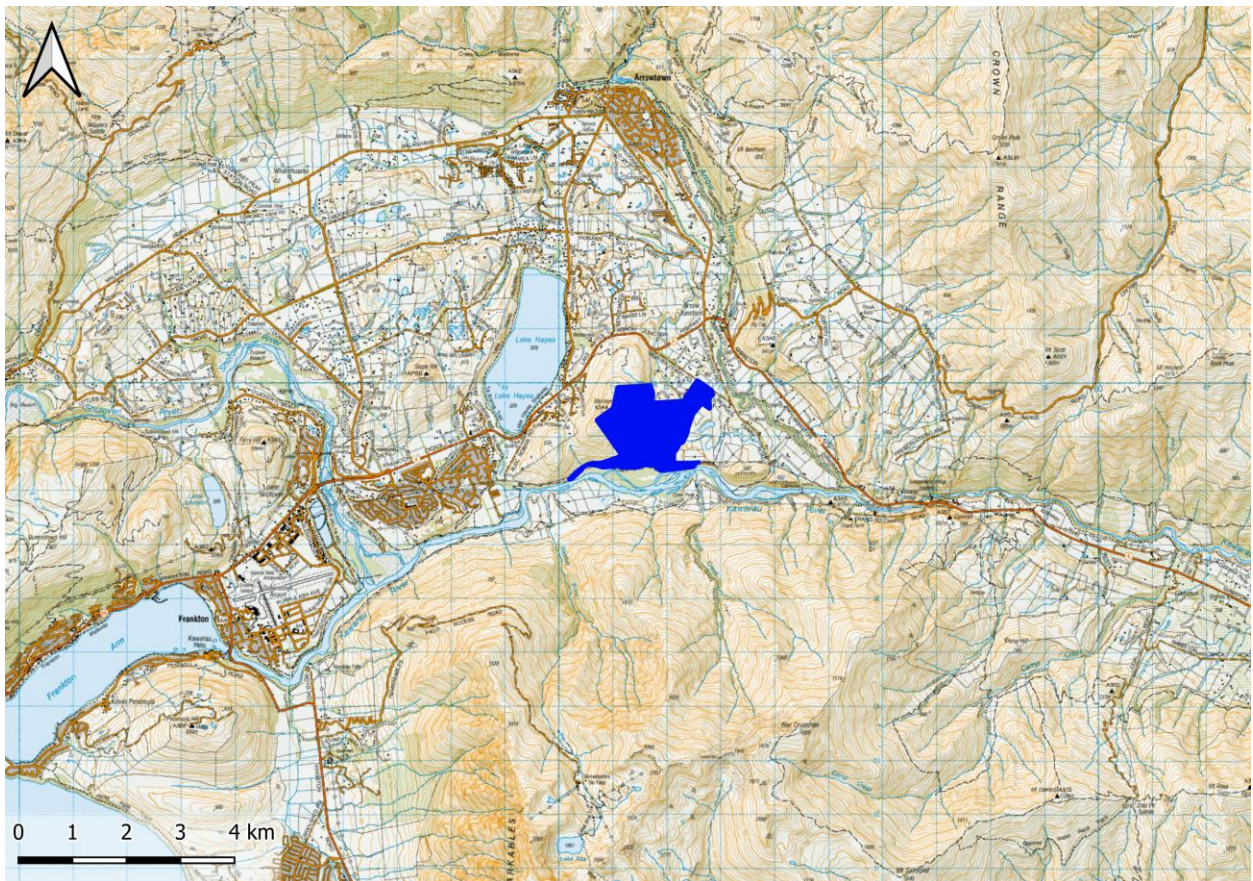


Figure 1. Site location as indicated by blue polygon (map source: LINZ NZ Topo 50).

¹ Viridis. 2026. Ridgeburn, Morven Ferry Road, Ecological Impact Assessment. Prepared for Ridgeburn Limited.

