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Parkburn, Luggate-Cromwell Road

Ecological Impact Assessment

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Author(s)	
	Annabelle Coates
	Senior Ecologist
Reviewer(s)	
	Mark Delaney
	Lead Ecologist | Director

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Cover photo: Vegetation and habitats present within the proposed Parkburn development area, photograph taken on February 2026.

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STATEMENT OF QUALIFICATIONS AND EXPERIENCE

Annabelle Coates (Author)

I am a Senior Ecologist at Viridis Limited (Viridis). Viridis is a small consultancy specialising in ecology and environmental science across New Zealand. I have been employed at Viridis since February 2023.

I hold a Bachelor of Science, completed in 2010 and a Master of Science in Environmental Science from the University of Canterbury, 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 13 years of professional experience in the ecological consulting field, including roles such as ecologist roles at Bioresearches 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 agree to 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. I have been employed at Viridis since December 2022.

I hold a Bachelor of Science from the University of Auckland, which I completed in 2005 and 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 Bioresearches 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 projects currently going through Fast Track Approvals Act consenting.

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

EXECUTIVE SUMMARY

Fulton Hogan Land Development Limited (FHLD) are proposing to develop a residential subdivision on a site at 922 Luggate-Cromwell Road, Cromwell, which is currently being operated as a shingle quarry. The proposal involves bulk earthworks, removal of existing culverts and replacement with a bridge, excavation of two 'coves' on the shore of Lake Dunstan/Te Wairere, and various landscaping and areas of revegetation.

The ecological values on the site are limited due to the past and existing land use and lack of established native vegetation. The site does support indigenous lizards, namely the Not Threatened McCann's skink, and At Risk – Declining southern grass skink are present in the wider area, but not likely within the works footprint. The bird community on the site is limited, though the periodic presence of Threatened and At Risk birds cannot be ruled out. The Park Burn flows through the site, which is an intermittent stream with moderate ecological value.

Values in the area are generally related to Lake Dunstan/Te Wairere. The lake supports a diverse community of birds and fish, including Threatened and At Risk species. Lake riparian vegetation, while dominated by exotics, provides some buffering to the lake and provides habitat for various aquatic birds.

Adverse effects within the site are mostly the result of vegetation clearance and bulk earthworks. Actual effects will depend on the level of vegetation remaining when quarrying activities cease. Effects on lizards and birds can be managed through management practices, including salvage and relocation of lizards prior to habitat removal. Salvaged lizards will be relocated to a specific lizard relocation area in the north west of the site, which will also be subject to habitat enhancement, pest control, and legal protection. Removal of the existing culverts on Park Burn and replacement with a bridge is expected to have an overall positive impact on the Park Burn through improved fish passage and retention of more natural instream conditions. Excavation of the 'coves' on the margins of Lake Dunstan/Te Wairere has the potential to impact the lake through impacts on birds, fish and generation of excess fine sediment. Mitigation including salvage of fish from excavated material and management of sediment are expected to significantly reduce the impact on the lake.

Significant landscaping and revegetation of the site and lake margins is proposed. Revegetation is focused around the Park Burn corridor, and area where it discharges into Lake Dunstan/Te Wairere. This will increase botanic diversity, provide buffering of the lake, and increase habitat for fauna, including lizards and birds.

The overall effect of the project on ecological values is considered to be low, with positive effects associated with the revegetation to be undertaken by FHLD.

A fish management plan and lizard management plan have been prepared to accompany this ecological impact assessment to set out how effects on fish and lizards will be managed during works. Effects on birds will be managed through seasonal controls around when vegetation can be removed.

1 INTRODUCTION

1.1 Background

FHLD is intending to develop the Parkburn Development Project (the Project). The Project involves the staged subdivision and development of land at 922 Luggate-Cromwell Road (State Highway 6), Cromwell, located approximately 8 kilometres north of the Cromwell township and adjoining Lake Dunstan/Te Wairere. The site includes part of the existing Parkburn Quarry. The Project provides for the establishment of a mixed-use urban development, including quarry rehabilitation, residential development, supporting commercial and community activities, open space, and associated infrastructure. Works are also proposed within the State Highway 6 (SH6) road reserve.

The project comprises the following components:

- Bulk earthworks to backfill and rehabilitate part of the existing Parkburn Quarry.
- Subdivision and development to enable approximately 1,000 residential allotments, supporting the construction of approximately 1,000 residential units across a range of housing densities.
- Subdivision and development to establish a neighbourhood centre, including retail, commercial, medical, and early childhood education activities, together with land for a primary school.
- Landscaping and development of an open space network, including recreation reserves, esplanade reserves, and restoration along the margins of the Park Burn and Lake Dunstan/Te Wairere.
- Formation of two coves extending into Lake Dunstan/Te Wairere.
- Construction of associated infrastructure, including three waters infrastructure, internal transport networks, and external access works connecting the site to State Highway 6.

As part of the development, it is proposed to undertake bulk earthworks, remove vegetation, construct a bridge over Park Burn, excavate two ‘coves’ at the edge of Lake Dunstan/Te Wairere, undertake planting along the Park Burn and the lake margin, and establish various areas of greenspace including parks, a recreation reserve and a greenway.

This report has been prepared to support an application under the Fast Track Approvals Act and discusses the ecological effects of the proposal. Where appropriate, recommendations have been provided to aid in the avoidance, minimisation and remediation of adverse effects that could arise as a result of the proposed works.

An ecological assessment of the site and neighbouring environment identified the presence of limited ecological values within the site, with the exception of areas of lizard habitat. The adjacent Lake Dunstan/Te Wairere provides high ecological values, namely as habitat for a relatively diverse bird community. Subject to implementation of the recommended mitigation measures, the proposal is expected to have an overall low level of effect on the ecological values of the area. The proposed mitigation and planting measures will ensure that adverse effect on the ecological values of the site are minimised.



Figure 1. Parkburn development site boundaries.

1.2 Assessment Scope

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

The EcIA 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 Central Otago District Council (CODC) planning documents, the NPS-FM, NES-F and the 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 CODC GIS was also undertaken.

Site assessments were undertaken in December 2025 and February 2026, 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 set out in Sections 2.2 through 2.3, below.

2.2 Terrestrial Ecology

The vegetation within the property was assessed during the February 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. Taonga species as listed in Schedule 97 of the Ngai Tahu Claims Settlement Act 1998 were searched for.

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 to Section 2.4).

2.2.1 Bird survey

An evening and dawn survey for avifauna was undertaken along the lake frontage on 3 and 4 February 2026. Various vantage points around the lake adjacent to the site were utilised to observe birds both on the lake itself and in the riparian zone. Records of birds observed were made, and photographs taken, where possible. Opportunistic observations of birds seen and heard on the site itself were made during the site visit, during the days of 3 and 4 February. Due to the lack of habitat within the site, formalised five-minute bird counts were not considered necessary and this was supported by the limited bird encountered as discussed below. Records were supplemented by review of existing data from eBird.org and iNaturalist.org in order to build a full picture of the bird community in the area.

2.2.2 Lizard survey

A formal lizard survey of the site was conducted in December 2025. The survey consisted of 100 baited Gee's minnow traps installed across 10 different areas within the site. The sites were selected to cover the range of habitats present within the site. Traps were installed on 19 December 2025, with daily checks until 24 December. Hand searching accompanied the trapping, including in areas where no traps were set but suitable habitat was present. Areas searched by hand included the Park Burn riparian zone, site boundaries and lake margin. Captured lizards were identified and their capture location recorded.

2.3 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. Six baited gee's minnow traps were installed in Park Burn overnight on 3 February 2026 to survey for fish. Traps were checked the following morning and any fish present identified.

Two representative aquatic macroinvertebrate samples were collected from Park Burn using a surber sampler. Samples were collected in accordance with the National Environmental Monitoring Standards for Macroinvertebrates (NEMS 2022). Samples were preserved in 70% ethanol before being sorted and processed using the 200+ Fixed Count with Scan for Missed Taxa Macroinvertebrate Processing Method, as per NEMS (2022).

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). 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 to Section 2.4).

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

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

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

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

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

3 SITE DESCRIPTION

3.1 Site Context

3.1.1 Ecological District

The site is located in the Pisa Ecological District (ED) of the Central Otago Region. The Pisa ED is characterised by mid to high elevation ranges and flats in some locations. The climate is generally dry, with cold winters and some small snowbanks that persist through summer. Tussocklands would have predominated historically, however now much of the district is modified by pastoral farming. Very small remnants of native forest remain.

Fauna habitat has been degraded and reduced over time as agricultural and urban development expanded. Notably, the Pisa district currently provides habitat for falcon (*Falco novaeseelandiae*; At Risk), which are relatively widespread in the wider region.

3.1.2 Local context

The site represents a highly modified area of the ecological district. While not currently urbanised, the site currently contains an active gravel quarry, and as such, has been heavily modified over the past 40 years. Prior to the quarry being established, the site was used for agricultural purposes. The neighbouring property to the north is formed by another active gravel quarry, while to the south is an existing residential development of Pisa Moorings. The western boundary is Luggate-Cromwell Road (SH6) with horticultural land beyond. The hydroelectric Lake Dunstan/Te Wairere is located on the site's eastern boundary. Further afield is the township of Cromwell.

The site is generally flat, however the quarry operation over many years has resulted in variations in ground level as a result of excavations. There are various buildings on the site associated with the quarry operation and the manufacture of products such as paving blocks. The site is located on a terrace above Lake Dunstan/Te Wairere, elevated approximately 5-10 m above lake levels. The Park Burn flows through the north eastern corner of the site.

Historically (pre-human) the site likely comprised scrub and/or tussockland. A review of historical aerial imagery shows the site was well established as agricultural land 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. Lake Dunstan/Te Wairere, on the site's eastern boundary, was first filled between 1992 and 1993. Prior to this, the Clutha River was located approximately 500 m beyond the site's boundary.

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.



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Figure 2. Parkburn - key ecological features

Site boundary
Park Burn
Artificial channel
Non-natural wetland

Vegetation

Mixed exotic screening, some native
Native bund planting
Pine dominant
Willow dominant
Willow/pine

SOURCES
Otago 0.2m Rural Aerial Photographs 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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3.2 Terrestrial Ecology

3.2.1 Vegetation

The vegetation community within the site was assessed during the site visit. Access to the active portions of the quarry was not available and therefore assessments of these areas have utilised existing information where available.

Exotic vegetation and pasture dominated areas
The botanical value of the exotic dominated areas of vegetation within the site was considered to be low.

It is understood that all areas within the site that have not yet been quarried, will be quarried over the next few years. As such, much of the vegetation currently present, will be removed as the quarry activities move across the site and the permitted/consented baseline of the site should be to consider all vegetation, excluding the planted perimeter vegetation, to be absent.

The site is located on an area of gravel outwash that would have been deposited over time as the Clutha River migrated across the valley floor. There is very little to no unmodified habitat within the site. Where quarrying has not yet occurred, the land has been subject to agriculture for several decades. The vegetation community is correspondingly impacted and is considered to be typical of the areas surrounding Lake Dunstan/Te Wairere.

Vegetation within the site was mostly limited to exotic vegetation planted as shelterbelts or large individual or groups of trees (Figure 3a and 3b), and extensive areas of exotic grassland. Species present included poplar (*Populus* sp.), macrocarpa (*Cupressus macrocarpa*), gum (*Eucalyptus* sp.) and occasional willows (*Salix* sp.).

The remainder of the site, that which was not currently part of the active quarry or associated yards, was vegetated with mixed exotic pasture species and pasture associated weeds (Figure 3). The grass is periodically cut to control fire risk. Species observed in the paddocks included sheep's sorrel (*Rumex acetosella*), viper's bugloss (*Echium vulgare*), goosefoot (*Chenopodium album*), California poppy (*Eschscholzia californica*), mallow (*Malva neglecta*), yarrow (*Achillea millefolium*), rabbitfoot clover (*Trifolium arvense*) and plantain (*Plantago major*).

Where land had been quarried, vegetation was either largely absent, or grass species had re-established over time (Figure 3d). A previous assessment identified a small number of *Raoulia australis* (At Risk – Declining) growing on bare ground within sparse grassland and herbfield (Beale Consultants 2023). *Raoulia australis* is relatively common, with a large distribution, despite its At Risk status. The report does not specifically state where these are, however review of the photographs included of the plants along with aerial images from the same time as the site visit suggest they were present in an area devoid of significant grass growth, that has since been quarried. The location of these is relatively confident given the presence of felled trees in the photographs, and aerial images between 2021 and 2023 showing a small stand of trees was felled and then left on the ground for a period of time. *Poa maniototo* (At Risk – Declining) was also identified during a previous assessment (Beale Consultants 2023) however it was not observed during the site visit.

A reviewer acting for CODC also identified *Colobanthus strictus* (nationally Not Threatened; Regionally At Risk – Declining) in area of quarry gravelfield at the southwestern corner of the site. As the active quarry was not able to be assessed during the site assessment, it was not detected at this time. *C.*

strictus is a small herb generally found in areas of rocky terrain or shallow stony soils. As it was found on a quarried area, it has established after quarrying has occurred and is also likely to be removed/impacted as quarrying activity continues.

While the entirety of the non-quarried portion of the site was walked to assess vegetation, the nature of vegetation surveys on moderate to large sites at a single time of year means there is the potential for plants to be missed. This is the case for all ecological surveys and it not a phenomenon restricted to vegetation. Conservative assessments are therefore necessary considering the history of the site and the context of the site in the wider landscape. It is possible additional native plants are present, however, the site itself contains habitat that is present and common throughout the Cromwell basin area and there is nothing unique about the site itself that would suggest the presence of plants only within the site boundaries.

a)



b)



c)



d)



Figure 3. a) to c) Exotic vegetation within the site, and d) vegetation adjacent to a quarried area.

Planted native vegetation

The botanical value of the planted native vegetation was considered to be low.

Around the perimeter of the site were areas of planted native vegetation, mostly on the perimeter bunds (Figure 4a). It is assumed this vegetation has been planted to partially screen the site from adjacent land. Plants were relatively small, suggesting they had not been in place for a significant length of time. Species present included common native species such as mingimingi (*Coprosma propinqua*), toetoe (*Austroderia* sp.), hebe (*Hebe* sp.), koromiko (*Veronica salicifolia*), cabbage tree (*Cordyline australis*), and *Olearia* sp.

Along the site boundary adjacent to Luggate-Cromwell Road was a line of planted mixed native species (Figure 4b). These were of mixed quality, with some dead, or almost dead. Species here included mingimingi, *Coprosma rugosa*, marsh ribbonwood (*Plagianthus divaricatus*), kohuhu (*Pittosporum tenuifolium*), koromiko, and hebe.

These areas of natives were all very narrow relative to their length, and as such, were heavily influenced by edge effects. Weeds were abundant; in some areas they were more abundant than the native vegetation itself. The vegetation provided very little ecological and habitat value.

a) **b)**



Figure 4. a) Native planting on the bund around the site, and b) line of natives adjacent to Luggate-Cromwell Road.

Lakeside vegetation

The ecological and botanical value of the vegetation on the land between the site and Lake Dunstan/Te Wairere was considered to be low.

Generally, vegetation was of a similar nature to the vegetation within the non-quarried parts of the site. It was dominated by pasture and common weed species, and included areas of exotic trees (Figure 5a). Crack willow (*Salix* × *fragilis*) was abundant around the lake margin, as well as along the Park Burn. Pines (*Pinus radiata*) were present, on land slightly elevated above the Park Burn flood plain (Figure 5b). An unpaved, but formal, public pathway (part of the Lake Dunstan/Te Wairere Trail) traversed the area.

Raoulia australis is also present on the constructed bund surrounding the site, but beyond the site boundaries.

a) **b)**



Figure 5. a) Grass and weed dominated vegetation on the lake edge and b) willows and pines near Park Burn.

3.2.2 Herpetofauna habitat

The ecological value of the site where lizard habitat was present was considered to be moderate due to the presence of native lizards, while it was considered to be low over the remainder of the site.

Two species of lizard have been recorded within 10 km of the site – McCann's skink (*Oligosoma maccanni*; Not Threatened) and Kawarau gecko (*Woodworthia* "Cromwell"; At Risk – Declining (nationally) and Regionally Declining (regionally)).

Lizard habitat within the site was mostly limited to areas of moderate and long grass that had not been subject to quarrying. Additionally, habitat was also present within the Park Burn riparian area, and it is also expected that habitat is present between the site and the lake margins. Some areas of debris were present, including dead trees and wood, which provided refugia and basking habitat for skinks. No gecko habitat of the type typically associated with Kawarau gecko was identified within the site and no geckos are expected to be present within the site. No lizards are expected to be present in the actively quarried area, and as such, values associated with lizard habitat are not attributed to these areas.

A lizard survey was undertaken in December 2025. One hundred baited Gee's minnow traps were distributed throughout the site, in 10 main areas (Figure 6), and this was complemented by manual hand searches in other suitable habitat. The areas were focused around areas where lizard habitat values were present. A total of 80 McCann's skink and one southern grass skink (*Oligosoma chionochloescens*; At Risk – Declining; Regionally Declining) were captured in traps and by hand search during the survey. An additional 38 separate observations of skink presence (guano, skins) were also noted. These observations were attributed to McCann's skink due to their locations and the habitat they were found in. An additional two observations were attributed to southern grass skink, however these observations were outside of the site on the lake margin. Higher densities of McCann's skink were present in the artificial channel where topographical constraints meant grass was not cut to the same length as the remainder of the grassland. These areas were targeted for the lizard survey as the represented the most likely areas amongst the grassed areas that skink would be present. A low value has still been prescribed to this area given the modified nature of the habitat and periodic vegetation management.

It is estimated that over 1,000 McCann's skink could be present within the entire site, including the riparian margins of Park Burn. Southern grass skinks are expected to occur in very low numbers within the site, and their presence will be limited to the riparian margins of Park Burn.



