

Bendigo-Ophir Gold Project

Lizard Values Assessment

Report prepared for

Matakanui Gold Ltd

Prepared by

RMA Ecology Ltd

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BETTER ECOLOGICAL OUTCOMES

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List of Abbreviations

Abbreviation	Term	Description
BOGP	Bendigo-Ophir Gold Project	Is the topic of this resource consent application and covers approximately 610 ha.
CIT	Come in Time	Area of gold resource
CODC	Central Otago District Council	
CODP	Central Otago District Plan	
DDF	Direct Disturbance Footprint	610 ha area of land within the ESA covering BOGP gold mining and ancillary activity areas that cause direct habitat loss through vegetation clearance and/or earthworks. Shapefile provided to RMA Ecology Ltd by Matakanui Gold Limited on 14 April 2025. The DDF also includes Ardour Rise (Thomson Gorge Road realignment) The DDF also includes the construction zone for the proposed predator proof fences.
DDZ	Potential Dewatering Drawdown Zone	Approximately 142 ha zone with potential to dewater because of indirect influence from the DDF.
DOC	Department of Conservation	
ED	Ecological District	A local part of New Zealand where the topographical, geological, climatic, soil and biological features, including the broad cultural pattern, produce a characteristic landscape and range of biological communities.
EPA	Environmental Protection Authority	The New Zealand government agency responsible for regulating activities within the country that affect the environment
ESA	Ecological study area	5,386 ha area of land composed of a mix of grazing lands, leasehold Crown land, and Crown land. It is divided into DDF and SL areas.
ELF	Engineered Landform	Overburden rock stack where rock is placed, engineered to achieve geochemical outcome.
MEP	Minerals Exploration Permit	MEP60311 is named Bendigo Ophir to indicate the exploration permit extends from the historic town of Bendigo to Ophir, with an area of 25,162 ha.
MGL	Matakanui Gold Limited	New Zealand company wholly owned subsidiary of Santana Minerals Ltd.
MPP	Minerals Prospecting Permit	
MRE	Mineral Resource Estimation	Evaluation estimating the grade and tonnage of an ore in a deposit.
ORC	Otago Regional Council	
RAS	Rise and Shine	Area of land with gold resource containing a MRE (2024) of 2,217,000oz of gold at a grade of 2.3g/t.
RMA	Resource Management Act	Resource Management Act 1991
SRX	Srex	Area of land with gold resource containing a MRE (2021) of 174,000oz of gold at a grade of 1.1g/t.
SRE	Srex East	Area of land with gold resource containing a MRE (2021) of 11,000oz of gold at a grade of 1.3g/t.
TSF	Tailings Storage Facility	Engineered structures designed and constructed to hold mineral waste (tailings) generated after the gold has been recovered at the processing plant.
WELF	Western Engineered Landform	Permanent engineered landform in an unnamed creek west of RAS pit.

Executive summary

Overview

This report describes the lizard values within the Direct Disturbance Footprint (DDF; 610 ha) of the Bendigo Ophir Gold Project (BOGP), at Bendigo, Central Otago. It also compares these lizard values to those of the surrounding Ecological Survey Area (ESA; approximately 5,400 ha).

Three species of native lizards were recorded as present in both the ESA and DDF. The same lizard species were found within the DDF as were found from surveys elsewhere within the ESA, including other parts of Ardgour station and Bendigo station, and within Bendigo Scenic Reserve and Bendigo Historic Reserve. Additional searches for lizards were conducted alongside road margins and vineyards at nearby Bendigo Loop Road, and also on land approximately 10 km to the west overlooking Lake Dunstan. In all of those locations, the same three species of native lizards were recorded. No frogs or exotic lizards were detected within or adjoining the DDF, or within areas searched for lizards within the wider ESA.