1.2 Site description

Four intermittent streams were identified within the site (Figure 5). Waterway 1 formed the outlet point for wetland B. It has contained water during some site visits only and is considered likely to only flow during winter and spring (Figure 2a). Substrates were dominated by compacted sediment, not loose sediment, further supporting the intermittent classification. The channel was approximately 0.5 m wide, and water was generally less than 0.3 m deep. The channel was well shaded by exotic vegetation, namely hawthorn trees. The lower reaches of the channel gradually reduced in size until no channel or water was observable. Review of aerial images suggests the channel would have continued north, before veering northwest at approximately the location of the northern most constructed pond. The channel has likely been modified over time and no longer flows continuously.

Instream habitat was considered to be of low quality, largely due to the intermittent nature of the flow. It is unlikely the stream supports any fish due to both the intermittent nature and the lack of connectivity to its lower catchment.

Waterway 2 was located close to the site's eastern boundary. It drained a small, shallow gully area and discharged into a constructed pond (Figure 2b). Review of historical aerial images does not suggest a channel was present in this location, however the topography, and the fact a small amount of flowing water has been present on occasion means an intermittent classification was considered appropriate. While portions of the channel were vegetated with pasture grass, other reaches did not contain terrestrial vegetation, and exposed soil formed the substrate. It is expected waterway 2 only flows for relatively short periods of time during wetter periods. No fish are expected to be present at any time, due to the very small amount of water present when flowing and lack of connection to other surface water habitats.

Waterway 3 was a short reach discharging from wetland D and will not be subject to works.

Waterway 4 was located near the sites southwestern corner and will not be subject to works.

a)



b)



Figure 2. Intermittent streams a) 1 and b) 2.

The Morven Ferry water race flows through the site (Figure 5). It entered the site on the northern boundary and then meandered largely southwards through the site before it flowed out on the site's eastern boundary (Figure 3). The race is artificial and has clearly been constructed. It did not follow natural contours and in one location it flowed, via an aqueduct, over a natural wetland. There are no records in the NZFFD for the race. Observations on site did not yield any fish (bullies are usually

observable). It is possible fish may be present within the race, depending on connections to other surface water (i.e., if fish barriers are present), however, given the steep discharge to the Kawarau River, movement of fish from the river into the race is considered limited. The only fish potentially present will be species with climbing ability such as eels or koaro. Fish habitat within the race was limited, with no undercut banks, instream vegetation or hydraulic heterogeneity.



Figure 3. Examples of the water race within the site.

Seven constructed ponds were identified within the site (Figure 5). Six of these ponds will be reclaimed while the pond located within wetland B will not be impacted. The ponds were generally dry, though a small amount of water has been present in ponds iii, v, and vii on occasion (Figure 4). Most ponds were isolated from other surface waters either directly, or their discharge channels did not connect to other surface water. It is unlikely fish are present within the ponds due to this, however, eels may be present if water is present.