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Figure 6. Lizard survey results and current lizard habitat

Site boundary
Park Burn
Gee minnow trap lines

Lizard survey
McCann's caught
McCann's sign
Tussock caught
Tussock sign

Lizard habitat
Low
Low-moderate
Moderate

SOURCES
Otago 0.2m Rural Aerial Photographs 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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DATE: 23/06/2026

3.2.3 Avifauna habitat

The value of the site for avifauna, including as 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 assigned due to the modified nature of the site. A high value has been assigned to the lake margins and lake itself due to the known provision of habitat (nesting and foraging) for Threatened species.

Habitat for birds within the site itself was limited, mostly due to the lack of vegetation present. The exotic trees present around site do provide limited roosting and nesting habitat for common native and exotic birds and limited foraging habitat will be present for insectivorous birds. The lack of fruiting trees within the site, coupled with the extensive areas of horticultural fruit trees surrounding the site mean the site itself provides very little foraging habitat in relation to the wider area. There is the potential for ground dwelling and nesting species to utilise the non-quarried areas of the site. However, the periodic mowing of the grass limits the value of this habitat. In addition, a stoat was observed in the site during the February site visit, further limiting the value of ground nesting habitats. Pest control does occur within the site.

Dusk and dawn surveys were undertaken around the lake margin, and opportunistic observations of birds within the site were made. Species observed are listed in Table 2 including the habitats where they were observed. Other species not observed, but considered likely to be present on or around the site, at least intermittently are listed in Table 3 including the habitat they are generally associated with. Observations of birds seen and heard within the site itself during onsite inspections identified only two species (Table 2).

As surveys during a single time of year do not capture all species seasonally present, existing records for the surrounding area were reviewed to build a full picture of the bird community. There are records in the wider area for other species, such as South Island dotterel, however they are unlikely to be present either within the site or within the land between the site and the lake due to a lack of suitable habitat, and the ongoing and regular disturbance generated by the public pathway, including from off leash dogs.

Pipit and falcon are both known from the wider area. Both species breed on the ground, though falcon also nest off the ground. The areas of long grass within the site provide potential nesting habitat for these species. However, the value of the habitat is limited by the periodic mowing of the grass. It is more likely these species are intermittently present in and around the site rather than resident.

Marsh crake are known to be resident at Low Burn approximately 4.7 km south of the site, generally utilising areas of raupō (*Typha orientalis*) and dense wetland vegetation. Similar habitat is potentially present, although at a smaller scale. No significant areas of raupō were present adjacent to the site, however the areas of wetland vegetation on the margins of the lake may provide a small amount of suitable habitat for marsh crake.

The lake itself provided habitat for various dabbling birds including the Threatened Australasian crested grebe. There is potential for grebes to nest on the lake margins, including in/around the areas of sedgeland and willows. Terns, assumed to be black-fronted terns (Threatened), were also observed foraging over the lake. No nesting habitat for terns was present in the site or on the lake edges. The lake does provide foraging habitat for terns, as well as various other birds.

Table 2. Native birds recorded within and around the site.

Common name	Species name	National conservation status	Regional conservation status	Observed on/over site	Observed on lake	Observed above lake
Mallard hybrid	*Anas superciliosa x platyrhynchos*	Not Threatened	NA		✓	
NZ scaup	*Aythya novaeseelandiae*	Not Threatened	Not Threatened		✓	
Black fronted tern*	*Chlidonias albostriatus*	Threatened – Nationally Endangered	Regionally Endangered			✓
Australasian harrier	*Circus approximans*	Not Threatened	Not Threatened	✓		
Australian coot	*Fulica atra australis*	At Risk – Naturally uncommon	Regional coloniser		✓	
South Island oystercatcher	*Haematopus finschi*	At Risk - Declining	Regionally vulnerable			✓
Pied stilt	*Himantopus himantopus leucocephalus*	Not Threatened	Not Threatened			✓
Welcome swallow	*Hirundo neoxena neoxena*	Not Threatened	Not Threatened			✓
Black backed gull	*Larus dominicanus dominicanus*	Not Threatened	Not Threatened			✓
Little pied shag	*Phalacrocorax melanoleucos melanoleucos*	Vagrant	NA		✓	✓
Australasian crested grebe	*Podiceps cristatus australis*	Threatened – Nationally Vulnerable	Regionally vulnerable		✓	
Paradise shelduck	*Tadorna variegata*	Not Threatened	Not Threatened		✓	
Spur winged plover	*Vanellus miles novaehollandiae*	Not Threatened	Not Threatened	✓		

* Assumed to be black fronted terns but observed from a distance and not able to definitively ID.

Table 3. Native birds known to be present in the wider area.

Common name	Species name	National conservation status	Regional conservation status	Terrestrial	Lake	Lake margin
Pipit	*Anthus novaeseelandiae novaeseelandiae*	At Risk - Declining	Not Threatened	✓		
Grey teal	*Anas gracilis*	Not Threatened	Not Threatened		✓	✓
Australasian shoveller	*Anas rhynchotis*	Not Threatened	Not Threatened		✓	✓
Banded dotterel	*Charadrius bicinctus bicinctus*	At Risk - Declining	Regionally vulnerable	✓	✓	✓
Black swan	*Cygnus atratus*	Not Threatened	Not Threatened		✓	
White faced heron	*Egretta novaehollandiae*	Not Threatened	Not Threatened	✓	✓	
Falcon	*Falco novaeseelandiae*	Threatened – Nationally Vulnerable	Regionally vulnerable	✓		
Black billed gull	*Larus bulleri*	At Risk - Declining	Regionally vulnerable	✓	✓	
Red billed gull	*Larus novaehollandiae scopulinus*	At Risk - Declining	At Risk – Regionally recovering	✓	✓	
Little shag	*Microcarbo melanoleucos*	At Risk – Relict	Regionally vulnerable		✓	✓
Black shag	*Phalacrocorax carbo*	At Risk – Relict	Regionally endangered		✓	✓
Marsh crake	*Porzana pusilla affinis*	At Risk - Declining	Regionally endangered			✓

3.3 Freshwater Ecology

Figure 2 shows the freshwater features present within the site.

3.3.1 Park Burn

The ecological value of the Park Burn was considered to be conservatively moderate, due to the potential for At Risk fish species to be present, at least intermittently.

The Park Burn flows through the northeast corner of the site. It originates north west of the site, on the Lowburn Face of the Pisa Range. The upper reaches flow through extensive agricultural land, while the lower reaches (on the river flats) flow through horticultural land. It flows into Lake Dunstan/Te Wairere immediately to the east of the site.

Within the site, the Park Burn is contained within a small gully, approximately 30 m wide, that has not been subject to quarrying. Substrates were dominated by gravels with smaller areas of fine sediment, and given sufficient flow, small braids can form (Figure 7a and b). Communication with the site manager

revealed the stream does run dry periodically and it is therefore considered appropriate to classify the stream as intermittent.

A triple arch culvert is located on the stream, providing a crossing point for trucks within the quarry (Figure 7c). At the time of the site visit flow was occurring only through the true left arch. It is expected the other arches are only utilised during periods of well elevated flow.

Riparian vegetation was dominated by exotic species and included willows, poplars and lupins (*Lupinus arboreus*). Rank grass was also present within the channel, suggesting it had been some time since flow was sufficient to scour the channel out. Generally, the channel appeared to be stable.

The stream has been modified over time. The expansion of horticulture in the lower reaches, as well as the development of the quarry on the site have constrained the stream over time. Historically, it appeared to migrate across its flood plain, occupying a small number of braided channels. In more recent years, the proliferation of willows, as well as expected channel training, have restrained the stream in its current channelised alignment.

a)



b)



c)



d)



Figure 7. Park Burn a) and b) within the site; c) the triple arch culvert within the site; and d) just upstream of where it flows into Lake Dunstan/Te Wairere, looking upstream.

Downstream of the site, the Park Burn flows into Lake Dunstan/Te Wairere through a small delta area. During the site visit, flow as contained within a single channel, however, various other dry channels were present and review of aerial images shows these periodically contain water (Figure 7d). Prior to filling the lake, this feature was not present. Instead, the Park Burn continued to flow through a moderately braided channel for an additional approximately 500 m before it would have discharged to the Clutha River.

Results from the macroinvertebrate samples are provided in Table 4. The macroinvertebrate community index (MCI) and quantitative MCI (QMCI) provide an indication of the quality of the stream and habitat based on the invertebrate species present within the stream. The MCI relies on presence/absence data, while the QMCI considers the relative abundance of each species. Results were variable, but generally indicated the Park Burn was influenced by moderate organic pollution or nutrient enrichment. One result (Sample A, MCI) fell below the National Bottom Line as indicated in Table 14 of the NPS-FM. The intermittent nature of the stream, coupled with the agriculture and horticulture heavy catchment meant this was not considered an abnormal result. However, the remainder of the metrics suggested degraded, but functional habitat and water quality, and the communities included a combination of sensitive and tolerant species.

Table 4. Macroinvertebrate results for Park Burn. MCI and QMCI results include the Attribute Band as per the NPS-FM.

	Sample A	Sample B
Taxa richness	13	16
MCI	83 (Attribute band D)	93 (Attribute band C)
QMCI	6 (Attribute band B)	4.8 (Attribute band C)
%EPT	31	25

Overnight fish trapping in the Park Burn yielded a single common bully (*Gobiomorphus cottidianus*; Not Threatened). Records for the Park Burn in the NZFFD have only recorded brown trout (*Salmo trutta*; Introduced and Naturalised) to date. Records for Lake Dunstan/Te Wairere, and for tributaries of Lake Dunstan/Te Wairere record the presence of various species, listed in Table 5.

The presence of hydroelectric dams downstream mean any eels present in the stream have been present since prior to the installation of the dams. Numbers are expected to be low, if any. Clutha flathead galaxias have been recorded in a tributary of the Low Burn, south west of the site. It is considered unlikely they are present in the site itself due to their non-migratory status. Koaro populations have also likely been impacted by the hydro dams as they are a migratory species requiring a period in the sea for reproduction. However, there are landlocked koaro populations, including in the Central Otago lakes. The only species expected to be present in Park Burn, within or near to the site, are brown trout, common and upland bully, and potentially a small number of eels.

Table 5. Fish species potentially present in Lake Dunstan/Te Wairere and its tributaries.

Common name	Species name	Conservation status
Shortfin eel	*Anguilla australis*	Not Threatened
Longfin eel	*Anguilla dieffenbachii*	At Risk – Declining
Clutha flathead galaxias	*Galaxias "species D"*	Threatened – Nationally Vulnerable
Koaro	*Galaxias brevipinnis*	At Risk – Declining
Upland bully	*Gobiomorphus breviceps*	At Risk – Naturally Uncommon
Common bully	*Gobiomorphus cotidianus*	Not Threatened
Rainbow trout	*Oncorhynchus mykiss*	Introduced and Naturalised
Chinook salmon	*Oncorhynchus tshawytscha*	Introduced and Naturalised
Perch	*Perca fluviatilis*	Introduced and Naturalised
Brown trout	*Salmo trutta*	Introduced and Naturalised

3.3.2 Lake Dunstan/Te Wairere

The ecological value of Lake Dunstan/Te Wairere was considered to be high.

Lake Dunstan/Te Wairere is an approximately 26 km^2 hydroelectric lake, formed in 1990s following the construction of the Clyde Dam. Prior to the lake being filled, the moderately braided Clutha River flowed in its place. The lake is long and narrow, occupying a river valley. The riparian zone of the lake contains variable land uses, including the township of Cromwell, SH8, and agricultural and horticultural land. Vegetation other than the abundant crack willows is generally limited (Figure 9).

Water quality within the lake is generally high. Review of monitoring data available on LAWA.org.nz shows the lake meets attribute band A criteria for total phosphorous, total, nitrogen, ammoniacal nitrogen, chlorophyll a and *E. coli*. In the past, the lake has had issues with elevated phosphorus, however, monitoring has revealed phosphorous levels are now generally decreasing. These results also indicate it has a relatively low trophic level index (TLI) score, with annual monitoring since 2011 falling within either the 'good' or 'very good' categories. The TLI is a measure of ecosystem health, that uses water quality to estimate biological productivity. Low scoring sites, or 'good' or 'very good' sites, have high water quality indicating a low risk of eutrophication as a result of nutrient enrichment.

Despite the generally high water quality, another measure of lake quality, the lake submerged plant index (lakeSPI), shows the lake meets attribute band C. While this is above the national bottom line as set out in the NPS-FM, it does indicate some level of habitat decline. LakeSPI is a method to quantify vegetation in lakes based on the composition of the native and invasive plants growing in a lake. Higher scores indicate higher ecological health. The reduced score is likely the result of invasive oxygen weed (*Lagarosiphon major*). Only one instance of lakeSPI monitoring has been undertaken in the lake, in 2020, therefore it is not possible to ascertain trends in ecological health based on this.

Any of the fish species listed in Table 5, with the exception of Clutha flathead galaxias, could be present in Lake Dunstan/Te Wairere. Invasive oxygen weed (*Lagarosiphon major*) is present in Lake Dunstan/Te Wairere, and is currently subject to control. Mats of oxygen weed were observable in the shallows in some locations adjacent to the site.

A high ecological value has been assigned due to the provision of habitat for At Risk and Threatened birds and fish, despite the artificial nature of the lake.

a) **b)**



Figure 8. Lake Dunstan/Te Wairere, adjacent to the site.

3.3.3 Artificial channels

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

Two constructed, artificial channels were present within the site. Both channels were dry during the site visit and did not appear to have contained water recently. Both were entirely vegetated with terrestrial species, suggesting water is only present on an ephemeral basis. The channel along the western boundary of the site was considered to be a roadside drain associated with SH6 (Figure 9a). Review of older Google Streetview images show it has been present since at least 2008. There were no apparent connections to other surface waters.

A second channel was present in roughly the centre of the site. It originated near the northern boundary of the site and meandered south and east before the channel disappeared, likely as a result of quarrying activities. Within the channel were various old flow control structures, all in a state of disrepair and unusable (Figure 9b). It is therefore assumed this channel was once an irrigation race or similar that has been abandoned. It is possible the channel periodically contains a small amount of water drained from the site following rainfall. It does not provide any aquatic habitat or ecological values.

a) **b)**



Figure 9. a) Roadside artificial channel and b) abandoned irrigation race, with some flow control infrastructure still present.

3.3.4 Wetlands

The ecological value of the wetlands located on the edge of Lake Dunstan/Te Wairere, in their current form, was considered to be moderate. Despite their dominance of exotic species and lack of structural complexity, they form part of the larger Lake Dunstan/Te Wairere system and contribute to the higher value Lake Dunstan/Te Wairere itself.

No natural inland wetlands, as per the definition in the NPS-FM were present within the site or within 100 m of the site.

Three areas of 'wetland' were present within 100 m of the site. The NPS-FM expressly excludes constructed wetlands and wetlands associated with constructed waterbodies from the definition of a natural inland wetland. The areas of wetland are directly associated with the margins of the artificial Lake Dunstan/Te Wairere. Review of aerial images from prior to the formation of the lake did not suggest the presence of any wetland characteristics (darker vegetation, surface water etc.) in these locations.

Regardless of their classification, the areas of artificial wetland do provide some habitat values. The southern and central areas were associated with small inlets on the lake margin. Both areas contained sharp spike sedge (*Eleocharis acuta*) on the lake edge, with willows and occasional raupō. The northern area was associated with the outlet of Park Burn. Occasional sedges were present, along with lotus (*Lotus pedunculatus*), pennywort (*Hydrocotyle sulcata*), *Cortaeria* sp. and occasional sharp spike sedge, creeping bent (*Agrostis stolonifera*), flax (*Phormium tenax*) and *Juncus edgariae.* Upland species were also abundant including sweet briar (*Rosa rubiginosa*), gorse (*Ulex europaeus*), and lupin.

The southern and central areas were generally narrow, with vegetation limited to a strip approximately one metre in width. The central area was best described as a small back beach, separated from the lake by a small gravel bar, with vegetation around the perimeter of the ponded water. Both areas of wetland vegetation provided minimal contribution to the functioning of the lake system due to their small size, however they will provide some level of filtration of overland flow entering the lake, and a small amount of habitat for fauna. The northern area, around Park Burn, provided more ecosystem functions through filtering of the water entering the lake via Park Burn.

a)



b)



c)



d)



Figure 10. Areas of non-natural wetland along Lake Dunstan/Te Wairere including the a) southern area, b) central area, and c) and d) northern area.

3.4 Taonga Species

Under Schedule 97 of the Ngai Tahu Settlement Act (1998), a list of various taonga species has been developed. While we cannot comment on these species in terms of their taonga status, we are able to comment on them as they relate to the wider ecological setting of the site. Table 6 provides a list of taonga species known or expected to be present in the site, or in close proximity to the site. The majority of these species are birds, including a number that are expected to be present only on Lake Dunstan/Te Wairere or the margins, not within the site itself. The plant species are all present around the perimeter of the site. None are remnant or self sown, and all have been planted as part of landscaping works undertaken.

Table 6. Taonga species, as per the Ngai Tahu Settlement Act (1998), present within and around the site.