The species recorded were (in order of extent of distribution and relative abundance across the DDF) McCann's skink (*Oligosoma maccanni*; Nationally and Regionally Not Threatened; abundant), Kawerau gecko (*Woodworthia 'Cromwell'*; Nationally and Regionally At Risk; common) and tussock skink (*Oligosoma chionocholescens*; Nationally and Regionally At Risk; sparse). No other species of native lizard were detected from the surveys, including other species of native gecko, or species of cryptic or large native skink, despite robust methods and considerable search effort specifically applied to detect those species.

Habitat for lizards within the DDF is similar to areas in the wider ESA and comprises low quality exotic pasture, through to moderate quality mixed shrubland, and high-quality native herbfield. Lizard values within the site (which incorporates species conservation status, habitat quality, and local distribution) are high for Kawerau gecko and tussock skink, and low for McCann's skink.

The presence of Kawerau gecko and tussock skink qualify the DDF as significant habitat of indigenous fauna in the operative Otago Regional Policy Statement (RPS) and the proposed RPS.

Given the declining population trend for tussock skink and Kawerau gecko nationally (as with other NZ reptiles), any loss of native lizards is important to avoid, where practical to do so. All native New Zealand lizards are protected by the Wildlife Act, and an Authority under that Act is normally required to salvage and relocate native lizards in order to prevent incidental injury or death, such as through habitat clearance (and such authorities are being sought as part of the Fast Track application).

In this regard, it is appropriate to take measures to minimise the potential risk of incidental injury or death to native lizards, and to provide enhancements to lizard populations at and near to the site.

Methods

Multiple methods were employed to survey lizards (and any incidental sightings of frogs) throughout the DDF, and across comparable, representative, areas of the surrounding ESA, including the use of active and passive methods during late spring 2023, summer 2024, autumn 2024, and spring 2024.

Survey methods included:

- Artificial Cover Objects (ACOs): 400 Onduline triple stacks; checked during summer and spring 2024;
- Pitfall trapping: 6 transect lines, each with 20 traps set over summer 2024);
- Gee's minnow funnel traps (6 transect lines, each with 4 traps set over summer 2024);
- Arboreal gecko basking daytime search (6 sites by binocular search and foliage search, searched twice; summer 2024);
- Drone aerial survey of tors (12 large tor systems within the DDF and nearby) to detect basking skinks in spring 2024;
- Tor/rock area large skink basking survey (6 aggregate sites surveyed by binoculars twice; summer 2024); and
- Manual timed search (79 sites spread across the DDF, Ardgour Station and Bendigo Station and searched over summer 2024, spring 2024, and summer 2025).

In total, approximately 620 person hours were expended on the ground undertaking searches for lizards across the ESA and associated areas. Many more hours were additionally expended reviewing site photos, drone video, and data collected from the site.

Results

Survey within the DDF and surrounding areas targeted the best examples of regenerating scrubland, tor vegetation, and valley tussock and scree vegetation in order to comprehensively survey for cryptic, large-bodied or very rare species including green skink, jewelled gecko, Otago skink, Nevis skink, and grand skink. None of these species were detected, despite multiple methods being applied, and multiple visits within seasons and between seasons.

At each of the areas surveyed for these 'special species', one or more of the more common species found at the site were noted (McCann's skink, tussock skink or Kawerau gecko), either basking, in natural refuges, within ACOs, caught in traps, or noted active across habitat. Our surveys were thorough, extensive, and targeted representative habitats. Some surveys were immediately after survey [REDACTED] where Otago and grand skinks were readily observed basking and active, reinforcing our conclusion that the survey results in the DDF of an absence of these species are real and not an artifact of survey, sampling, or climatic conditions. From this, we conclude that neither the DDF, nor other parts of Ardgour or Bendigo Stations extensively surveyed, support Otago skink, grand skink, Nevis skink, green skink or jewelled gecko.