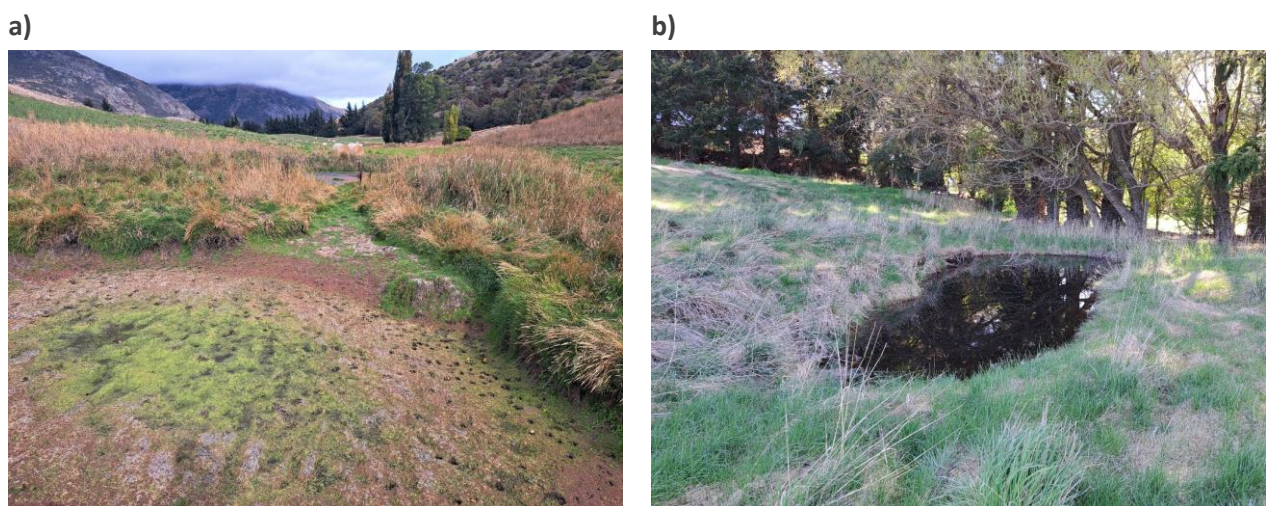


Figure 4. a) Pond v with vi in the background with no water present and b) pond iii with water present.

No formal survey of fish has been conducted due to the lack of habitat within the site. Records from nearby streams obtained from the New Zealand Freshwater Fish Database suggest the following fish species may be present in the wider catchment:

- Longfin eel (*Anguilla dieffenbachii*, At Risk - Declining)
- Shortfin eel (*Anguilla australis*, Not Threatened)

- Common bully (*Gobiomorphus cotidianus*, Not Threatened)
- Brown trout (*Salmo trutta*, Introduced and Naturalised)
- Koaro (*Galaxias brevipinnis*; At Risk – Declining)
- Rainbow trout (*Oncorhynchus mykiss*; Introduced and Naturalised)
- Perch (*Perca fluviatilis*; Introduced and Naturalised)

Based on the stream and pond sizes, location and habitat within the site, as well as the presence of existing fish barriers within the site, only shortfin eels are likely to be present. The other species listed are considered unlikely to be present.

Figure 2 - Freshwater features within Ridgeburn development area

-  Site boundary
-  Constructed pond
-  Wetland
-  Intermittent stream
-  Water race

SOURCES
Nearmap.com 2025

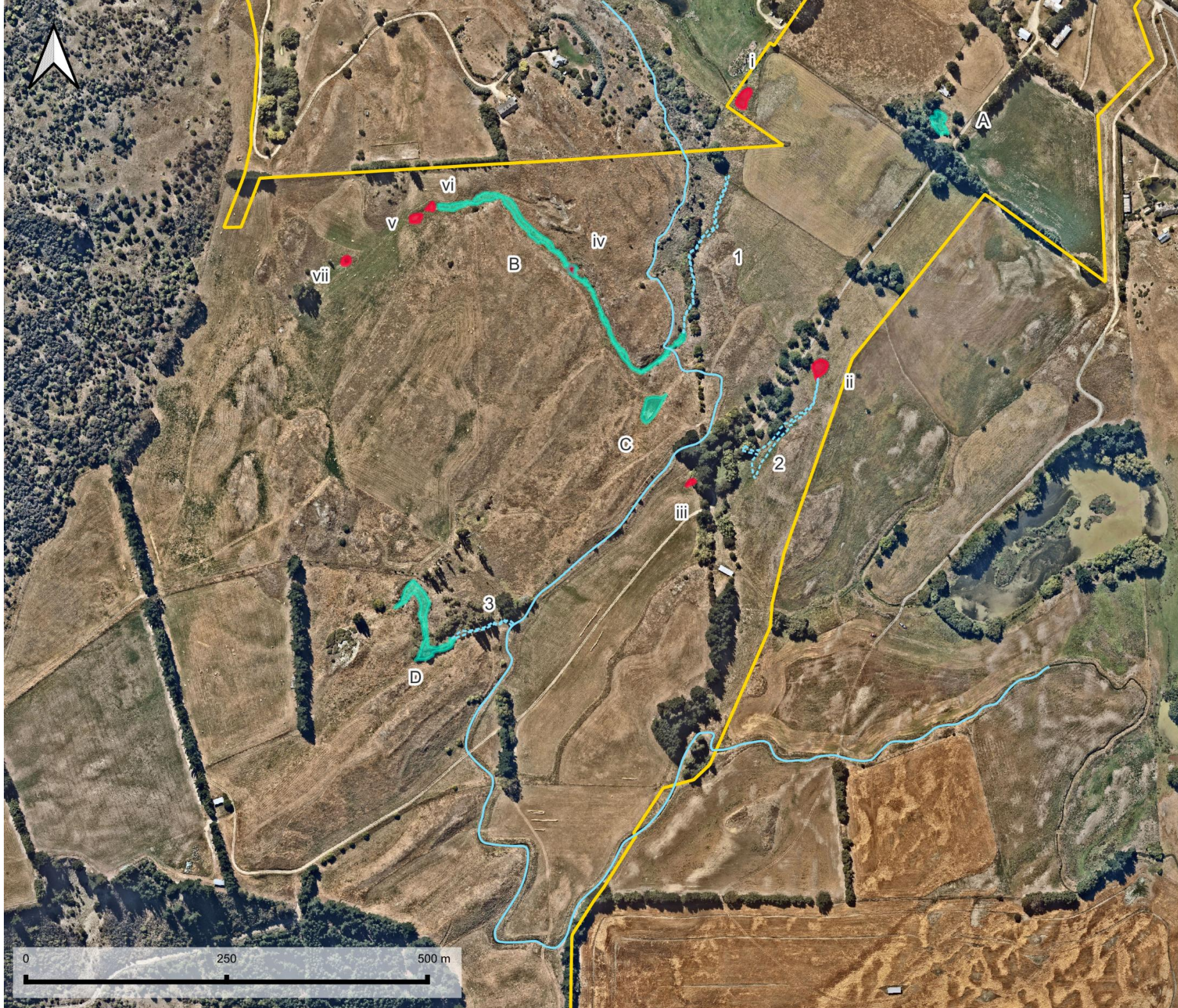
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DRAWN BY: AJC