Maori name	Common name	Species name	National conservation status	Location
Birds				
Kahu	Australasian harrier	*Circus aproximans*	Not Threatened	Site
Kāmana	Crested grebe	*Podiceps cristatus australis*	Threatened – Nationally Vulnerable	Lake Dunstan/Te Wairere
Kārearea	Falcon	Falco novaeseelandiae	Threatened – Nationally Vulnerable	Site
Karoro	Black backed gull	*Larus dominicanus dominicanus*	Not Threatened	Site and Lake Dunstan/Te Wairere
Kōau	Black shag Little shag	Phalacrocorax carbo *Microcarbo melanoleucos*	At Risk – Relict At Risk – Relict	Lake Dunstan/Te Wairere
Kuruwhengu/ Kuruwhengi	Australasian shoveller	*Anas rhynchotis*	Not Threatened	Lake Dunstan/Te Wairere

Pārera*	Grey duck	Anas superciliosa	Threatened – Nationally Vulnerable	Lake Dunstan/Te Wairere
Pīhoihoi	New Zealand pipit	*Anthus novaeseelandiae*	At Risk – Declining	Site
Poaka	Pied stilt	*Himantopus himantopus leucocephalus*	Not Threatened	Lake Dunstan/Te Wairere
Pūtakitaki	Paradise shelduck	*Tadorna variegata*	Not Threatened	Site and Lake Dunstan/Te Wairere
Tara	Terns	Various	Various	Lake Dunstan/Te Wairere
Tete	Grey teal	Anas gracilis	Not Threatened	Lake Dunstan/Te Wairere
Plants				
Koromiko/ Kōkōmuka	Koromiko	Veronica *salicifolia*	Not Threatened	Planted bund
Raupō	Bulrush	Typha orientalis	Not Threatened	Lake margins
Tī rākau/ Tī Kōuka	Cabbage tree	Cordyline australis	Not Threatened	Planted bund
Toetoe	Toetoe	Cortaderia richardii	Not Threatened	Planted bund

* Highly unlikely non-hybridised grey ducks are present in the area

3.5 Significance assessment

The site, and adjacent Lake Dunstan/Te Wairere have been subject to consideration against the criteria for determining if a site qualifies as a significant natural area (SNA) under the operative and proposed Otago Regional Policy Statements.

The site is not considered to meet any significance criteria. It provides common, exotic dominated habitat that supports species widespread throughout the ecological district and surrounding areas. Lake Dunstan/Te Wairere itself is considered to meet all criteria, and is therefore considered to be a significant ecological feature.

Representativeness

The site does not meet representativeness criteria. The site is a modified environment dominated by exotic species, with a high incidence of weeds. While the underlying gravel outwash habitat could be considered representative, the long history or agriculture on the site (including expected pasture improvements, removal of non pasture plants, fertilisation and pest control) have significantly altered the naturally occurring plant community. Minor presence of a small number of native plants occur naturally on the areas that have already been quarried. These species are found in multiple ecological districts and regions across the South Island. The persistence of these plants will be impacted by currently consented quarrying activities. The site provides some habitat for native birds, however, significantly higher value bird habitat of similar nature is present across the ecological district and wider area, including away from human development that is more representative of the habitat they typically occupy. Exotic-dominated vegetation as is present on the site is not characteristic of indigenous biodiversity in the ecological district. While the site provides some habitat for one or two species, it does

not provide the full or typical suite of native species present in the ecological district and is not representative of the district's typical ecological pattern. Falcon and pipit nesting in exotic landscapes is an adaptive use of modified environments, not a representative ecosystem state. The site provides habitat for native lizards. Species present over the site are common both locally and within the South Island.

Lake Dunstan/Te Wairere does meet representativeness criteria. While it is an artificial environment resulting from damming a river, the lake provides habitat for a broad suite of fish and bird fauna, typical of river and shallow lake habitats in the ecological district.

Diversity and pattern

The site does not meet diversity and pattern criteria. The site is small relative to the connected wider habitats, relatively flat, and is separated from Lake Dunstan/Te Wairere by an esplanade strip. The site does not provide any ecotones or biological gradients. Minor diversity is provided by Park Burn and its riparian strip, however this is very small in relation of the features within the ecological district. The site does not contain a diverse native vegetation community. Native vegetation is limited to a small number of common native species and is dominated by exotic species. The bird community present in the site is limited by the low quality habitat and is expected to be dominated by common native and exotic species. A low diversity of common lizards is present within the site.

Lake Dunstan/Te Wairere does meet diversity and pattern criteria. The Lake is of moderate size, and contains both longitudinal and depth gradients. It contains ecotones along the lake margin where terrestrial habitats transitions to lake habitat. The lake provide habitat that supports a diverse community of birds and fish.

Rarity and distinctiveness

The site is not considered to meet rarity and distinctiveness criteria. The habitats within the site are common throughout the ecological district and wider Central Otago area. The habitats present within the site are characteristic of the lower elevations of nearby ecological districts including Dunstan, Lindis, Huxley, Maniototo, Shotover and Remarkables. Records from herpetological and avifauna databases, together with published ecological district descriptions, indicate that pipit, falcon, and banded dotterel are distributed widely throughout the ecological district and surrounding ecological districts.

Appendix 1 of the NPS-IB provides criteria to determine if a site is significant. It also provides a small number of exceptions, including:

If an area would qualify as an SNA solely on the grounds that it provides habitat for a single indigenous fauna species that is At Risk (declining), and that species is widespread in at least three other regions, the area does not qualify as an SNA unless:

a) *the species is rare within the region or ecological district where the area is located; or*
b) *the protection of the species at that location is important for the persistence of the species as a whole.*

Pipit, falcon and banded dotterel are widespread in the ecological district and surrounding districts and are not rare in the region. The site is not important for the persistence of the species as a whole (due to its size, modified nature, and abundant similar habitat in the immediate and wider area). In assessing whether the site is important for the persistence of these species, it is important to consider the scale of the site relative to the extent of available habitat within the ecological district and surrounding districts.

The site represents a very small proportion of the extensive open pasture dominated habitat available in the Lake Dunstan/Te Wairere area and wider region. There is no evidence that the site supports a discrete or isolated population, or that it functions as a critical breeding, roosting or refuge area. In this context, the site does not make a meaningful contribution to the viability or long-term persistence of these species at a district, regional or national scale.

Lake Dunstan/Te Wairere does meet rarity and distinctiveness criteria. It provides habitat for a suite of At Risk and Threatened bird and fish species. While lake habitat is not uncommon in the area, it is one of the key features of the ecological district.

Ecological context

The site does not meet ecological context criteria. The site is small and contains habitat abundant in the ecological district and wider area. Vegetation on site does not provide linkages or stepping stones between other habitats. The riparian vegetation along the lake margin provides better examples of linkage habitat compared to the small number of exotic trees and low quality planted vegetation on site. The site does not provide habitat that is important or critical for a species or a component of its lifecycle. Habitat present is common in the wider Lake Dunstan/Te Wairere area.

Lake Dunstan/Te Wairere does meet ecological context criteria. The Lake itself provides an important habitat feature to the ecological district and adjacent district. Riparian vegetation along the lake provides linkage habitat for birds moving between the main lake habitats of Central Otago. It provides important habitat for breeding and foraging for a number of bird and fish species.

4 ASSESSMENT OF ECOLOGICAL EFFECTS

4.1 Proposal

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

- Undertake bulk earthworks across the site;
- Remove vegetation;
- Construct associated infrastructure including three waters infrastructure;
- Remove a culvert on Park Burn and install a new vehicle bridge;
- Install stormwater outfalls on Park Burn and Lake Dunstan/Te Wairere;
- Construct 'coves' on the margins of Lake Dunstan/Te Wairere; and
- Undertake extensive revegetation.

Figure 11 presents the footprint of these activities in relation to the key ecological features in and around the site. The magnitude and level of effect of 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 low, mitigated to positive.

The majority of the vegetation within the site, including grass, exotic trees and planted natives on the perimeter bunds, will be removed to facilitate bulk earthworks and construction activities. However, the majority of the grassland and many of the exotic trees are on an area that has yet to be quarried, and therefore will be removed as part of normal, consented quarrying activities. The baseline to assess vegetation removal effects against is therefore considered to be a fully quarried site with the bulk of the vegetation, except permitter plantings, absent.

While some At Risk plants are known to be present on site (*Colobanthus strictus*, *Raoulia australis*) at least in small numbers, the site is not considered to be critical habitat for these species, and loss of a small number of individuals will not have a significant impact on the population of each species. Review of records on iNaturalist.org shows *Colobanthus strictus* is more commonly found in alpine environments and is relatively well spread throughout the Southern Alps, as well as on the higher portions of Banks Peninsula. Likewise, *Raoulia australis* is well spread across the South Island, including along the major braided rivers on the east coast. *Poa maniototo*, which has been previously identified as being present on site, is also relatively well spread throughout the Central Otago area, extending up to at least the upper Rakaia River catchment. It is worth noting that iNaturalist records likely underestimate distributions as they rely on members of the public uploading results of their own volition. It is also worth noting that any of these species present on non-quarried areas will be removed as part of the already consented quarrying activities. *Raoulia australis* has established on constructed bunds. It is expected this species will establish naturally on areas of exposed shingle, given the remaining source population both in the immediate area around the perimeter and lake margin, and in the wider landscape.

The overall impact on vegetation, including At Risk species, is considered to be low.

Exotic trees around Park Burn will be removed over time as proposed riparian enhancement planting establishes. The crack willows around the edge of Lake Dunstan/Te Wairere will also be gradually removed as proposed planting establishes. They are proposed for retention for a small number of growing seasons to allow plantings to establish under the shelter of the willows. Once plantings have established, willows will be poisoned and left to decompose naturally, continuing to provide shelter as well as nutrients from decomposing vegetation.

Significant revegetation is proposed around the edge of Lake Dunstan/Te Wairere and within the Park Burn delta. This will be complemented by buffer planting along the northern and western boundaries, riparian planting of Park Burn within the site, and the drainage reserve through the centre of the site. Approximately 13.5 ha of native revegetation is proposed as part of the development across reserves, the greenway, Park Burn riparian corridor and around the lake margin and proposed new coves (LWL and Reset 2026a). The exact amount will be determined at detailed design phase and minor variations may occur to account for proposed pathways, play equipment and landscape features. Additional revegetation will occur across the Park Burn delta on the edges of Lake Dunstan/Te Wairere, however the final area will consider what native species in this area can be retained. It is estimated approximately 2.2 ha of additional infill planting will be undertaken on the delta. Figure 11 illustrates where planting will be undertaken. It is important to note that reserves will not be entirely planted, with areas left for grass, play equipment and pathways. This has been considered in the planting area total.

The planting palette for the site includes a variate of native species to achieve a diverse and moderately complex plant community. The plant list includes variable heights, from tussocks to large trees. Species to be planted also include nationally and regionally At Risk scented tree daisy (*Olearia odorata*) and the regionally naturally uncommon twiggy tree daisy (*Olearia bullata*). Species such as Hall's totara (*Podocarpus laetus*) are also proposed. While Hall's totara is not threatened, it is significantly less common in the ecological district than it once would have been. Establishing populations of these types of species contributes to the overall protection of the species as a whole, and also establishes new seed sources allowing for natural dispersal of these species throughout the Cromwell area.

Once plantings have established, there will be a significant increase in botanical value within the site and in the adjacent land between the site and the lake margin. It is expected vegetation associated with residential properties will also contribute to botanical values over time.

VIRIDIS
Environmental Consultants

Figure 11. Proposed development activities on site

- Site boundary
- Proposed new coves
- EW boundary
- SW outfalls

Landscape planting

- Riparian
- Greenway
- Lizard habitat
- Lake side
- Park Burn delta (indicative only)
- Reserve
- Buffer

SOURCES

Otago 0.2m Rural Aerial Photographs 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 **1:8,000** @ A4

PROJECT NO.	10418
DRAWN BY:	AJC
DATE:	16/07/2026

0 100 200 m

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 such as the majority of the Park Burn corridor, 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 are they are likely to be present anywhere within the site where habitat is suitable. While southern grass skink are also potentially present, their habitat is limited to areas around the Park Burn and the lake margin, which will mostly not be subject to works. No geckos are expected to be present within the site.

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 B. It is currently planned to relocate salvaged lizards to an area in the north west corner of the site, which will also be subject to revegetation, habitat enhancement, pest control and weed control. A secondary release site is proposed adjacent to the Park Burn where it flows out of the site and into the lake side area. As this area will require earthworks prior to establishment of lizard habitat and planting, the area will be subject to salvage prior to works commencing, with salvaged lizards relocated to the primary release site. Revegetation will increase the habitat available in the release sites allowing them 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.

A Wildlife Act authority is being sought, allowing for lizard salvage and incidental killing. The information required for Schedule 7 of the FTAA is included in this document and the draft LMP. Appendix C summarises the information required.

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, there was potential habitat for birds along the Lake Dunstan/Te Wairere margins, including where the 'coves' will be constructed. The works have the potential to result in 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 long grass and scrubby vegetation 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 (September to February, inclusive). If clearance is unable to occur outside of breeding season, it is recommended that a condition of consent require an ecologist to inspect the affected vegetation within 24 hours before 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 area where the 'coves' will be excavated. 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. 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, if they choose to. If no recolonisation occurs, no impact on the bird community, including species assemblage and abundance is expected. The site is small in relation to the wider bird habitat and is already subject to significant disturbance as a result of the quarrying activities. Development of the site does not remove the only habitat suitable for species potentially present within the site (e.g. pipit, falcon) from the landscape. Rather, it introduces a small amount of urban development, in an area where development is not abundant.

The significant planting and revegetation that is proposed, including within the development area and around the edge of Lake Dunstan/Te Wairere, will provide a large amount of high quality habitat for native birds. Once the plantings have established, it is expected the bird community diversity will markedly increase.

4.2.4 Increased animal presence resulting from landuse change

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

Developing the site from a more rural land use to urban land use is expected to significantly increase permanent 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 mouse abundance, however there will likely be an associated increase in pest control within individual properties. Potentially significant increases in domestic cat numbers may occur due to the increase in residential development in an area where residential dwellings are not currently present. While Pisa Moorings does form the sites southern boundary, the active quarry is likely discouraging domestic cats from roaming within the site. The only effective mitigation to address increases in domestic cat numbers is to place restrictions on cat ownership within the development. This is not currently proposed.

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. Dogs are already present regularly along the Lake Dunstan/Te Wairere pathway, including roaming off-leash. It is recommended signage is installed in reserves as well as on any access points to Lake Dunstan/Te Wairere stating that dogs must be on leashes and explaining the reasons why dogs should be leashed (e.g. wildlife protection).

The effects of increased predator numbers will be most significant in areas that provide habitat for native fauna that are preyed on, i.e. birds, lizards. Habitat such as this will be of limited extent and value within the residential areas themselves. Enhancement plantings around the lake, Park Burn and in the green strip will provide habitat and are correspondingly most at risk from an increase in predator

numbers. Pest control within these areas will be undertaken, including within the lizard release site. The impact of predators on ground nesting birds around Lake Dunstan/Te Wairere has the potential to be moderate, however, the existing prevalence of off-leash dogs along the lake margin already results in significant disturbance to the area, reducing the suitability of the lake edges for nesting.

The establishment of the plantings on the Park Burn and on the lake edge will increase habitat availability for possums, rats and mustelids. Pest control within these areas will occur, mitigating the potential increase in population.

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

4.2.5 Effects on invertebrates

The magnitude of effect on terrestrial invertebrates is considered to be low due to the lack of habitat present within the disturbed site.

No targeted terrestrial invertebrate surveys were undertaken on the site given the relatively small-scale impacts proposed on vegetation and the absence of identified high-value or specialised invertebrate habitats. As discussed, the bulk of the site will be quarried prior to the development of the subdivision, therefore the baseline habitat for assessing impacts against is considered to be a fully quarried area.

Terrestrial invertebrate communities are generally closely linked to vegetation type, habitat complexity and indigenous plant diversity. Based on vegetation mapping and field surveys undertaken, the site is currently either exotic dominant grassland, planted native buffers, occasional exotic trees or active quarry. In the absence of specialised habitats (e.g., mature undisturbed forest, undisturbed sand as required by the Cromwell chafer beetle (*Prodontria lewisii*)), terrestrial invertebrate communities are expected to reflect those typical of modified rural environments in the Central Otago area and are therefore likely to be dominated by common indigenous and introduced species.

However, a review of available desktop information, including publicly accessible from iNaturalist and relevant DOC New Zealand Threat Classification System (NZTCS) assessments was undertaken (note, only Gastropoda, Lepidoptera, Hymenoptera, Onychophora, Orthoptera and Araneae have published threat classification documents) to understand potential presence in the area. The Cromwell chafer beetle (*Prodontria lewisii*; Threatened – Nationally Endangered) is currently restricted to an 81 hectare nature reserve on the southern side of Cromwell township. It occupies low sand dunes, habitat which is not present within the site. *Mecodema chiltoni*, a large flightless beetle is present in the wider area, though populations have only been found at sub alpine elevations which are not present within the site. Various moths are also present in the Otago region, though these are generally associated with tussockland habitat, which is also not present within the site.

While many terrestrial invertebrate taxa in New Zealand are poorly described or classified as Data Deficient, the likelihood of Threatened or At Risk species being present is strongly constrained by habitat availability. The vegetation within the site itself is highly modified, lacks native vegetation with the exception of planted buffers or infrequent instances of a small number of species on land disturbed by quarrying, and does not comprise intact or specialised habitats typically associated with Threatened or At Risk terrestrial invertebrate species.

Potential effects on terrestrial invertebrates are primarily associated with vegetation clearance and ground disturbance. However, the continued operation of the quarry will result in the majority of the existing exotic dominated grassland being removed prior to construction of the subdivision.

Overall, potential effects on terrestrial invertebrates are considered to be low, increasing to positive in conjunction with the proposed revegetation both within the site and on the edges of Lake Dunsan that are expected to improve terrestrial habitat quality and connectivity over time.

4.3 Impact on Freshwater Ecology

4.3.1 Effects of cove construction on Lake Dunstan/Te Wairere

The magnitude of effect of constructing the coves on Lake Dunstan/Te Wairere is considered to be low.