In contrast, Kawerau gecko, tussock skink, and McCann's skink were ubiquitous throughout the DDF and ESA. At least one of these three lizard species, and often all three, were detected in each of the seven vegetation communities within the DDF, as well as within the ESA and in areas opportunistically surveyed outside of the ESA. Only gravel roads and cropping areas without rock did not support lizards, although roadside margins, including recently bulldozed berms, did support lizards.

Relative abundance of lizards - as measured through catch per unit effort for ACOs and unit effort manual searches – varied between species and vegetation communities. General patterns noted – and which are supported by multiple lines of evidence including replicated searches, traplines, and other methods - include:

- McCann's skink is the most widely distributed lizard within the DDF. It occupies almost all vegetation communities (excluding the centre line strip of gravel roads) and is found at up to

31.9 individuals (on average) per person hour manual searching, and up to 1.4 lizards (on average) per ACO device check. Abundances were greatest within taramea communities and where mixed shrubland was sparse and included rank grassland or rockland.

- Kawerau gecko is also widely distributed within the DDF, occupies all vegetation communities and is found at up to 13.8 individuals per person hour manual searching, and up to 3.6 lizards per ACO device check. Numbers can be very abundant locally where rock exists in scattered piles or tors, with noticeably fewer individuals found in communities that lack rock crevices or other suitable refuges.
- Tussock skink was found within most vegetation types within the DDF, but at low abundance relative to other species, with capture rates up to 0.8 individuals per person hour manual searching, and up to 0.17 lizards per ACO device check. Tussock skink captures were greatest in valley bottoms and other places where ground cover and moisture were most likely to persist over the summer months.
- The proportion of lizards that had lost tails and regrown them can be used as an indicator of predator pressure. All captured lizards from ACOs were assessed for regenerating tails. Tail regeneration occurrence was: McCann's skink 97 out of 377 skinks (25.7 %); tussock skink 7 out of 31 skinks (22.6 %); Kawerau gecko 144 out of 572 geckos (25.2 %). Tail loss (and regeneration) for Kawerau geckos recorded in the ESA from these investigations is similar to that of the proportion of tail loss recorded from a recent study by others for a similar species of gecko [REDACTED] in the presence of uncontrolled introduced predators (23.8 %). This suggests that geckos (if not also skinks) within the ESA and DDF are experiencing pressure from uncontrolled levels of introduced mammalian predators.
- The impact of introduced mammalian predators on native lizards is highlighted by the occurrence of native lizards in the diets of feral cats and ferrets (tussock skink and McCann's skink), and hedgehogs (McCann's skink), as reported in the Mammalian Pest Survey report for this project by HabitatNZ;
- Methods used to survey lizards are not suitable for accurately estimating abundance within the DDF; however, based on our time on site and the results of the various methods employed, our coarse estimate of abundance of lizard species within the DDF is:
 - o McCann's skink low 100,000s
 - o Tussock skink low 1,000s
 - o Kawerau gecko High 10,000s

Morphological data and pictures were taken for lizards that were captured, including diagnostic features for skinks and geckos that aided confirmation of classification; the raw data are not presented in this report, but are available upon request.

To assist in the preparation of the Assessment of Ecological Effects, potential adverse effects on native lizards from the proposed BOGP are outlined. The proposed BOGP will require the clearance of habitat occupied by lizards, and is likely to have the following adverse effects:

1. Temporary loss of approx. 610 ha of lizard habitat within the DDF, with restoration through rehabilitation of most habitat types following clearance for mining, and development of viable habitat capable of supporting lizard populations following completion of rehabilitation works;

2. Net loss of some lizard habitats that cannot be replicated in the rehabilitation areas, such as herbfield-cushionfield;
3. Possible disruption to resident lizard communities through relocation of salvaged lizards from the DDF, and release into the proposed release sites at neighbouring Ardgour Station and parts of Bendigo Station (the Mine Regeneration Zone) set up for the management of native lizards; and
4. Injury and death to some portion of native lizards within the DDF that are not relocated prior to habitat removal, or which do not survive the relocation and release process.