DATE: 21/01/2026



2 METHODOLOGY

2.1 Timing

Fish salvage and relocation will be undertaken immediately prior (within 2-3 days) to the commencement of any instream works or pond reclamation. Ongoing maintenance of any temporary fish barriers by the contractors will be undertaken until stream and pond works are complete within the area. Fish salvage should preferentially occur during the drier summer months when weather is generally more settled. No salvage should occur if moderate or higher rainfall is forecast for the salvage period.

2.2 Exclusion devices

Prior to commencing works to pipe the water race fish salvage, barrier/s will be installed to prevent fish moving up and downstream through the area of works. Exclusion devices are not necessary for the intermittent streams as they are already naturally isolated from receiving environments, i.e. they discharge to ground at the downstream extent of works. Exclusion devices are not needed for pond reclamation works due to their natural isolation.

Exclusion devices, if required, will be constructed from steel warratahs and shade cloth, or similar. Shade cloth, or a similar material, allows water to continue to flow downstream while preventing fish passage. The exclusion screen will extend at least one metre past the wetted widths of the aquatic habitat and will be embedded into the dry ground or the banks (Figure 6).

Warratahs will be securely hammered into the ground and evenly spaced across the stream to support the shade cloth. Where extra support is necessary, i.e. if the flow is very swift, wire will be threaded horizontally across through the warratahs. Shade cloth will be fastened to the warratahs and wire supports (where applicable) using zip ties. The shade cloth will extend approximately 0.5 m above the water level. Along the stream bed the shade cloth will either be embedded and pinned or securely weighted down, or an apron of the shade cloth will be formed and pinned. This creates a pocket, preventing fish from passing under the barrier.



Figure 6. Sketch showing fish barrier installed in a stream to prevent passage into or out of an area.

2.3 Fish capture

2.3.1 Ponds and intermittent streams

If the ponds or intermittent streams are dry at the time of works, no fish salvage is necessary.

If ponds contain water at the time of works, they may be partially dewatered prior to commencement of fish salvage. At least 50% of the pond volume, 50% of the pond area or 50% of the pond depth, whichever is largest, shall be maintained at all times following partial dewatering to ensure there is enough habitat to support any fish as salvage occurs. Netting/trapping is proposed within the ponds, and also within the stream channels if water is present. If water is not present, but saturated mud/sediment is present in either the ponds or the intermittent streams, this should be searched for eels.