As part of the development, two 'coves' will be excavated. The coves will be broadly similar to the features excavated during the development of Pisa Moorings, to the south of the site. The southern cove, located at the south eastern extent of the site, will be approximately 200 m in length, up to approximately 30 m wide, and 10 m deep with a water level range of approximately two and 5.5 m depending lake water level. The northern cove, located near the southeast corner of the site will be approximately 290 m in length, up to approximately 40 m wide, and 10 m deep with a water depth between approximately three and six metres depending on lake water depth. Both coves are located where there are existing small, natural coves and these will be extended. The northern cove currently includes an approximately 90 m length pond feature, separated from the lake by a barrier beach comprised of gravel and driftwood. Both areas contain non-natural wetland habitat (as discussed in Section 3.3.4) which will be lost as part of the works.

The works will create a small amount of new lake habitat. Given the artificial nature of Lake Dunstan/Te Wairere, this is not considered to be particularly noteworthy from an ecological perspective, however, the lake does provide significant habitat for Threatened and At Risk native birds and fish. The main ecological effects associated with the coves arise from construction activities, including the generation of excess fine sediment in the lake, effects on fish, effects on non-natural wetlands, and biosecurity risks. The construction and operation of the coves is not expected to alter lakeSPI or TLI measurements either locally or in the wider lake, providing the spread of exotic plants is managed. Each of these is discussed separately below.

4.3.2 Effects on the Park Burn

The magnitude of effect of the proposed works on the Park Burn is considered to be moderate, and temporary, mitigated to positive.

The existing culverts facilitating the crossing of the Park Burn within the site will be removed. A bridge will be constructed in place of the culverts. The bridge will be founded on abutments on either bank, and one pier will be located within the channel. The pier location is to be confirmed, however it will be located outside of flowing water, under normal baseflow conditions. The pier will be constructed 'in the dry' either when Park Burn itself is not flowing, or following temporary diversion of flow around the works area. Removal of the culverts allows the stream to flow in a more natural pattern beneath the bridge, rather than be directed through and constrained by the culverts. Fish passage is expected to be improved through the removal of the culverts as currently two of the three culverts are elevated above normal baseflow. If works must occur when flowing water is present, fish management should be in place to ensure no fish are present within the works footprint.

The main impacts associated with the works are the temporary impacts during construction. As the Park Burn is an intermittent stream, it is recommended culvert removal and construction of the piers preferentially occur during summer months when the stream is not flowing, or at least flow is

significantly reduced. Effects of sediment generated during construction are discussed separately below.

To manage potential impacts on the stream during earthworks, the Park Burn will be temporarily diverted into a constructed diversion channel to ensure periods of elevated flow can be appropriately managed during construction. Diversions will be staged to align with earthworks stages. The Environmental Management Plan (EMP) (Landpro 2026) sets out methods and reasoning for diversions. The establishment, relocation and decommissioning of diversion channels will preferentially be undertaken when the Park Burn is dry and during settled weather. Each diversion reach will be constructed offline, with flow diverted into it (if flow is present) once the diversion is stabilised. The channels will be generally V shaped to ensure low flow conditions maintain sufficient water depth to support fish passage. The final channel dimensions, longitudinal grade and freeboard will be confirmed via detailed design.

If the diversion/s are only in place during periods of no flow, no impacts on instream values are expected. If flow is present, a minor, temporary reduction in instream habitat value will likely be experienced. However, habitat is currently of low value as a result of upstream agricultural impacts, limited riparian vegetation and long dry periods. Instream habitat, flora and fauna will rapidly reestablish once flow is diverted back into the natural channel, replicating what occurs following periods where the stream itself is dry.

The main impact of the proposed temporary diversions is the potential for impacts on fish, which are discussed in more detail in section 4.3.5 below.

4.3.3 Impacts of stormwater

The magnitude of effect associated with the construction of stormwater outfalls on Park Burn and Lake Dunstan/Te Wairere is considered to be low. The discharge of operational stormwater itself will occur as a permitted activity and as such is not considered further in this impact assessment. The discharge of construction phase stormwater will require consent and is considered here and in section 4.3.4.

Five stormwater outfalls will be installed to service the municipal stormwater network associated with the development. Two outfalls will be located on Park Burn, just beyond the site boundaries. Three will be located on Lake Dunstan/Te Wairere, one discharging to each of the two coves, and the final outfall discharging directly to Lake Dunstan/Te Wairere.

Stormwater generated on the site would naturally enter either Park Burn or Lake Dunstan/Te Wairere via overland sheet flow and/or shallow subsurface flow. The construction and operation of a stormwater network formalises this discharge into point source discharges. The largest risk of point source discharges is the potential for erosion and scour. The outfalls will all be designed to slow water discharges down, reducing the chances of detrimental impacts. Providing they operate as designed, no impact from the outfalls is expected beyond temporary minor disturbance during construction. Impacts during construction will be managed through erosion and sediment control practices.

Construction phase stormwater will be managed on site with the ultimate receiving environment being Lake Dunstan, however, with the exception of activities to construct the coves on the lake edge, no stormwater will discharged directly to the lake. Construction phase stormwater will be directed to infiltration basins allowing water to infiltrate to ground via permeable gravels. The infiltration basins will be located away from identified contaminated areas, however a Remediation Action Plan has been prepared outlining procedures that must be followed to undertake remedial work associated with

contaminants. Should unexpected contamination be identified, the EMP (Landpro 2026) identifies measures to be taken before works can commence or continue.

The proposed works will not result in excessive nutrients, or heavy metals being mobilised to enter the lake and therefore no changes to water quality or habitat quality are expected as a result. Measures will be in place to manage the risk of contamination as a result of spills and vehicle refuelling. Operational phase stormwater is not expected to contain contaminants other than sediment. The effects of sediment are discussed below. Providing the erosion and sediment control measures operate as intended, the impact of operational phase stormwater on the lake is considered to be low.

4.3.4 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 and excavation within freshwater environments has the potential to release fine sediment which can enter waterways and waterbodies. 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 that 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. Provided the measures works as intended, the effects of sediment are expected to be mitigated to low.

Erosion and sediment control details are included in the draft EMP (Landpro 2026) . Various measures are proposed including clean and dirty water diversions, infiltration basins, and the use of silt curtains and floating booms are proposed for use in Lake Dunstan/Te Wairere during cove excavation. The measures appear to be appropriate from an ecological perspective, noting EMP's are generally 'live' documents and it is expected it will be updated throughout construction should the need arise.

4.3.5 Effects on fish

The magnitude of effect of proposed cove excavations on fish is considered to be moderate, mitigated to low.

Excavation of the proposed coves will require at least some excavation works within Lake Dunstan/Te Wairere where fish could be present. Any fish present within areas that will be excavated, including the pond associated with the northern cove, have the potential to be detrimentally impacted through disturbance, or physical injury or mortality if they are excavated and not returned to the lake.

While construction methodologies have not yet been confirmed, it is recommended fish management occurs during cove construction, where works occur in surface water. Management should include, at the minimum, a suitably qualified person on site during excavation to monitor all excavated spoil for fish, retrieve any fish present in the spoil, and return them to the lake. A draft fish management plan (FMP) FMP is provided in Appendix D. The plan may be updated when construction methodologies are finalised.

Provided excavated fish are returned to the lake, detrimental effects on fish are expected to be adequately mitigated.

The main impact of the proposed temporary diversions in the Park Burn is the potential for impacts on fish. As discussed, if no flow is present, no impacts on fish or habitat are expected. If the diversions are required to occur when flow is present, fish should be salvaged from the works area and relocated prior to flow being diverted into the diversion. Works will occur as per the FMP.

While diversion channel design will be confirmed during detailed design stage, it is expected the diversions can provide fish passage. If engineering constraints limit fish passage, the limitation will be temporary (a matter of weeks) and no significant impact on fish populations is expected. Due to the lack of migratory species in the wider area, as a result of hydroelectric dam development, a temporary restriction in fish passage will not have any material impact on migration or breeding behaviours of fish present in the stream, and therefore no corresponding impact on wider fish populations. As the Park Burn is an intermittent stream, natural periods of reduced fish passage already exist. A bully was captured within the stream during the site visit despite this. If the diversion results in a temporary restriction of fish passage, passage will be restored immediately once flow is reestablished in the Park Burn channel.

Providing fish are salvaged from the Park Burn prior to any diversions occurring (if water is present) and the diversions are designed to provide for fish passage, or limit fish passage on a temporary basis (weeks), no impact on fish populations is expected.

4.3.6 Effects on wetlands

The magnitude of effect on natural inland wetlands will be negligible, due to the lack of natural wetlands within or around the site. Non-natural wetland habitat is present, and the magnitude of effect on this is considered to be moderate, mitigated to low.

Due to the non-natural status of the wetlands on the margin of Lake Dunstan/Te Wairere, the NES-F does not apply. However, the wetlands present do provide a negligible amount of ecosystem services such as bank stabilisation and filtration of overland flow, as well as some level of habitat values for species, including birds. There will be a temporary loss of approximately 2,180 m^2 (incorporating 780 m^2 in the southern wetland and 1,400 m^2 in the central wetland) of wetland vegetation as the coves are excavated. Not all of the vegetation in both wetlands will be removed, therefore it is expected that sharp spiked sedge, the dominant species in the existing wetland habitat, will self-establish around the new coves over time as they are stabilised. The habitat is common around the edges of the Lake, and its loss will not result in the removal of the habitat from the lake, or exclusion of species which utilise this habitat.

Similar wetland type habitat will be established around the new coves. Approximately 2,630 m^2 of diverse wetland vegetation will be planted around the southern cove as part of the landscaping for the site (LWL and Reset 2026b). In addition, a further approximately 10,300 m^2 of wetland vegetation will be established within the greenway and more than two hectares of the Park Burn delta will be subject to enhancement planting, mostly consisting of wetland plants (though upland species will be established on the higher areas of the delta). As a result, there will be an overall net increase wetland habitat type as a result of the project, as well as a significant increase in plant diversity given the wetlands are currently dominated by a single common species. Species to be planted include *Carex secta, Carex virgata, Juncus edgariae,* bog rush (*Schoenus pauciflorus*), bulrush (*Typha orientalis*) and flax (*Phormium tenax*) (LWL and Reset 2026b).

4.3.7 Effects of invasive aquatic plants

The magnitude of effect associated with the risk of spread of invasive aquatic plants is considered to be moderate.

Oxygen weed is already present in Lake Dunstan/Te Wairere. It is confined to the shallower portions of the lake, in habitats similar to what will be created by the cove excavation. The northern cove is proposed to include a boat ramp. Oxygen weed, and other invasive aquatic plants, are often transported between waterbodies on pleasure boats. They can also be transported on machinery that may be used during construction. There is a risk that invasive plants may become established in the shallow areas of the coves.

It is recommended a condition be included that all machinery used in the excavation of the coves is thoroughly dried and/or cleaned, following current industry best practice, prior to coming into contact with water. It is recommended signage be installed at the proposed boat ramp informing about the risk of inadvertently transporting invasive species between water bodies, and how to minimise the chances of this occurring. Ultimately, the risk cannot be entirely avoided, however the fact oxygen weed is already present in the lake and ongoing control is in place, means the potential impact of its establishment in the coves can likely be managed.

4.4 Effect on taonga species

The effect of the proposal on taonga species present within and around the site can only be assessed by us from an ecological perspective. As discussed in the sections above, there is the potential for detrimental effects on birds through direct impacts and indirect disturbance. Effects can be adequately mitigated, as discussed in section 4.2.3. The proposed works will not exclude any of these species from the wider landscape. Revegetation of the Park Burn corridor, and the lake side will include various plant species listed as taonga. These species will also be used in neighbourhood parks and the greenway. There will be a significant increase in taonga vegetation as part of the development. In turn, this is expected to result in an increase in the number of taonga birds utilising the area as habitat values will have been improved.

From an ecological perspective, all effects on taonga species can be adequately mitigated and enhanced through proposed ecological mitigations.

4.5 Level of effect

The overall level of effect of the proposed works is determined using the ecological value of a feature, and the magnitude of effect of the works on that feature, as per Table 1. Table 7 provides a summary of the overall level of effect expected for the project.

Provided the recommended mitigation measures are implemented, 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. Proposed revegetation of the Park Burn and the lake margin will enhance ecological values through increased diversity and provision of fauna habitat.

Table 7. 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	Proposed mitigation
Terrestrial effects					
Effect of vegetation removal	Low	Low	Positive	Positive	Revegetation of Park Burn, lake edge, landscaping within site
Effects on lizards	moderate	Moderate	Low	Low	Management as per LMP
Effects on birds	Moderate/High	Moderate	Low/Positive	Low/Positive	Restrictions around vegetation removal season, revegetation
Effect on invertebrates	Low	Low	Low	Very low	No specific mitigations, revegetation will increase habitat values
Increased domestic animals resulting from land use change	Moderate	Moderate	Low	Low	Pest control in revegetation, signage in public areas about dogs on leashes
Freshwater effects					
Effects of construction of the coves	High	Moderate	Low	Low	Erosion and sediment control
Effects on Park Burn	Moderate	Moderate	Positive	Positive	Erosion and sediment control, culvert replacement with bridge
Effects of stormwater outfalls	High	Moderate	Low	Low	Engineered outfalls
Effects of sediment on freshwater environments	High	Moderate	Low	Low	Erosion and sediment control
Effects on fish	Moderate	Moderate	Low	Low	Management as per FMP, replacement of Park Burn culvert with bridge
Effects on wetlands	Moderate	Low	Low/Positive	Very low/Positive	Park Burn delta, lake edge enhancements
Effects of invasive aquatic plants	High*	High	Low	Very low	Biosecurity protocols during construction

* denotes the value of Lake Dunstan/Te Wairere.

5 SUMMARY AND RECOMMENDATIONS

FHLD intends to develop a residential subdivision on a site at 922 Luggate-Cromwell Road, Cromwell which currently contains an active gravel quarry. As part of the development, it is proposed to undertake bulk earthworks, remove vegetation, remove the existing culverts and install a new bridge over Park Burn, excavate two 'coves' on the edge of Lake Dunstan/Te Wairere, and undertake riparian and lake margin planting.

An ecological assessment of the site revealed the presence of generally low ecological values within the site, with the exception of habitat for lizards, which was considered to be high where habitat was present. Lake Dunstan/Te Wairere, adjacent to the site, contained high ecological values, notably as habitat for birds. The proposed works are expected to have an overall low level of effect on ecological values provided recommended mitigations measures are implemented. The proposed lake margin and riparian planting, as well as landscaping is expected to have a positive long term ecological impact through increased abundance and diversity of vegetation and provision of habitat for native fauna.

Recommended mitigation includes:

- Vegetation clearance should occur outside the bird breeding season (October to February, inclusive). Alternatively, if clearance is required during the bird breeding season, the vegetation must be inspected by a suitably qualified ecologist to identify any active native bird nests. If an active native bird nest is identified, vegetation clearance within 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.
- Works should be completed under the LMP provided in Appendix C or any subsequent updated versions. The LMP should include measures to capture native lizards from any suitable habitat within the site, and locations where they will be released.
- Works should be completed under the fish management plan provided in Appendix D or any subsequent updated versions. The plan should be prepared once a construction methodology is in place. The construction method will determine how much fish salvage will be necessary, and what methods will be most appropriate.
- All machinery used for the excavation of the coves or within Park Burn should be thoroughly dried and/or cleaned, following industry best practice, prior to coming into contact with any water.
- Signage should be installed around the lake 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.
- Install signage regarding the risks of introducing invasive aquatic plants at the proposed boat ramp.