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1.0 Introduction

1.1 Project background

Matakanui Gold Limited (“MGL”) is applying for resource consents to construct and operate a new gold mine, ancillary facilities and environmental mitigation measures on Bendigo and Ardgour Stations in the Dunstan Mountains of Central Otago. The project is named the Bendigo-Ophir Gold Project (“BOGP”) and is located approximately 20 km north of Cromwell.

The BOGP is located within the footprint of Minerals Exploration Permit 60311, which overlays several pastoral stations that have grazed sheep and cattle in the area for over 100 years. MEP60311 is held by MGL under the Crown Minerals Act 1991. MGL has land access agreements with Bendigo and Ardgour Stations. The BOGP is located adjacent to land administered by the Department of Conservation (“DOC”), including the Bendigo Historic Reserve, the Bendigo Conservation Area, and the Ardgour Conservation Area. The BOGP planned operations do not directly impact these areas.

The BOGP’s exploration has discovered numerous soil geochemical anomalies and extensive drill evaluation has defined four gold deposits worthy of economic extraction. The most significant is the Rise and Shine (“RAS”) discovery. The other discoveries at Come in Time (“CIT”), Srex (“SRX”) and Srex East (“SRE”) are smaller in size and tenor.

The defined orebodies are planned to be mined by open pit methods. Underground mining is planned for the deeper parts of the RAS orebody in the later years of development.

The majority of the mining activities, ancillary facilities and associated infrastructure will be located in Shepherds Creek Valley. Access, and service and administration offices are planned to be located on the adjoining Ardgour Terrace.

Figure 1 provides an overview of the footprint associated with the establishment, operation and rehabilitation within the BOGP. We understand this footprint includes a range of buffers, with widths varying for different components of the design. We have assumed that vegetation/ habitat clearance and/or earthworks will occur in the entirety of this area. We understand that the area is designed to account for potential minor changes in the DDF over future revisions due to engineering and design alterations that may occur during detailed engineering design. A further 13.09 ha (approximately) of disturbance will be needed to establish the Thomson Gorge Road alternative alignment (Ardgour Rise). A further 2.75 ha (approximately) of disturbance will be needed to construct predator proof fences. The maximum potential disturbance, herein referred to as the Direct Disturbance Footprint (DDF) (Figure 2), including contingency, Ardgour Rise road (replacement for the existing Thomson Gorge Road), and the proposed predator proof fences is approximately 610 ha.

Aspects of the project that are not included in the DDF are the pipeline, borefield, and walking track to the CIT battery (Figure 1) as we understand (from the applicant) that these will be undertaken either as permitted activities (pipeline and borefield) or will have nil impact (walking route).

Approximately 52 ha of the DDF is in the agricultural area on Ardgour Terrace. This area will be used for offices, security, medical, laboratory, laydown, storage, contractor areas, topsoil storage, emulsion manufacture and magazine facilities plus quarries and roading.

Ecological work will include rehabilitation on directly disturbed areas, ecological uplift activities and pest exclusion area(s) adjacent to the footprint on nearby areas such as Ardgour and Bendigo Stations. A full description of the various activities comprising the establishment, operation and rehabilitation within the BOGP is provided in the Assessment of Environmental Effects prepared by Mitchell Daysh Limited.

However, by way of summary, the BOGP includes the following components:

- The establishment of the RAS Open Pit and SRX Open Pit, which are planned to form partial pit lakes at closure;
- The establishment of RAS Underground which utilises backfill with cement paste;
- The establishment of the CIT Open Pit, which is the smallest of all the footprints and is planned to be progressively backfilled with waste rock from the RAS Open Pit and profiled to integrate with the surrounding terrain. Rehabilitation will enable nearby native herb fields to be re-established (assuming successful prior trials) at the completion of mining activities;
- The establishment of the small SRE Open Pit, which will be backfilled with waste rock before being covered with overburden to form the engineered landform for the adjoining SRX Open Pit ("SRX ELF");
- A conventional hard rock gold processing plant (1.2 million tonnes per annum expandable to 1.8Mtpa) applying modern Carbon-in-Leach ("CIL") technology constructed in the lower reach of Shepherds Valley. The plant will operate in a closed water circuit with the TSF. Residual chemicals in the tailings slurry will be detoxified and / or precipitated with specialist plant;
- The operation of the process plant will be supported by ancillary facilities such as maintenance workshops, raw material and process chemical storage, fuel depot, laboratory and warehousing. Mine offices, carparking and security services will also be established;
- The construction of the plant in the lower reaches of the Shepherds Valley will include the realignment of Shepherds Creek;
- The establishment of water storage dams and tankage for use in the process plant, dust suppression and drinking water supply;
- The establishment of a Tailings Storage Facility ("TSF") in the upper reach of Shepherds Valley (including clean water diversion drains), which will utilise waste rock from mining activities within the project site;
- The establishment of permanent engineered landforms in the Shepherds Valley ("Shepherds ELF") and an unnamed creek west of RAS pit ("WELF");
- The establishment of temporary topsoil, vegetation and brown rock stockpiles around the project site;
- The extraction of groundwater from the Bendigo Aquifer for use in mining-related activities as well as supplying BOGP drinking water and replacing small irrigation water takes from Shepherds Creek. Bore water will be pumped to the processing plant via a pipeline over approximately 6.5 km;
- The establishment of supporting infrastructure / activities for the project, such as the upgrade of Ardgour Road and parts of Thomson Gorge Road to provide improved access to the BOGP, internal mine access and haul roads, water pipelines and underground utilities, and electricity supply to the project site from Lindis Crossing via a new 66kV overhead powerline that will follow the existing road reserve corridor;

- A realignment of part of Thomson Gorge Road, via Ardgour Station (Ardgour Rise) is planned to maintain public access through to the Manuherikia Valley;
- Main explosives magazines and emulsion mixing facilities (located outside the project site on Ardgour Terrace);
- The establishment of non-operational infrastructure associated with the BOGP on the Ardgour Terrace, including security, first aid and administrative offices, geology facilities, high voltage substation and temporary construction workers accommodation;
- The establishment of pest exclusion area(s) for ecological enhancement activities; and
- The establishment of the Ardgour Restoration Area.

1.2 Purpose and scope

RMA Ecology Limited has been engaged by MGL to undertake ecological investigations and to prepare ecological values assessments for vegetation, wetlands, birds and lizards¹. These ecological values assessments form the basis of an ecological effects assessment that has been prepared by Alliance Ecology Limited to support an application for approvals under the Fast-Track Approvals legislation².

Broadly, the scope of this report is to describe the lizard values of the Direct Disturbance Footprint (DDF) and the Surrounding Landscape (SL), which together make up the 5,386 ha Ecological Study Area (ESA) (Figure 2). Specifically, this report contains:

- A description of the methods employed to investigate the lizard communities of the ESA;
- A description of the ecological context of the ESA and wider Central Otago region with regard to natural history and anthropogenic influences;
- An assessment of the lizard values that are contained within the DDF;
- An assessment of ecological significance criteria with regard to lizards; and
- A summary of the potential ecological effects of the BOGP on lizards.

The scope of this report is limited to assessing lizard values and does not include an assessment of effects of the Project on these values. An assessment of effects on lizard communities and species is provided in the Assessment of Ecological Effects prepared by Alliance Ecology Ltd.

¹ This report was prepared in accordance with an approved variation (16 May 2024) of our original approved offer of service (24 October 2023).

² The Fast-Track Approvals Bill was introduced to the House on 7 March 2024 and is currently proceeding through Select Committee.