The *New Zealand Freshwater Fish Sampling Protocols* (Joy *et al.* 2013) will be followed unless specified within this plan.

Providing water levels allow, baited Gee-minnow traps and fyke nets will be placed at intervals over the stream works areas and ponds and left in place overnight. Fine meshed fykes with a separator grill will be used if depth allows. All nets and traps will be set with an airspace to provide trapped fish access to atmospheric oxygen and will be set in general accordance Joy *et al.* (2013). Floats placed in the fyke nets if required to ensure an airspace is available. The traps will be checked the following morning, prior to 9 am, with any captured fish recovered.

Trapping densities will be set, at minimum, one fyke net and two Gee-minnow traps over 25 m per Joy *et al.*, (2013). However, if sufficient length and depth of water is present, the densities of traps and nets may be increased if deemed appropriate by the ecologist completing the fish salvage and relocation. Where water depth prevents fykes being set, the densities of Gee-minnow traps will be increased and hand-netting of any aquatic habitat (e.g. pools, overhanging vegetation, woody debris) will be undertaken. Hand netting will occur moving up the impact reach to sweep for any fish present within the channel which may not be able to move into the traps due to the shallow water depth. Hand netting will cease when less than two indigenous fish are captured. If water depths are not suitable for Gee-minnow traps, hand netting will still occur.

If more than 20 native fish are caught during a single trapping effort within the target area, trapping will continue until numbers are depleted to the satisfaction of the ecologist completing the fish salvage and relocation (using an 80% removal rate as a target, based on the Hayne's (1949) regression method). A single trapping effort is considered to be one night of trapping. Target removal rates will be adjusted to 95% if any Threatened or At Risk species are captured.

Complete dewatering in the ponds will commence provided minimum performance standards have been met. All pumps used for dewatering will be appropriately screened to prevent fish being entrained in the pump. Screens will have gaps no larger than 3 mm. Native fish, such as eels (*Anguilla* spp.), will burrow into silt substrates when they are disturbed or as water levels decrease. As a result of this, during the dewatering stage, a freshwater ecologist will be present to search through drained habitat, rocks/debris, remaining pools or thick sediment for any remaining fish. Once dewatering is completed an excavator will be used to carefully scrape out any thick layers of sediment, if necessary. A toothed bucket will not be used on the excavator. In our experience it is more effective to use a non-toothed bucket. Providing a minimum depth of approximately 200 mm of sediment is scraped, any eels buried within the mud will be scooped up unharmed. Toothed buckets are inefficient for 'muck outs' as the

teeth mean a shallower depth is scraped. Any sediment removed from the intermittent streams will also be manually checked by the freshwater ecologist using the same methods as for the ponds.

2.3.2 Water race

While a stream works method for piping the water race has not yet been confirmed, it is assumed the pipe will be constructed offline with flow diverted into the new pipe once construction has been completed. The race is considered unlikely to contain fish, however, their presence cannot be ruled out. Prior to diverting flow into the new pipe, exclusion devices will be installed at the upstream point where the pipe commences and the downstream point where the new pipe will discharge to the original channel. Two nights of trapping will occur within the race. Following trap checks in the morning, electric fishing will occur from upstream to downstream along the length of the isolated race reach. Upstream to downstream direction allows any missed fish to be moved downstream, allowing easier salvage at the downstream exclusion device. If no fish are encountered during the first electric fishing pass, no additional passes are required. If fish are encountered, additional passes will be undertaken, with the number depending on numbers of fish captured and the depletion rate.

Once trapping and electric fishing has been completed, the upstream point of the race will be bunded, diverting all flow into the new pipe. The open channel will then naturally drain. Hand netting of the channel, with the assistance of an electric fishing machine as necessary, will be undertaken to rescue any fish trapped in pools as water levels recede.

The open channel can then be filled in.