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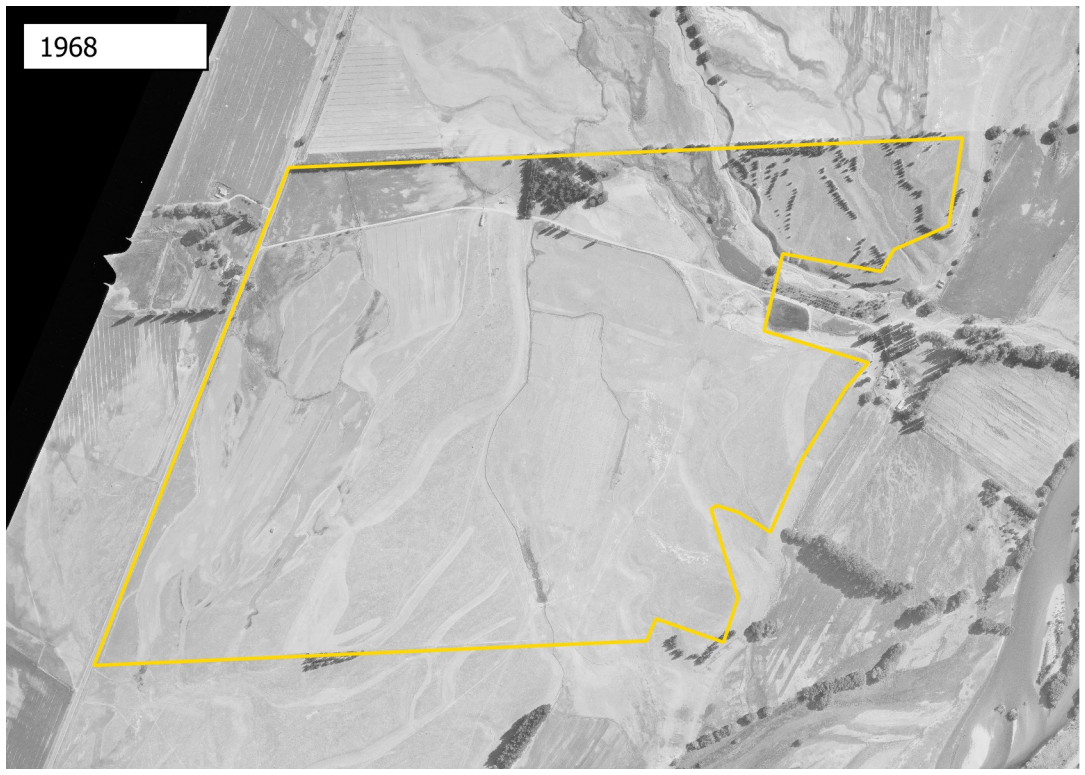
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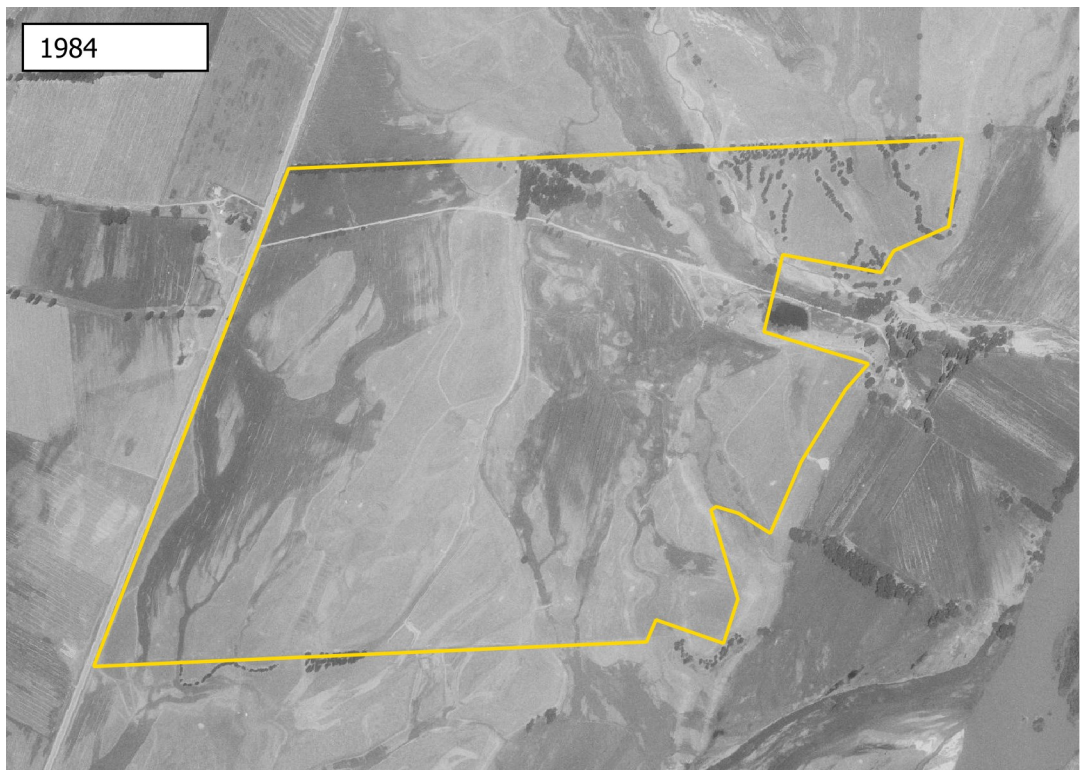
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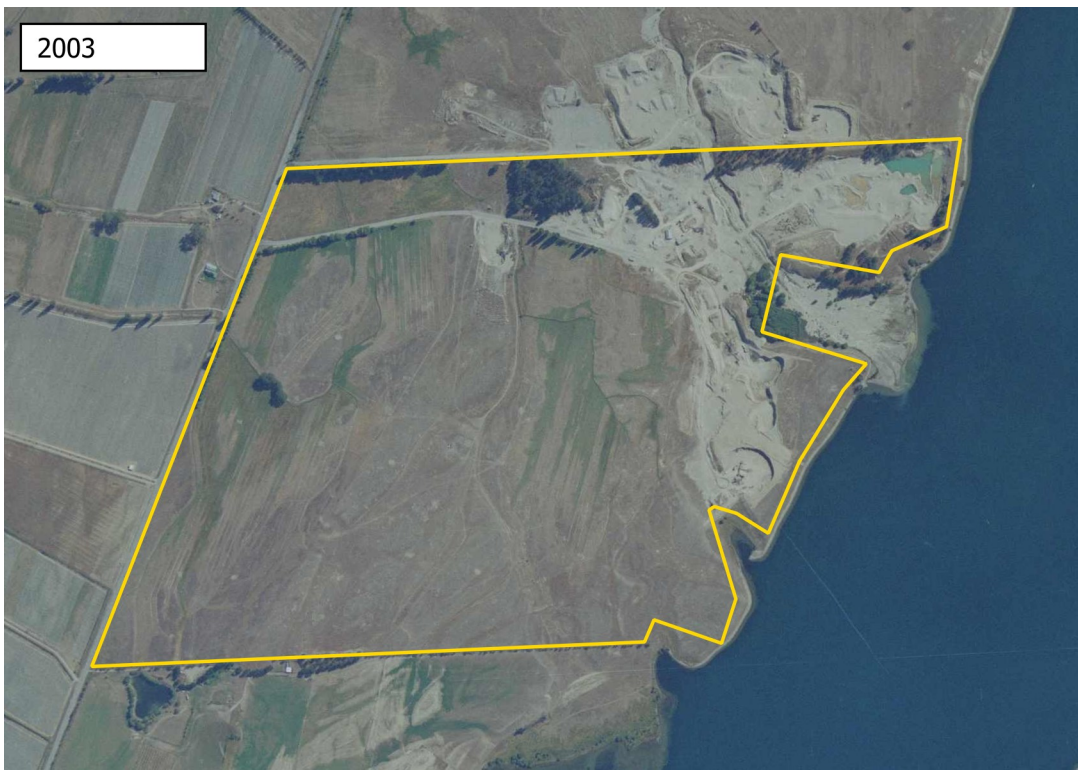
Appendix A
Historic aerial images


1958


1968


1978


1984


2003


2013-14


2025

Appendix B
FTAA Schedule 7 Wildlife Approval Checklist and Information Requirements

Wildlife Approval Checklist and Information Requirements

Introduction

This appendix identifies the Wildlife Act approval requirements for the Parkburn Fast Track application and summarises how the application addresses the information requirements for a Wildlife Approval under clause 2 of Schedule 7 of the Fast Track Approvals Act 2024 (FTAA).

This Wildlife Approval application is for the capture, handling, temporary holding and relocation of indigenous lizards that may be present within suitable habitat affected by the proposed works. It also seeks approval for any incidental injury or mortality of indigenous lizards that may occur despite implementation of authorised lizard salvage, destructive searches, vegetation clearance controls and associated habitat removal procedures undertaken in accordance with the Lizard Management Plan (LMP).

For the avoidance of doubt, a Wildlife Approval is not sought for indigenous birds. The Ecological Impact Assessment (EcIA) and LMP accompanying the Parkburn Fast Track application sets out avoidance and management procedures for birds, including nesting bird checks and avoidance of vegetation clearance in the bird breeding season, as far as practicable. These measures are intended to avoid direct handling, injury or mortality of indigenous birds.

Wildlife Approval information checklist

The information requirements for a Wildlife Approval under clause 2 of Schedule 7 of the FTAA are addressed in Table B2. The checklist is intended to be read alongside the EcIA and LMP, which provide the detailed assessment, management procedures and implementation measures relevant to indigenous lizards.

Table B2. Wildlife Approval information checklist.

Schedule 7 clause	Wildlife Approval information requirement	Application reference and response
2(1)(a)	Specify the purpose of the proposed activity.	**LMP:** Sections 1.1, 2 and 3. The purpose of the wildlife-related activity is to minimise injury and mortality to indigenous lizards by salvaging and relocating any individuals present within suitable habitat before and during vegetation clearance, earthworks and associated habitat removal, and relocating them to suitable alternative habitat.
2(1)(b)	Identify the actions the applicant wishes to carry out involving protected wildlife and where they will be carried out, whether on or off public conservation land.	**LMP:** Sections 3.4 and 3.5; Figure 4. The applicant seeks approval to capture, handle, temporarily hold (<8 hours) and relocate indigenous lizards, and to provide for incidental injury or mortality that may occur during authorised lizard salvage and habitat clearance. Actions will occur within suitable lizard habitat affected by the proposed works, with relocated lizards released into a specified release site that will be subject to enhancements, protection and pest control. Activities will occur on land

Schedule 7 clause	Wildlife Approval information requirement	Application reference and response
		associated with the Parkburn project, as well as on two small sections of LINZ land around the margin of Lake Dunstan and not on public conservation land.
2(1)(c)	Include an assessment of the activity and its impacts against the purpose of the Wildlife Act 1953.	**EcIA:** Sections 3.2.2 and 4.2.2. **LMP:** Section 2. The Wildlife Act protects indigenous wildlife and controls interactions with protected wildlife. The proposed activity is consistent with that purpose because it provides a controlled and ecologist-led process to minimise injury and mortality to indigenous lizards that may otherwise be affected by vegetation clearance and earthworks. The LMP requires lizard salvage, humane handling, release to suitable habitat, habitat enhancement, pest control, post release monitoring, reporting and additional response measures if unexpected captures, injury or mortality occur.
2(1)(d)	List protected wildlife species known or predicted to be in the area and, where possible, the numbers of wildlife present and numbers likely to be impacted.	**EcIA:** Sections 3.2. L**MP:** Section 2.2. Site surveys detected McCann's skink (*Oligosoma maccanni*) and southern grass skink (*Oligosoma chionochloescens*). Approximately 1,150 McCann's skink and <10 southern grass skink are expected in the project area.
2(1)(e)	Outline impacts on Threatened, Data Deficient and At Risk wildlife species, as defined in the New Zealand Threat Classification System.	**EcIA:** Section 4.2. **LMP**: Sections 2.6 and 2.7. Southern grass skink are classified as At Risk. If present within affected habitat, potential effects include injury or mortality during vegetation clearance and earthworks, temporary habitat loss, disturbance and displacement. Following implementation of the LMP, residual effects on lizards are expected to be very low for the reasons set out in the EcIA. McCann's skink are classified at Not Threatened.
2(1)(f)	State how the methods proposed to conduct the actions involving protected wildlife will ensure best practice standards are met.	**LMP**: Section 3. Lizard management will be implemented by a suitably qualified project herpetologist. Methods include works-area demarcation, seasonal timing, artificial cover objects, pitfall and/or funnel trapping, active searches, destructive or machine-assisted searches, humane temporary containment, release-site enhancement and pest control, completion reporting and post-release monitoring if required.

Schedule 7 clause	Wildlife Approval information requirement	Application reference and response
2(1)(g)	Describe the methods to safely, efficiently and humanely catch, hold or kill the animals and identify relevant animal ethics processes.	**LMP:** Section 3.4. Lizards will be captured using accepted lizard salvage methods, including trapping, active searches and machine-assisted searches under the direction of the project herpetologist. Captured lizards will be temporarily contained in clean, ventilated containers for the period necessary to complete search or trap inspections, then released at the identified release location. Injured lizards will be taken to a suitably qualified veterinarian. Euthanasia of an injured lizard will only occur where directed by DOC or a suitably qualified veterinarian, as appropriate.
2(1)(h)	State the location or locations in which the activity will be carried out, including a map and GPS coordinates if available.	**LMP:** Figures 4 and 6, and Section 3.4 and 3.5. The lizard salvage activity will be carried out within suitable lizard habitat proposed for vegetation clearance or earthworks. The proposed release site is identified in Figure 6 of the LMP.
2(1)(i)	State whether authorisation is sought to temporarily hold or relocate wildlife.	**LMP:** Sections 3.4 and 3.5. Authorisation is sought to temporarily hold and relocate indigenous lizards. Temporary holding will be limited to the period required for active searches or trap inspections and transport to the confirmed release site and is expected to be a matter of hours, and no more than eight hours.
2(1)(j)	List all actual and potential wildlife effects, adverse or positive, of the proposed activity, including effects on target species, other indigenous species and ecosystems at the site.	**EcIA:** Section 4.2. **LMP:** Sections 2.7. Potential adverse effects on lizards include injury or mortality during vegetation clearance and earthworks, temporary habitat loss and disturbance. Positive effects include relocation of any salvaged lizards to a specified release site subject to planting, habitat enhancement, weed control and pest mammal control. Wider project related revegetation is also expected to increase habitat values within and around the site.
2(1)(k)	Where adverse effects are identified, state what methods will be used to avoid and minimise those effects, and any offsetting or compensation proposed	**EcIA:** 4.2. **LMP:** Section 3. Effects on lizards will be managed through pre-clearance planning, works-area demarcation, lizard salvage, ecologist-directed clearance of suitable habitat, relocation to specified habitat subject to enhancement, pest control and protection, completion reporting and post-release monitoring. No separate lizard offset or compensation is proposed because

Schedule 7 clause	Wildlife Approval information requirement	Application reference and response
	to address unmitigated adverse effects, including steps taken before the project begins such as surveying, salvaging and relocating protected wildlife.	residual effects on lizards are expected to be low following LMP implementation.
2(1)(l)	State whether the applicant or any company director, trustee, partner or anyone else involved with the application has been convicted of any offence under the Wildlife Act 1953.	This matter relates to applicant declarations and is outside the scope of the ecological assessment.
2(1)(m)	State whether the applicant or any company director, trustee, partner or anyone else involved with the application has any current criminal charges under the Wildlife Act 1953 pending before a court.	This matter relates to applicant declarations and is outside the scope of the ecological assessment.
2(1)(n)	Provide proof and details of all consultation, including with hapū or iwi, on the application specific to wildlife impacts.	Consultation is addressed in the application consultation material. Any consultation specific to wildlife impacts is to be confirmed by the applicant/project planner.
2(1)(o)	Provide any additional written expert views, advice or opinions the applicant has obtained concerning the proposal.	Relevant ecological expert material includes the EcIA and LMP.

Appendix C
Draft Lizard Management Plan

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Parkburn, Luggate-Cromwell Road

Draft Lizard Management Plan

Prepared for: Fulton Hogan Land Development Limited

October 2026



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Author(s)	
	Annabelle Coates
	Senior Ecologist
Reviewer(s)	
	Mark Delaney
	Lead Ecologist

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Cover photo: Lizard habitat within the Parkburn site, February 2026

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1 INTRODUCTION

1.1 Purpose of this Lizard Management Plan

This Lizard Management Plan (LMP) has been prepared to identify and manage the actual and potential adverse effects of the proposed Parkburn residential subdivision development on indigenous lizards and lizard habitat at 922 Luggate-Cromwell Road, Cromwell.

The LMP outlines procedures and management measures relating to:

- pre-construction lizard salvage;
- vegetation clearance supervision;
- lizard capture, handling, and relocation;
- release-site establishment and habitat enhancement;
- pest animal management;
- post-release monitoring; and
- completion reporting.

The overall objective of this LMP, and the purpose of the activity with regard to Schedule 7 of the Fast Track Approvals Act 2024 (FTAA), is to avoid, minimise, and mitigate adverse effects on indigenous lizards and achieve no net loss of lizard populations associated with the development. This will be achieved by salvaging and relocating any individuals present within suitable habitat before and during vegetation clearance, earthworks and associated habitat removal.

This draft LMP accompanies the FTAA application and associated Wildlife Act Authorisation (WAA) application and will be finalised following confirmation of construction methodologies, detailed design, and consultation with the Department of Conservation (DoC).

1.2 Project Background

Fulton Hogan Land Development (FHLD) Limited has applied for resource consent through the Fast Track Approvals Act (2024) (FTAA) to develop a residential subdivision on the property at 922 Luggate-Cromwell Road (State Highway 6), Cromwell.

The proposed development includes:

- earthworks;
- vegetation clearance;
- installation of stormwater infrastructure;
- quarry rehabilitation; and
- associated residential development works.

The site has been heavily modified through historical agricultural use and more recent quarrying activities. However, areas of indigenous lizard habitat remain within portions of the site, particularly within areas of rank grassland, woody debris, scrub vegetation, and the Park Burn riparian corridor. As a result, there is potential for indigenous lizards to be adversely affected by vegetation clearance and habitat disturbance associated with the proposed works.

This LMP should be read in conjunction with the Parkburn Ecological Impact Assessment Report ('EcIA')[1], which assesses the ecological values of the site and the potential effects of the proposed works.

[1] Viridis. 2026. Parkburn, Luggate-Cromwell Road, Ecological Impact Assessment. Prepared for Fulton Hogan Land Development Limited.

2 SITE CONTEXT, ECOLOGICAL VALUES, AND POTENTIAL EFFECTS

2.1 Site Description

The site is located in the Pisa Ecological District (ED) of the Central Otago Region. The Pisa ED is characterised by mid to high elevation ranges and flats in some locations. The climate is generally dry, with cold winters and some small snowbanks that persist through summer. Tussocklands would have predominated historically, however now much of the district is modified by pastoral farming. Very small remnants of native forest remain. Fauna habitat has been degraded and reduced over time as agricultural and urban development expanded.

The site represents a highly modified area of the ecological district. While not currently urbanised, the site contains an active gravel quarry and has been heavily modified over the past 40 years. Prior to the quarry being established, the site was used for agricultural purposes. The neighbouring property to the north is formed by another active gravel quarry, while to the south is an existing residential development of Pisa Moorings. The western boundary is Luggate-Cromwell Road (SH6) with horticultural land beyond. The hydroelectric Lake Dunstan is located on the site's eastern boundary. Further afield is the township of Cromwell.

Historically (pre-human) the site likely comprised scrub and/or tussockland. 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. Lake Dunstan, on the site's eastern boundary, was first filled between 1992 and 1993. Prior to this, the Clutha River was located approximately 500 m beyond the site's boundary.

Currently the site is occupied by an operational gravel quarry, with various buildings associated with the quarry and the manufacture of products such as paving blocks.

The location of the site is shown in Figure 1.

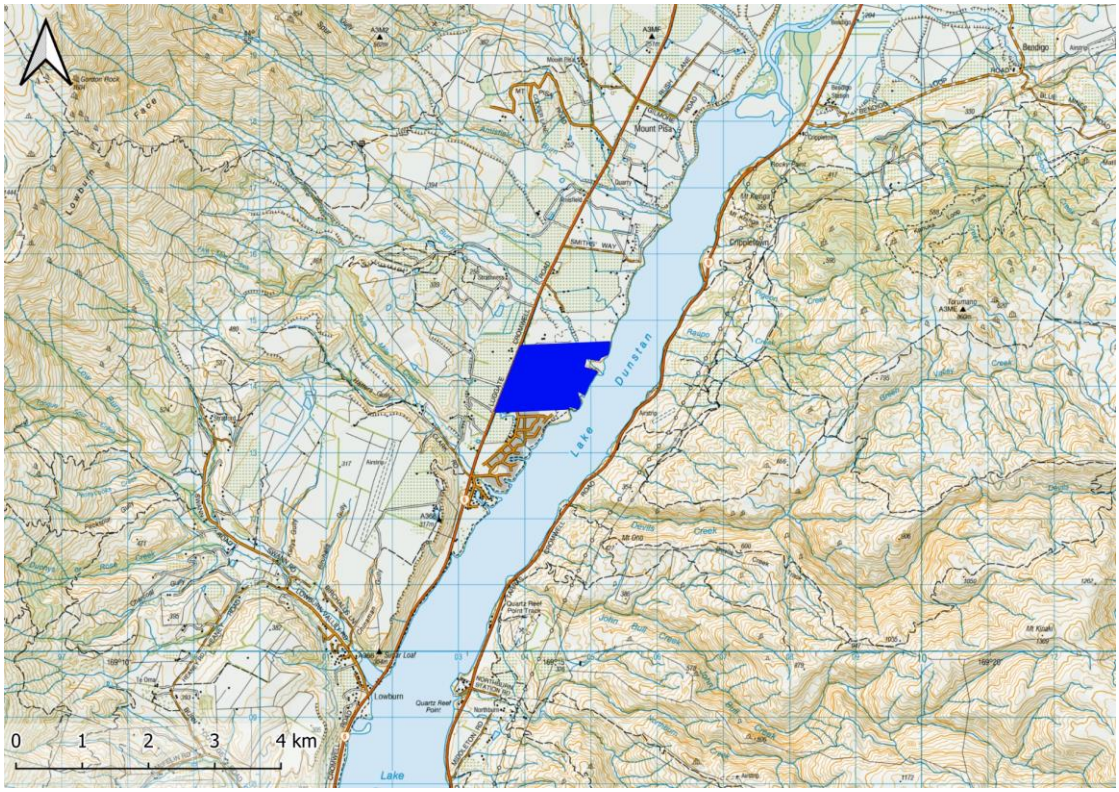


Figure 1. Site location as indicated by blue polygon (map source: LINZ NZ Topo 50).

2.2 Species Potentially Present

Viridis (2026) 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 Lizard Expert NZ within the site. The results of the findings are summarised below.

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. Two species of lizard have been recorded – McCann's skink (*Oligosoma maccanni*; Not Threatened) and Kawarau gecko (*Woodworthia* "Cromwell"; At Risk – Declining (nationally) and Regionally Declining (regionally)).

Lizard habitat within the site was mostly limited to areas of moderate and long grass that had not been subject to quarrying (Figure 3). Additionally, habitat was also present within the Park Burn riparian area between the site and the lake margins. Some areas of debris were present within the site, including dead trees and wood, which provided refugia and basking habitat for skinks. Habitat typically associated with Kawarau gecko was not identified within the site, and geckos are therefore considered highly unlikely to be present.. No lizards are expected to be present in the actively quarried area, and as such, values associated with lizard habitat are not attributed to these areas.

A lizard survey was undertaken in December 2025. One hundred baited Gee's minnow traps were distributed throughout the site (Figure 3), and this was complemented by manual hand searches in other suitable habitats. The areas were focused around areas where lizard habitat values were present, i.e. not within the actively quarried area. A total of 80 McCann's skink and one southern grass skink (*Oligosoma chionochloescens*; At Risk – Declining; Regionally Declining) were captured in traps and by hand searches during the survey. An additional 38 separate observations of skink presence (guano, skins) were also noted. These observations were attributed to McCann's skink due to their locations and the habitat they were found in. An additional two observations were attributed to southern grass skink, however these observations were outside of the site on the lake margin.

2.3 Lizard Habitat

McCann's skink are likely to be present throughout the site where habitat is suitable, i.e. not within the actively quarried areas. It is possible southern grass skink may be present, predominantly in the Park Burn riparian corridor, although the survey did not detect any southern grass skink in this area. The site contained areas of long grass that provides low-moderate skink habitat. These areas were within a wider quarry area and are subject to period mowing to prevent grass getting too long. Where grass was regularly cut or mown, habitat values were considered low. Where grass was in close proximity to trees or shrubs, it was considered to be low-moderate. Where fallen debris was present amongst grass, lizard habitat was considered to be moderate.

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 scrubby vegetation and woody debris.

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. 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 1.7 ha of moderate value habitat (long grass with basking debris), approximately 11 ha of low-moderate (maintained grass in proximity to trees/shrubs) and 33 ha of low quality habitat (periodically mown grass).

Given the low to moderate habitat quality with no pest mammal management, and the results of the preliminary survey, a rough estimate of 25 skinks per ha could be expected across the site. This would equate to approximately 1,150 McCann's skinks in the project footprint.

Southern grass skink habitat is largely unimpacted. A conservative estimate of approximately 0.6 ha of southern grass 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 10 skinks per ha could be expected. This would equate to <10 southern grass skink within the project footprint potentially affected by the works.

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 managed grass or active quarry. Lizard habitat is concentrated in long grass around trees, shrubs and in proximity to debris forming basking habitat. Figure 3 illustrates areas where lizards were detected during a targeted survey of the site, however it should be noted that quarrying will continue and therefore the habitat currently present on site does not equate to the habitat that will be present at the time subdivision development works commence. This LMP will require updates when it is finalised

to confirm where lizard habitat remains within the site. A site visit by a suitably qualified ecologist will be sufficient to determine remaining habitat given skinks have already been confirmed as present within the site.



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Figure 3. Lizard survey results

Site boundary
Park Burn

Lizard survey

McCann's caught
McCann's sign
Tussock caught
Tussock sign

SOURCES
Otago 0.2m Rural Aerial Photographs 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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2.6 Description of Impacted Habitat

The ecological values of the habitat on the site are assessed and described in Viridis (2026). The vegetation on the site affected by the proposed clearance is described as:

- Long grass around trees and shrublands.
- Woody debris forming basking habitat.
- Scrubby vegetation within the Park Burn corridor and around the edge of Lake Dunstan.

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.

Avoidance of lizard habitat is not possible. However, given the ongoing quarrying activities occurring on the site, the values of the habitat at the time construction of this project commences are likely to be lower than they are currently. The impact on lizards is therefore proposed to be minimised through salvage and relocation of lizards that remain within the site when construction commences. The contents of this plan set out methods for minimisation.

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 where works are 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 lizard 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 the methodologies outlined within this LMP and may amend or refine the methodologies where necessary to respond to site conditions, habitat changes, weather conditions, construction staging, or updated ecological information available at the time works commence.

The project herpetologist will have authority to modify salvage methodologies, trapping effort, search methodologies, release procedures, and timing of activities where necessary to improve salvage outcomes, minimise adverse effects on indigenous lizards, or address health and safety considerations, provided the overall intent of this LMP and any conditions of the WAA continue to be met.

Any material amendments to the methodologies outlined in this LMP will be documented by the project herpetologist and communicated to the relevant contractors and regulatory authorities where required.

3.4 Lizard Search and Capture Methodology

3.4.1 Timing of activities

Revegetation activities associated with the release site should be completed prior to commencing lizard salvage activities. Pest control should be in place within the release site 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. Seven days of lizard trapping, hand searching and destructive searches of habitat will be completed in the two weeks leading up to vegetation removal. If weather conditions are unsuitable (e.g. too cold, raining) salvage will continue until seven days of salvage have been completed.

3.4.2 Trapping and habitat searches

Salvage shall occur in all areas of moderate and low-moderate value (red and orange areas) lizard habitat within the earthworks footprint (Figure 4). However, it is noted quarrying will continue on the site until development of the subdivision commences and therefore the habitat identified in Figure 4 below will require updates prior to this LMP being finalised. The updates should reflect habitat available and the completion of quarrying activities. Salvage in low value areas will occur at the discretion of the project herpetologist depending on habitat values at the time. Areas of salvage will be confirmed by the project herpetologist prior to works commencing.

Salvage of lizards is expected to occur in stages, as earthworks and associated development progresses through the site. For each period of lizard salvage, the following process will be undertaken.

- A minimum seven-day 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.
- If, after seven days, a decreasing trend in lizard numbers being caught is not present, trapping and searches will continue for an additional five days.
- After the additional five days, if a decreasing trend is still not observable, an additional three days of trapping will be undertaken.
- Following the additional three days, if a decreasing trend is still not present, additional blocks of three days of trapping will be implemented until a decreasing trend is observed.
-

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 (as far as practicable) 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 3.4.5 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.

3.4.3 Numbers of lizards to be salvaged

It is currently estimated that to approximately 1,150 McCann's skinks are present within the project footprint and less than 10 southern grass skink. However, as quarrying activities will continue on the site, this estimation is not likely to reflect the number of lizards on site when works commence.

It is estimated that up to 1,150 McCann's skink and up to 10 southern grass skink will be salvaged during works. Contingency measures are proposed in section 3.9 should more lizards be encountered.



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Figure 4. Lizard survey results and current lizard habitat

Site boundary
Park Burn

Lizard survey

McCann's caught
McCann's sign
Tussock caught
Tussock sign

Lizard habitat

Low
Low-moderate
Moderate

SOURCES
Otago 0.2m Rural Aerial Photographs 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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a)



b)



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

3.4.4 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. The excavation methodology and bucket type used during machine-assisted searches will be determined by the project herpetologist and contractor based on site conditions and the need to effectively expose concealed lizards while minimising the risk of injury..

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.

3.4.5 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-authorised, 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.

3.4.6 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 will 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

The proposed release sites are illustrated in Figure 6. The sites have been selected as they meet the key criteria for a suitable lizard release area. The location of the primary release site is 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. Separation will be further supported by a lizard fence being installed around the release site which will be left in place for as long as works are being undertaken. The fence 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 primary release site is currently of equal value to the salvage site. It is in an area of the site that has not been quarried and will not be subject to quarrying works between now and when construction of the subdivision commences. It has remained undeveloped for at least 20 years, and contains a small number of shrubs and trees providing low levels of refugia. The area will be enhanced through removal of weeds, revegetation with appropriate native species, installation of additional basking habitat, and pest control.

The primary release location will be protected in perpetuity via consent notices or covenants preventing additional development and requiring vegetation to be maintained and pest control.

The secondary release site is located adjacent to the Park Burn. It has been selected for its proximity and connection to the Park Burn and lake margin habitat. The habitat in the secondary site is of moderate value currently, and contains long grass, willows and scrubby vegetation. The secondary release location will be where all At Risk – Declining southern grass skink are permanently released.

This area will require earthworks as part of the site development, prior to planting and enhancement of the area being completed. As lizards are known to be present in the area, these lizards will be salvaged prior to works commencing in the secondary relocation area. Lizards will be released to the primary relocation area.

It is possible the secondary area contains southern grass skink as they are generally found in proximity to water, such as the Park Burn. As works are required in this area, any southern grass skink salvaged from the secondary relocation site will be temporarily released to a sub enclosure within the primary release location. The sub enclosure will consist of a fenced off, 10x10 m area located within the primary relocation area. The fencing will consist of silt fencing, partially buried in the ground, held in place by waratahs and wire. Once works in the secondary release site are completed, and planting has been undertaken, any salvaged southern grass skink will be removed from the sub enclosure and re released to the secondary area.

The secondary area will be protected in perpetuity via covenants, preventing additional development and requiring vegetation to be maintained.

The primary release site will be used for up to 3,500 lizards. The secondary release site will be used for all southern grass skink, and up to 1,200 McCann's skink. The primary release site overflow area will then be used for up to 1,000 lizards. Combined, the release sites will provide habitat for 5,700 lizards, providing significant redundancy over the approximately 1,150 McCann's skink expected to be present and the very small number of southern grass skink.

Release site suitability is summarised in Table 1.

Table 1. Summary of release site suitability.

Component	Primary location assessment	Secondary location assessment

Suitability of existing habitat	The release site contains habitat of similar quality and value to the rest of the site. It will be enhanced, protected and subject to predator control further increasing its suitability. These actions will be in place before lizards are released to it.	The release site contains habitat of similar quality and value to the rest of the site. It will be enhanced, protected following earthworks in the area, and subject to predator control further increasing its suitability. These actions will be in place before lizards are released to it.
Proximity of the site from the salvage	The release site is immediately adjacent to the development site, within the same property.	The release site is immediately adjacent to the development site, within the same property.
Long-term protection of the site	The release site will be protected via a consent notice or covenant.	The release site will be protected via a covenant.
Accessibility for release	The site is readily accessible for lizard release, pest control, and monitoring.	The site is readily accessible for lizard release, pest control, and monitoring from either the internal road where it crosses the Park Burn, or from the lake margin.
Size of the release site and its connectivity to other habitat	The size of the release site has been calculated based on a conservative estimate of the number of lizards to be salvaged and expected carrying capacities for enhanced, protected and pest managed habitat (i.e. the release site). Approximately 1,150 skinks are expected. The release site was sized to accommodate 1 skink per square metre. The release site is 3,987 m^2 providing significant redundancy. An additional 1,213 m^2 of area along the northern boundary, connected to the primary release site is also available if needed.	The area is 1,460 m^2 in area, which when combined with the primary area provides significant redundancy for the number of lizards expected to be salvaged. It is connected to existing habitat around the lake.
Existing lizard populations	McCann's skink are known to be present in the release site in low numbers. Given the proposed habitat enhancements, pest control and larger than necessary area, the relocated lizards will have no measurable influence on existing lizard populations (e.g., overcrowding).	McCann's skink are known to be present in the release site in low numbers. Southern grass skink may be present in very low numbers. Given the proposed habitat enhancements, pest control and larger than necessary area, the relocated lizards will have no measurable influence on existing lizard populations (e.g., overcrowding).
Habitat enhancement opportunities	The release site will be subject to revegetation and habitat enhancement and pest control.	The release site will be subject to revegetation and habitat enhancement and pest control.
Existing predator control or opportunities to	Predator control, planting and habitat enhancements will be established in the release site prior to lizards being released.	Predator control, planting and habitat enhancements will be established in the release site prior to lizards being released.

enhance predator control		



Figure 6. Proposed lizard release sites

PROJECT NO.	10418
DRAWN BY:	AJC
DATE:	20/10/2026
SCALE	**1:2,000** @ A4

Site boundary

Park Burn

Proposed lizard release site

Primary site

Overflow area

Secondary site

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SOURCES
Otago 0.2m Rural Aerial Photos 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.

3.5.3 Habitat enhancement of release sites

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 release locations will be undertaken as part of the development of the site. Beyond the revegetation, specific lizard centric planting will occur in the release sites and this will be completed prior to lizard salvage commencing. Silver tussock (*Poa cita*), creeping pohuehue (*Muehlenbeckia axillaris*), scrub pohuehue (*Muehlenbeckia astonii*) and mingimingi (*Coprosma propinqua*) should be planted in patches around the primary site to create a mosaic of lizard habitat (e.g. refugia and foraging). In the secondary site, these species should be planted beyond the specific riparian planting that will occur in the Park Burn corridor.

Creeping pohuehue and silver tussock should be sized at PB3, while the other species should be sized at PB5. Larger plant sizes reduces the time needed for plants to establish and provide effective habitat.

Plants should be maintained until 80% ground/canopy coverage is achieved. Monitoring will be undertaken as part of general landscape planting monitoring. If plants have died and left gaps of 1 m^2 or larger, infill planting should be undertaken during the first growing season following gap identification. Dead plants should be replaced with individuals of the same species. Weed maintenance should preferentially occur by hand. Targeted spraying should only occur for significant infestations, however providing weed maintenance occurs regularly (every three months) significant infestations should not establish. The use of weed whackers or similar should be avoided.

The planting will be complemented by installation of eco piles. Eco piles are created by piling woody debris and rocks together to form complex three dimensional structures. Eco piles are used by lizards for cover, basking and foraging. The branches of exotic tree species removed during works on the wider site should be split into small sections and retained for use as lizard enhancement. Willows should not be used due to their ability to propagate from branches, unless the trees are already dead prior to clearance. A total of 40 to 50 eco piles should be located within the primary area at roughly equidistant separation. In the secondary area, two lines of eco piles should be constructed, parallel to the flow of the Park Burn, but above flooding levels. One line should be on either bank, and they should be separated by approximately five metres.

It is recommended a herpetologist should be onsite during installation of the eco piles to ensure they are constructed appropriately.

3.6 Pest Control

Predator control will be undertaken in the release sites before lizards are released, and for five years post release to reduce predation pressure while lizards establish within the release site. FHLD or suitably qualified individuals action on FHLD's behalf, will carry out the pest control.

Trapping will commence at least two months prior to planned release of lizards within the primary release site and as soon as practicable in the secondary release site ensuring at least four weeks of pest control has occurred prior to release of lizards to the secondary area. Earlier commencement is acceptable and may be timed with lizard habitat enhancement planting. Control will be conducted over

a four week period with traps baited only in week one, then actively set (with baits) in weeks two to four. At the end of week four, traps should be left *in situ*, but all baits removed.