2.4 Handling of fish

Fish handling will be in accordance with Section 3.9 of the *New Zealand Freshwater Fish Sampling Protocols* (Joy *et al.* 2013) and the Viridis MPI Special Permit (875) and Native Fish Transfer Authorisation (NFT420).

All fish captured in traps/nets or via electric fishing, will be immediately transferred to waterfilled, lidded containers of an appropriate volume for the number of fish captured. Multiple containers will be used if necessary. Containers will be stored in the shade. Fish will be stored in the containers for no more than one hour. If storage for longer is required, water will be changed at least once per hour and/or a battery powered air pump will be placed in each container to ensure oxygen levels are sufficient. A water conditioner, such as API stress coat may be added to the water to reduce fish stress. Water conditioner will be added as per manufacturer instructions.

If any individual captured fish shows signs of stress (loss of righting response, exuding excessive mucus, gulping air, and or mouth gaping) the water will be changed to provide more oxygen, or the fish will be moved to the relocation site immediately.

Fish will be visually examined for general health (visual skin lesions or heavy fungal burdens) and if considered unhealthy by an appropriately qualified freshwater ecologist, they will be humanely euthanized in accordance with condition 14 of the MPI Native Fish Transfer Authorisation (420).

Large eels (> 500 mm) will be contained individually to avoid injury to other smaller captured fish. Kōura (*Paranephrops sp.*), if present, will also be separated into their own containers.

Captured fish will be securely transported to the relocation site and gently transferred into the stream within two hours of being captured. If large numbers of fish are captured, they will be distributed across multiple release points in the general area to avoid short term overstocking and predation risks.

2.5 Relocation site

2.5.1 Ponds and intermittent streams

Fish captured within the ponds or intermittent stream will be released to the Arrow River (Figure 7). All freshwater features within the site are within the Arrow River catchment. Prior to changes in flow paths that have occurred as a result of construction of amenity ponds and residential houses in the area, the intermittent streams would have ultimately discharged to the Arrow River.

The river is large enough that it provides variable habitat, and will be capable of supporting any released fish. While numbers of fish captured are not expected to be large, it is important that the receiving habitat is capable of supporting them.

2.5.2 Water race

Any fish captured from the water race will be returned to the water race upstream of the piped section (Figure 7). If access to neighbouring properties to reach the race is not available, it is accessible from the road at the corner of SH6 and Morven Ferry Road.

2.6 Biosecurity

All equipment will be thoroughly cleaned and dried prior to use. Equipment includes but not limited to; electric fishing machine, waders, fyke nets, gee minnow traps, stop and dip nets and transfer buckets.

Any pest fish caught will be humanely euthanized and all euthanized pest fish will be disposed of in a bio secure manner to land, in accordance with condition 20 of MPI Special Permit 875 and 16(d) of Native Fish Transfer Authorisation 420.

2.7 Adaptive Management

Due to the high level of intrinsic variability in any fish recovery and relocation, this plan may be slightly modified by an appropriately qualified freshwater ecologist to ensure fish are recovered in a safe and professional manner, as well as in accordance with the *New Zealand Freshwater Fish Sampling Protocols* (Joy et al 2013).

Figure 7. Proposed fish release locations

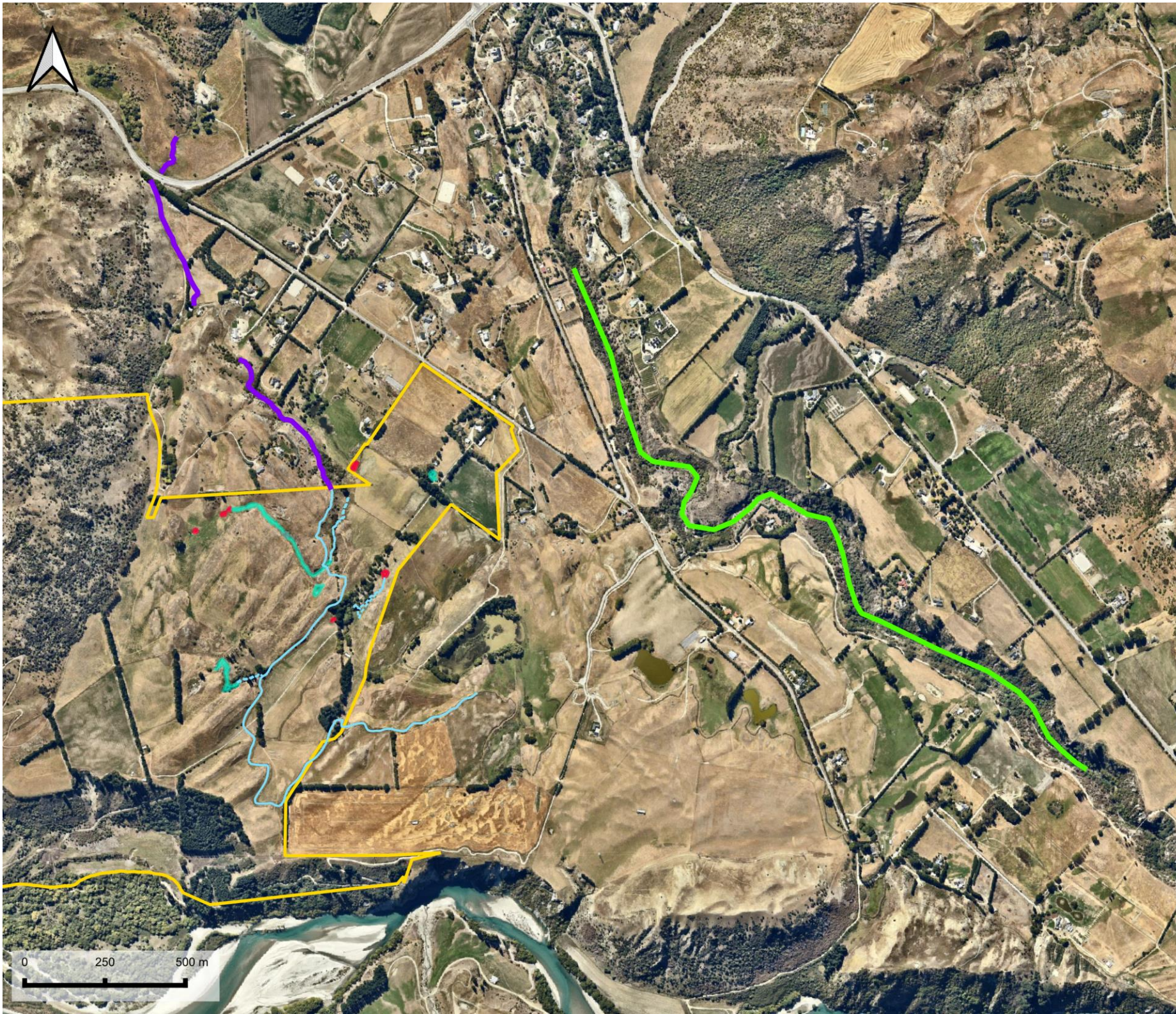
-  Site boundary
 -  Constructed pond
 -  Wetland
 -  Intermittent stream
 -  Water race
- Fish release sites**
-  Pond and intermittent stream release area
 -  Water race release areas

SOURCES
Nearmap.com 2025

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3 REPORTING

Following the relocation, a short report will be prepared detailing the fish captured (species and number of fish) during the recovery, as well as details on the relocation site. Otago Regional Council shall be provided with a copy of the report within five days of completion of all fish relocation works. Data can be made available following the completion of works on an individual pond/stream if works are to be staged.

Fish records will also be sent to NIWA to be included in the New Zealand Freshwater Fish Database.

Reporting will be in accordance with any resource consent conditions.

4 PERMITS

Viridis hold an MPI Special Permit (875) and Native Fish Transfer Authorisation (420) that allows Viridis Limited, and their agents, representatives, and employees to take relocate aquatic life to a suitable habitat where this is necessary or required to mitigate adverse effects of habitat modification on the aquatic life.

As the capture and relocation sites are not within a conservation area and since any fish captured will be relocated within the same catchment, no other permits are considered necessary.

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