The sections below set out recommended methods and spacing for pest control. While cats represent a significant threat to lizards, the proximity of the site to current and proposed residential areas means cats present are highly likely to be domestic.

3.6.1 Rats and mice

Bait stations installed between 25 and 50 m apart is generally recommended for control of rats and mice. For the primary release site, two bait stations will be installed. A further two stations may be required if the overflow area is utilised. These will be installed as needed. The secondary release site will also contain two stations.

Lockable (e.g., Philproof) or run through bait stations will be used where possible, these will be spaced 50 m apart in a location that are easily accessible (Figure 7). As plants establish, bait station locations should be revised as appropriate 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.

3.6.2 Mustelids and hedgehogs

Trap lines 800 m to 1 km apart, with traps location 200 m apart is recommended for mustelid control (i.e., stoats, weasels). DOC 200 traps inside wooden tunnels are recommended (Figure 7). Due to the size of the release areas, only one trap per area is recommended for this site.

DOC 200s will also catch rodents and 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 and therefore unlikely to provide sufficient canopy cover. Traps should be placed on edges of features (e.g. close to the lizard fence) as these provide pathways mustelids are likely to utilise. 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.

3.6.3 Possums

Trap lines 100 m apart with traps spaced 20 to 40 m initially, then up to 100 m apart is generally recommended for sufficient control of possums (Figure 7) and therefore one trap will be installed within the each of the release sites.

Flipping Timmy traps or Trapinator traps will be used 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 will 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 will be avoided to minimise the risk of non-target capture.

3.6.4 Lagomorphs

One Philproof bait station will be installed within each relocation area, along a fenceline. Pindone pellets will be used within the bait station as this type of poison bait does not require pre-feeding. Stations will be baited with Pindone for two weeks before being emptied and rebaited for another two weeks. Lagomorph control should occur two months before commencement of enhancement planting to ensure the population is low and will not damage newly planted native vegetation.

3.6.5 Pest control summary

The table below summarises the recommended methods and spacing for pest control.

Table 2. Recommended pest control methods for the lizard release site.

Pest	Method	Density	Bait / Lure	Maintenance / Notes
Rats and mice	Philproof or run-through bait stations	Two bait stations within the release site, spaced approximately 50 m apart	DoubleTap bait blocks (diphacinone and cholecalciferol)	Traps to commence at least two months prior to release. Bait stations to remain in situ and be rebaited as required. Locations may be adjusted as vegetation establishes.
Mustelids and hedgehogs	DOC 200 trap in wooden tunnel or GoodNature A24 self-resetting trap	One trap per 20 ha (one trap proposed for the site)	Fresh rabbit meat or eggs preferred; salted/freeze-dried alternatives may be used	Tunnel entrances to remain clear of debris and cobwebs. Trap to be checked and serviced regularly to ensure effective operation.
Possums	Flipping Timmy or Trapinator traps	Approximately one trap per hectare (one trap proposed within the release site)	Apple with cinnamon, peanut butter, citrus peel, carrot, vegemite, or alternative possum lures	Bait types should be rotated periodically to maintain effectiveness. Meat- or fish-based baits should be avoided due to proximity to residential areas.
Lagomorphs	Philproof bait station	One bait station within the release area, positioned along a fence line	Pindone pellets	Bait stations to be baited for two weeks, rebaited, and maintained for a further two weeks. Control to occur prior to enhancement planting.



Figure 7. Lizard release site pest control

Site boundary
Park Burn

Proposed lizard release site
Primary site
Overflow area
Secondary site

Pest control
Rat and mice
Mustelid and hedgehog
Lagomorph
Possum

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SOURCES
Otago 0.2m Rural Aerial Photos 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.

3.7 Post Release Monitoring

Post release monitoring of the lizard population in the release sites is recommended if a substantial number of lizards are salvaged from the works area. Monitoring in the secondary release site is only necessary if the site is used, either to release southern grass skink, or as overflow for McCann's skink. Monitoring is necessary to determine the success of the salvage and enhancement works at the release site. The monitoring will be commissioned by FHLD Limited, and completed by a suitably qualified herpetologist/s.

The primary release site currently contains very limited habitat (limited to a small amount of planted shrubs along the road, and mown grass. A line of large pines is present just beyond the release site). Therefore, during any post release monitoring in the primary site, it is expected the vast majority of lizards detected will be individuals that were relocated there during salvage works. The secondary release site will be subject to salvage prior to earthworks being undertaken. Habitat enhancement will only occur once earthworks have been completed. Therefore, all lizards detected in the secondary site will have been released following salvage, or will have recolonised naturally following planting.

3.7.1 Monitoring triggers

The following monitoring triggers are proposed. As salvage will occur over several stages, monitoring is also proposed in stages. Stage 1 will establish if lizards are persisting in the release sites post relocation. Stage 2 will assess the overall success of the full relocation programme.

Stage 1

- <100 lizards captured and no southern grass skink captured – no monitoring required
- ≥100 lizards captured, and any southern grass skink or any other species captured during season 1 of salvage – monitoring to be completed in all areas where lizards have been released, the season following release. The aim of this monitoring is to determine if lizards are persisting in the release site/s.
- ≥1000 lizards captured during season 1 of salvage – monitoring to be completed in all areas where lizards have been released over three consecutive monitoring seasons (i.e. three years). The aim of this monitoring will be to track if populations change over time.

Stage 2

- <1500 lizards total captured across all stages of salvage – monitoring in all release sites the season following salvage completion. The aim of this monitoring is to determine lizard persistence in the release site/s.
- ≥1500 lizards total captured across all stages of salvage - monitoring to be completed in all areas where lizards have been released over three consecutive monitoring seasons (i.e. three years). The aim of this monitoring is to determine persistence over time.

3.7.2 Monitoring methods

The monitoring of translocated lizards to measure long term 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, and estimates of population size in each relocation area, as necessary.

Standard survey techniques (i.e ACOs, baited pitfalls, baited gee's minnow traps) will be employed at the release sites. The number and location of traps will be determined at the time depending on the number of lizards salvaged. Traps will be checked every day for one week (seven days) 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 temporarily marked using a non-toxic, xylene-free paint pen. Marks will be applied in unique combinations and locations for each day of capture to generate short-term capture-mark-recapture histories. Capture-mark-recapture analyses will be undertaken to generate an estimate of lizard abundance. 'Closed population' methods are considered appropriate given the week long survey where limited to no influence of migration/births/deaths can be expected. Should monitoring occur more than annually, populations estimates can be compared to understand how the population is changing over time.

The herpetologist undertaking the post-release survey may recommend additional monitoring if survey results do not indicate a healthy population. They may also recommend additional habitat enhancements or pest control as necessary. 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.

3.8 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.

3.9 Contingency measures

Management of lizards for any project comes with some level of risk and uncertainty. While this document is intended to be a 'live' document, and subject to updates if/when necessary, Table 3 below sets out the most likely risks and uncertainties associated with management options, and includes measures to minimise or address these risks.

Table 3. Proposed contingency measures for lizard management.

Risk	Details	Likelihood	Management	Residual risk
Additional lizard species encountered	Additional species other than those listed in this LMP	Very low	Stop works, notify DOC for further instructions. Follow incidental discovery protocol.	Very low
Unsuitable weather	Weather during salvage needs to be suitable for	Low	The lizard salvage season generally extends from October to April.	Very low

conditions for salvage	lizard activity, i.e. not cold or raining		Seven working days of salvage are still required as per sections 3.4.1 and 3.4.2. Project planning will ensure sufficient time is available prior to vegetation clearance to meet objectives if adverse weather occurs.	
Relocation site failure	Failure of revegetation plantings	Very low	Planting and enhancement of the release site will be undertaken prior to lizard works commencing. If vegetation not established appropriately, lizard salvage cannot commence until alternative release site confirmed or revegetation plantings established.	Very low
Pest control failure	Failure of pest control measures to reduce/manage pest abundance	Low	Revisit pest control measures, extra pulses of pest control. Provide additional habitat features, e.g. log/rock piles.	Very low
More lizards than expected captured and relocated	It is not possible to know exactly how many lizards will be captured, best efforts to estimate have been made based on the survey results.	Low-moderate	Salvage will continue until a decreasing trend in lizard numbers is established, for a minimum of five additional days as per section 3.4.2.	Very low
	More lizards than expected may mean the release site is not sufficient.	Low	The primary release site is large enough to support close to four times the expected numbers of lizards to be salvaged. The secondary release site will be used if more than 3,500 individuals are salvaged. Additional space (1,213 m^2) can be added to the primary site if needed also.	
Residual lizard populations remaining following habitat clearance	It is unlikely every lizard will be captured from the works areas. The Wildlife Permit application includes the application for 'incidental killing' of lizards that elude salvage.	Moderate	Follow incidental discovery protocol.	Low

3.10 Incidental discovery protocol

The following protocols are to be followed if lizards are encountered on site during works, after lizard salvage has been completed. The protocol will be distributed to the construction team, including plant operators.

Lizards could be present in and on vegetation that has either not been cleared, or has established following initial clearance. Vegetation could include long grass, scrub and weedy vegetation. They may also bask in sunny exposed spots, such as in/on wood or rock piles, and may be found underneath debris. They may be uncovered when disturbed.

Following discovery of a lizard after salvage has occurred, the following steps will be taken:

- Immediately (as soon as discovery of a lizard is made) stop any activities within five metres of the discovery. If the species encountered is a species with a Threat Classification status of 'Threatened' then all works must cease immediately within 100 m, until an assessment is made of the risk for that species by the works, and any specific management identified, including avoidance.
- If possible, catch the lizard and place in a container with grass/leaf litter. Useful containers include clean lunch boxes or clean materials boxes. Ensure to create breathing holes in the container if the container is airtight. Store the lizard in the container in a safe, cool, shady location out of sun until a decision is made.
- Immediately inform the Project Herpetologist and site manager.
- Note the date, time, name of person who observed the lizard and the person who caught the lizard (if caught). Photograph the lizard/s and the habitat where it was found and record GPS location (e.g. a pin on Google Maps). A cell phone photo will be sufficient providing it is in focus. If the lizard was not captured, note any details possible (e.g. colour, body markings, size, body shape in order to describe to the Project Herpetologist or DOC.
- If the lizard is injured immediately (within one hour) contact the Project Herpetologist and a local veterinarian and arrange for the lizard to be transported to the veterinarian. Treatment by the veterinarian will likely require payment. Photograph the injury.
- If a dead lizard is found note the location it was found, the time it was found, and the approximate time of death if this can be determined (e.g. time materials where a lizard was found were moved). Notify the Project Herpetologist and DOC. If DOC require arrange for the carcass to be sent to Massey University Wildlife Postmortem Service, Massey University, in Palmerston North. If the carcass can be delivered within 72 hours, chill it, or if delivery will take longer, freeze it.

3.11 Checklist

Table 4 contains a checklist summarising the responsibilities for lizard management within the site.

Table 4. Lizard Management Checklist

Task	Required of:	Completed
Project start-up		
Appointment of project herpetologist	FHLD / Consent holder	
Finalisation of lizard management techniques and LMP	Project herpetologist	
Submission of final LMP to DoC / Council	Project herpetologist / FHLD	
Approval of LMP	DoC / Relevant authority	
Pre-works management prior to vegetation clearance		
Contractor induction regarding lizard management requirements	Project herpetologist / Site manager	
Installation of release-site pest control	FHLD or suitably qualified contractor	
Release-site enhancement planting and eco pile installation	FHLD / Landscape contractor	
Installation of lizard exclusion fencing around release area	Contractor under supervision of project herpetologist	
Deployment of ACOs, pitfall traps and / or funnel traps	Project herpetologist	
Pre-works lizard trapping and active searches	Project herpetologist	
Works phase lizard management		
Confirmation of salvage areas and habitat suitability	Project herpetologist / Site manager	
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	
Post-release monitoring (if triggered)	Project herpetologist	

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Appendix A
Assessment against the key principles for lizard salvage and transfer in New Zealand

Table 5. Assessment of the proposed works against the key principles for lizard salvage and transfer in New Zealand.

Principle		Discussion
1	Lizard species' values and site significance must be assessed at both the development and receiving sites	Surveys have been undertaken of the salvage site and relocation site confirming the presence of McCann's skink in the salvage and release sites (Figure 3), and the likely presence of southern grass skink around the lake edge. The values of the release site were confirmed through surveys and hand searching. The release site currently has low-moderate values, in line with the majority of the lizard habitat in the rest of the site. Values will be increased through planting, enhancements and pest control, increasing the significance of the habitat as well. The significance of the site as a whole (salvage and relocation areas) was considered moderate to moderate due to the presence of Not Threatened McCann's skink. At Risk southern grass skink were only present around the lake edge. The value of the site was considered to be lower due to the lack of native vegetation, and pressure from agriculture. McCann's skink is very common in the wider area, and eastern South Island.
2	Actual and potential development-related effects and their significance must be assessed	Section 2.7 of this report and section 4.2.2 of the EcIA discuss actual and potential effects. Direct effects include injury and mortality during physical works. Indirect effects include loss of habitat, habitat fragmentation, disturbance during works as a result of noise and machinery/vehicle movement and other construction activities, and changes in habitat due to application of treated wastewater. The significance of the wider site is not expected to change At Risk species are most likely to be present around the lake margins. The value and significance of areas to contain houses and commercial areas is likely to be reduced.
3	Alternatives to moving lizards must be considered	There are no areas of high value habitat in the site. The ongoing quarrying activities continue to impact habitat values. Development of the site means lizards must be moved out of harms way. Compensation in the form of enhancement elsewhere was not considered to address actual effects on site.
4	Threatened lizard species require more careful consideration than less-threatened species	The species expected to be encountered most is Not Threatened McCann's skink. Southern grass skink habitat is minimal and mostly located outside of the site. It has been avoided as far as possible when it comes to development of the coves through minimising the number of coves and locating these in areas where there is already natural inlet topography. Where avoidance is not possible works have been minimised. Only very small numbers of southern grass skink are expected to be encountered in very discrete areas (cove excavation).
5	Lizard salvage, transfer and release must use the best available methodology	Best practice methodologies have been proposed as per section 3.4 of this document. The LMP is considered to be a 'live' document, and can be updated if evidence requires alternative methodologies be considered. The release site will be subject to habitat enhancement, revegetation, pest control and ongoing protection in line with best practice.

6	Receiving sites and their carrying capacity must be suitable in the long term	The release site will not be subject to development. It will be protected via consent notices or covenants. It has been sized conservatively to accommodate expected numbers of lizards with significant redundancy. It is four times larger than the minimum size needed, and will be subject to habitat enhancements and pest control, increasing the carrying capacity significantly over and above what it would currently support.
7	Monitoring is required to evaluate the salvage operation	Post release monitoring is proposed as per section 3.7 of this LMP. The monitoring of translocated lizards to measure survivorship and population establishment is difficult without physically marking the lizards. 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.
8	Reporting is required to communicate outcomes of salvage operations and encourage process improvements	Reporting regarding post release monitoring, and completion reporting, are proposed as per section 3.7 and 3.8 of this LMP.
9	Contingency actions are required when lizard salvage and transfer activities fail	The enhancement, revegetation and pest control of a larger area of habitat within the site than is necessary will support resident lizards in these areas and are expected to result in growth of the resident population even in the absence of lizards being released to these areas. Significant revegetation and landscape enhancements are occurring as part of the wider project, including around the lake margin. These activities will significantly increase habitat values for lizards beyond the site boundaries and will create new habitat opportunities in the site for lizards to move into of their own accord.

Address | Unit A1, 72 Apollo Drive, Mairangi Bay, Auckland 0632
Post | PO Box 301709, Albany, Auckland 0752
Telephone | 64 9 475 5750
Email | contact-us@viridis.co.nz

www.viridis.co.nz

Appendix D
Draft Fish Management Plan

VIRIDIS
Environmental Consultants

Parkburn, Luggate-Cromwell Road

Draft Fish Management Plan

Prepared for: **Fulton Hogan Land Development Limited**

September 2026



DOCUMENT CONTROL AND REVISION HISTORY

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Author(s)	
	Annabelle Coates
	Senior Ecologist
Reviewer(s)	
	Mark Delaney
	Lead Ecologist | Director

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

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1 INTRODUCTION

1.1 Purpose of this Fish Management Plan

This Fish Management Plan (FMP) has been prepared to manage the actual and potential adverse effects of the proposed works on freshwater fish and fish habitat associated with the Parkburn residential subdivision development at 922 Luggate-Cromwell Road, Cromwell.

The FMP outlines procedures for:

- the installation and maintenance of fish exclusion devices;
- fish salvage and relocation;
- fish handling and transportation;
- relocation site selection;
- biosecurity measures;
- monitoring and reporting requirements; and
- adaptive management during works.

The purpose of these measures is to minimise adverse effects on freshwater fish during instream works within Park Burn and excavation works associated with the proposed Lake Dunstan coves.

This draft FMP accompanies the Fast-track Approvals Act 2024 (FTAA) application and will be finalised following confirmation of the detailed construction methodology and any relevant consent conditions.

1.2 Project Background

Fulton Hogan Land Development (FHLD) Limited has applied for resource consent through FTAA to develop a residential subdivision on the property at 922 Luggate-Cromwell Road (State Highway 6), Cromwell.

The proposed development includes:

- replacement of the existing triple-arch culvert with a bridge crossing;
- excavation of two coves along the margin of Lake Dunstan;
- temporary diversion of the Park Burn to manage sediment during excavations; and
- associated earthworks and infrastructure works.

As these works will occur within or adjacent to freshwater habitats, there is potential for adverse effects on freshwater fish and aquatic habitat.

This FMP should be read in conjunction with the Parkburn Ecological Impact Assessment Report ('EcIA')[1], which assesses the ecological values of the site and the potential effects of the proposed works.

[1] Viridis. 2026. Parkburn, Luggate-Cromwell Road, Ecological Impact Assessment. Prepared for Fulton Hogan Land Development Limited.

1.3 Site description

The site contains two freshwater environments relevant to this FMP:

- Park Burn, an intermittent stream flowing through the site; and
- the margins of Lake Dunstan adjacent to the proposed cove excavation areas.

The location of the site is shown in Figure 1.

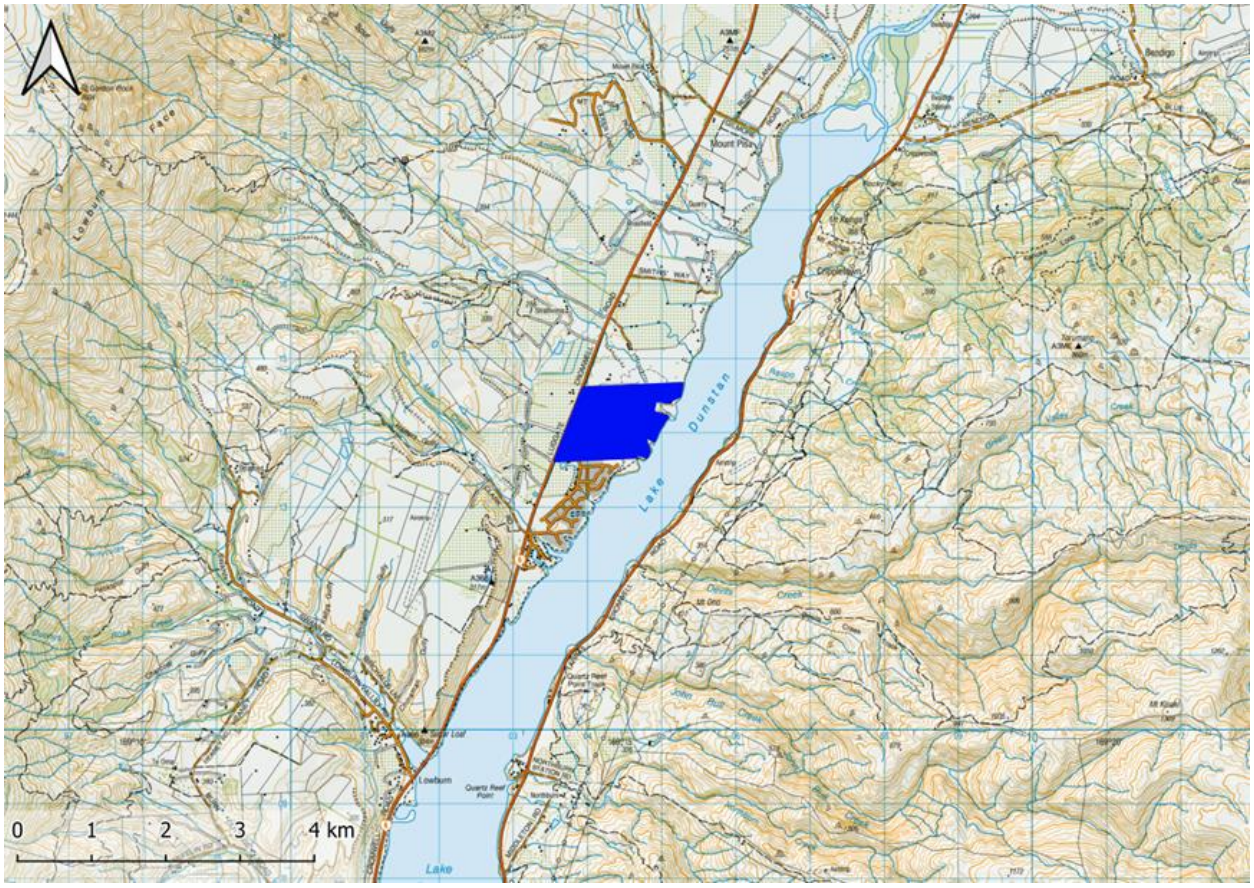


Figure 1. Site location as indicated by blue polygon (map source: LINZ NZ Topo 50).

1.3.1 Park Burn

One intermittent stream, Park Burn, flows through the site. It originates northwest of the site, on the Lowburn Face of the Pisa Range. The upper reaches flow through extensive agricultural land, while the lower reaches (on the river flats) flow through horticultural land. It flows into Lake Dunstan immediately to the east of the site.

Within the site, the Park Burn is contained within a small gully, approximately 30 m wide, that has not been subject to quarrying. Substrates were dominated by gravels with smaller areas of fine sediment, and given sufficient flow, small braids can form (Figure 4). It periodically runs dry, therefore it has been classified as intermittent.

Park Burn is considered to have moderate ecological values. Despite its modified nature, there is the potential for At Risk fish species to be periodically present.

a)



b)



Figure 2. Park Burn within the site.

1.3.2 Lake Dunstan

Lake Dunstan is an approximately 26 km^2 hydroelectric lake, formed in the 1990s following the construction of the Clyde Dam. Prior to the lake being filled, the moderately braided Clutha River flowed in its place. The lake is long, narrow and relatively shallow, occupying a river valley.

The lake is considered to have high ecological value due to it providing habitat for a number of Threatened and At Risk fish and bird species.

a)



b)



Figure 3. Lake Dunstan adjacent to the site.

1.4 Fish Values and Species Potentially Present

A survey of Park Burn within the site yielded a single common bully (*Gobiomorphus cotidianus*, Not Threatened). Records for the Park Burn in the New Zealand Freshwater Fish Database have only recorded brown trout (*Salmo trutta*; Introduced and Naturalised) to date. Records for Lake Dunstan, and for its tributaries record the presence of various species.

The presence of hydroelectric dams downstream means any eels present in Park Burn or Lake Dunstan have been present since prior to the installation of the dams. Numbers are expected to be low, if any in Park Burn, but they are expected to be present in the lake. Clutha flathead galaxias have been recorded in a tributary of the Low Burn, southwest of the site. It is considered unlikely they are present in the site itself due to their non-migratory status and they do not reside in lakes. Koaro populations have also

likely been impacted by the hydro dams as they are a migratory species requiring a period in the sea for reproduction. However, there are landlocked koaro populations, including in the Central Otago lakes.

Species expected to be present within Park Burn or Lake Dunstan include:

- Longfin eel (*Anguilla dieffenbachii*, At Risk - Declining)
- Shortfin eel (*Anguilla australis*, Not Threatened)
- Common bully
- Upland bully (*Gobiomorphus breviceps*; At Risk – Naturally Uncommon)
- 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)

1.5 Objectives of Fish Salvage and Relocation

The objectives of fish salvage and relocation are to:

- minimise injury and mortality to freshwater fish during works;
- prevent fish entering active work areas;
- safely capture and relocate fish from affected habitats;
- relocate fish to suitable habitat within the same catchment;
- minimise stress during capture, handling, transport, and release;
- ensure works are undertaken in accordance with relevant permits and industry best practice; and
- maintain appropriate biosecurity controls.

1.6 Roles and Responsibilities

The roles and responsibilities associated with implementation of this FMP are outlined in Table 1.

Table 1. Roles and responsibilities

Role	Responsibility
Supervising freshwater ecologist	Oversee implementation of the FMP; undertake fish salvage and relocation; determine salvage effort requirements; supervise fish handling and release; implement adaptive management measures where necessary; record fish capture data; and prepare post-salvage reporting.
Contractor	Install and maintain fish exclusion devices as directed by the freshwater ecologist; provide safe access to work areas; comply with directions provided by the freshwater ecologist; and ensure works are undertaken in accordance with this FMP.
Project manager / consent holder	Ensure relevant permits and approvals are in place prior to works commencing; coordinate timing of salvage works; ensure resource consent conditions are complied with; and provide required reporting to Otago Regional Council where applicable.



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Figure 4. Freshwater features

Site boundary
Park Burn

SOURCES
Otago 0.2m Rural Aerial Photographs 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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2 METHODOLOGY

The methodology outlined below describes the procedures that will be implemented to minimise adverse effects on freshwater fish during works within Park Burn and Lake Dunstan.

2.1 Timing

Fish salvage and relocation will be undertaken immediately prior (within 2-3 days) to the commencement of any instream works or cove excavation. Ongoing maintenance of any temporary fish barriers by the contractors will be undertaken until stream and cove excavation 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 on Park Burn (either temporary diversion, bridge construction activities or removal of the existing culverts) barrier(s) will be installed to prevent fish moving up and downstream through the area of works. Exclusion devices are still required on Park Burn if it is dry as a period of rain may set the stream flowing again.

Isolation devices are considered impractical for the cove excavation due to the size of the area and depth of the lake.

Exclusion devices 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 width of the aquatic habitat and will be embedded into the dry ground or the banks (Figure 5).

Waratahs 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 through the waratahs. Shade cloth will be fastened to the waratahs and wire supports (where applicable) using zip ties or similar mechanism. 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.

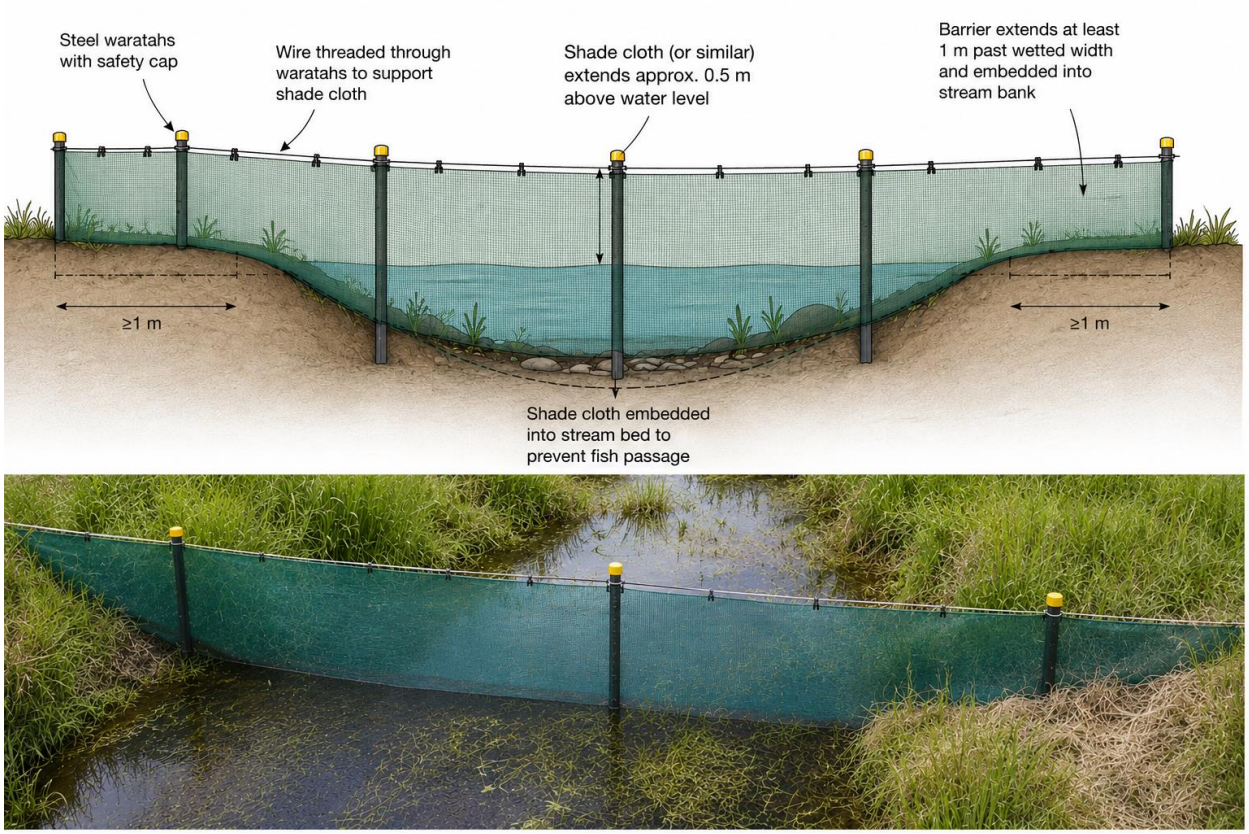


Figure 5. Example of a fish barrier installed in a stream to prevent passage into or out of an area.

2.3 Fish capture

2.3.1 Park Burn

If the Park Burn is dry at the time of works, no fish salvage is necessary.

A combination of electric fishing and netting/trapping is proposed within the Park Burn if water is present. If water is not present, but saturated mud/sediment is present in the Park Burn, 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.

Electric fishing will be undertaken in the works reach prior to setting any nets. Several passes may be undertaken depending on fish capture rate. Following electric fishing and providing water levels allow, baited Gee's minnow traps and fyke nets will be placed at intervals over the stream works areas 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 with Joy et al. (2013). Floats will be 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, at least one fyke net and two Gee's minnow traps over 25 m, in accordance with 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 supervising freshwater ecologist. 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's 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 supervising freshwater ecologist (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. Electric fishing will be undertaken again following clearance of the nets.

While a streamworks methodology has not yet been confirmed, it is expected works within Park Burn will be required to occur 'in the dry'. At this point, bunding or sheet piling or similar will be installed to isolate the works area. Complete dewatering of the works area will commence provided capture rates have declined to the appropriate thresholds. 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, the supervising 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.

2.3.2 Cove excavation

While a works method for excavation of the coves has not yet been confirmed, it is expected some level of excavation within the lake itself will be required. It is not feasible to completely isolate the works area due to the size of the excavation area, depth of Lake Dunstan, and the open connectivity of the lake environment. Fish are also able to freely move into and out of the excavation area, meaning pre-construction salvage would likely result in only temporary and incomplete removal of fish from the area. The works area represents a very small proportion of the lake habitat and effects of works are considered to be very low.

As a result, salvage associated with excavation of sediments during works is considered the best practicable method to minimise adverse effects on fish within the lake environment. This approach focuses on recovering fish that may become entrained within excavated sediment, particularly benthic species and burrowing species such as eels.

The supervising freshwater ecologist will be on site for all excavation works that are in direct contact with the waters of Lake Dunstan. Excavated material will be deposited on the banks of the lake to allow any eels present to naturally move back into the lake. In addition, the ecologist will manually search through all excavated sediment for any fish entrained within the sediment.

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.

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 water-filled, 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 the supervising freshwater ecologist, they will be humanely euthanised 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 Park Burn

Fish captured within the Park Burn will be released back to the Park Burn upstream of the works area (Figure 6). Access is readily available from Luggate-Cromwell Road. Keeping fish within the same system they are salvaged from removes the risk of increased population densities, unsuitable habitats and biosecurity risks. There is sufficient upstream habitat to support additional fish species for the short period works will occur.

2.5.2 Lake Dunstan

Any fish captured from the Lake Dunstan will be returned to the lake (Figure 6). Whether they are returned to the lake to the north or south of the site will depend on any sediment released into the lake environment. Access is readily available to both the north and south of the works sites.



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Figure 6. Proposed fish release locations

Site boundary
Park Burn
Works area
Lake Dunstan release location
Park Burn release location

SOURCES
Otago 0.2m Rural Aerial Photographs 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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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's minnow traps, stop and dip nets and transfer buckets.

Any pest fish caught will be humanely euthanised and all euthanised pest fish will be disposed of in a biosecure 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 the supervising 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).

2.8 Contingency Measures

Unexpected conditions may arise during fish salvage, relocation, dewatering, or excavation works. The following contingency measures will be implemented where necessary to minimise adverse effects on freshwater fish and aquatic habitat.

2.8.1 Rainfall events

Fish salvage and relocation will not be undertaken during periods of moderate or heavy rainfall, or where such conditions are forecast during the proposed salvage period. Elevated flows and reduced water clarity can reduce salvage effectiveness and increase risks to both fish and personnel.

If significant rainfall occurs during salvage or instream works, activities will cease until flows and water quality have stabilised to a level considered suitable by the supervising freshwater ecologist. Following any significant rainfall event, fish exclusion devices and isolated work areas will be inspected to confirm they remain functional and secure.

2.8.2 Fish mortality

If unexpected fish mortality occurs during salvage, handling, dewatering, or excavation works, the supervising freshwater ecologist will investigate the likely cause and determine whether modifications to salvage methods, handling procedures, work practices, or fish holding arrangements are required.

Any significant fish mortality event, including mortality of Threatened or At Risk species, will be recorded and reported to the relevant regulatory authority where required by resource consent conditions or permit requirements.

2.8.3 Discovery of Threatened or At Risk species

If Threatened or At Risk fish species are captured in greater numbers than anticipated, salvage methodologies and effort may be modified by the supervising freshwater ecologist to increase capture efficiency and reduce adverse effects on the affected species.

Where necessary, additional salvage effort, increased trap densities, or revised handling and relocation procedures may be implemented. Works within the affected area may be temporarily delayed if considered necessary by the supervising freshwater ecologist to ensure appropriate management of the species.

2.8.4 Equipment failure

In the event of equipment failure during salvage or dewatering activities, works will cease until the equipment is repaired or replaced, where failure may compromise fish salvage effectiveness, fish safety, or environmental protection measures.

Backup equipment, including spare nets, buckets, aeration devices, and dewatering pumps (where practicable), will be available during salvage operations to minimise delays and risks to fish.

3 REPORTING

Following completion of fish salvage and relocation works, 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 stages 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 holds an MPI Special Permit (875) and Native Fish Transfer Authorisation (420) that allows Viridis Limited, and their agents, representatives, and employees to take and 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.

Address | Unit A1, 72 Apollo Drive, Mairangi Bay, Auckland 0632
Post | PO Box 301709, Albany, Auckland 0752
Telephone | 64 9 475 5750
Email | contact-us@viridis.co.nz

www.viridis.co.nz

Address | Unit A1, 72 Apollo Drive, Mairangi Bay, Auckland 0632
Post | PO Box 301709, Albany, Auckland 0752
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