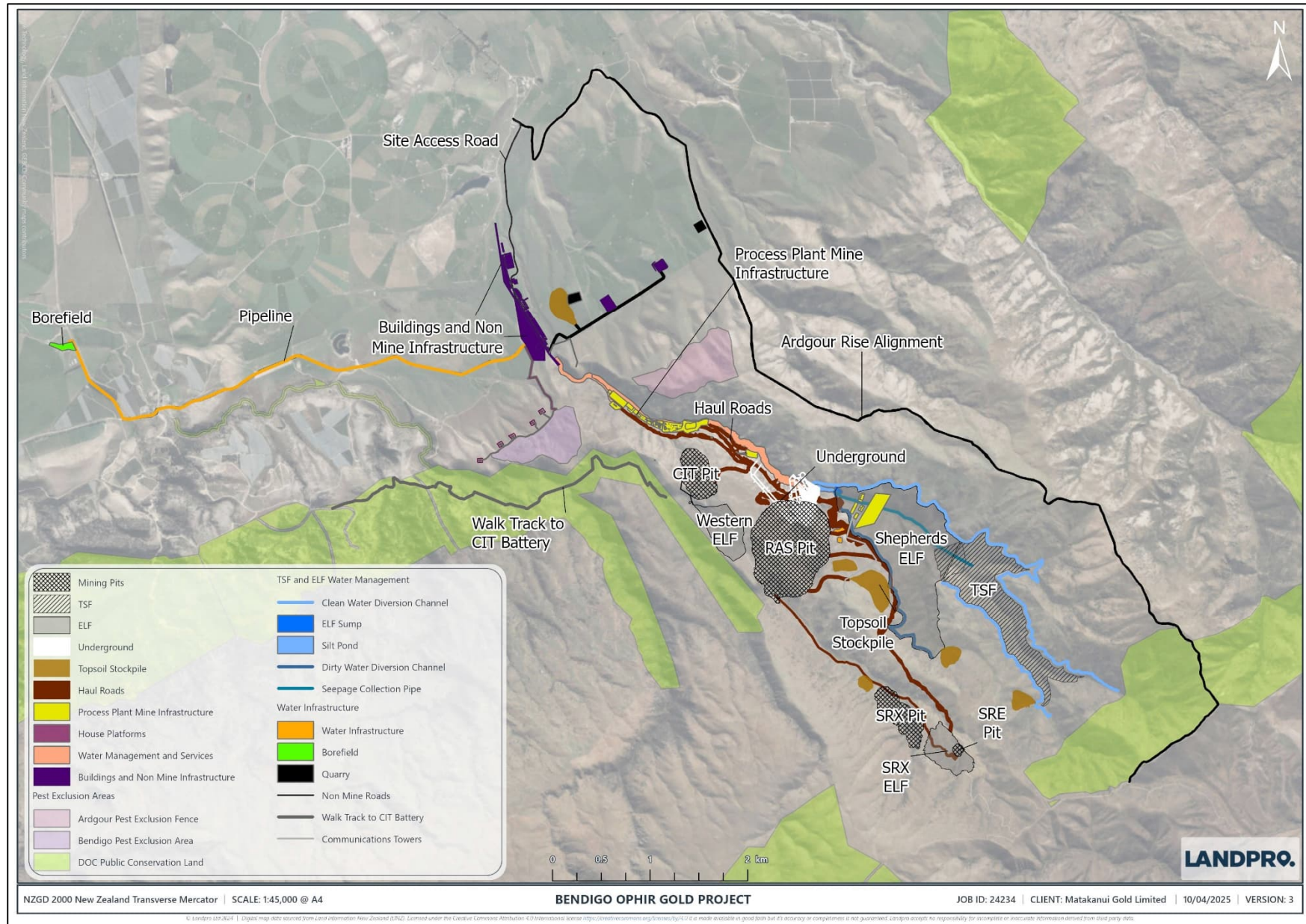


Figure 1. Overview site layout of the Bendigo-Ophir Gold Project. Source: Matakaniui Gold Limited.

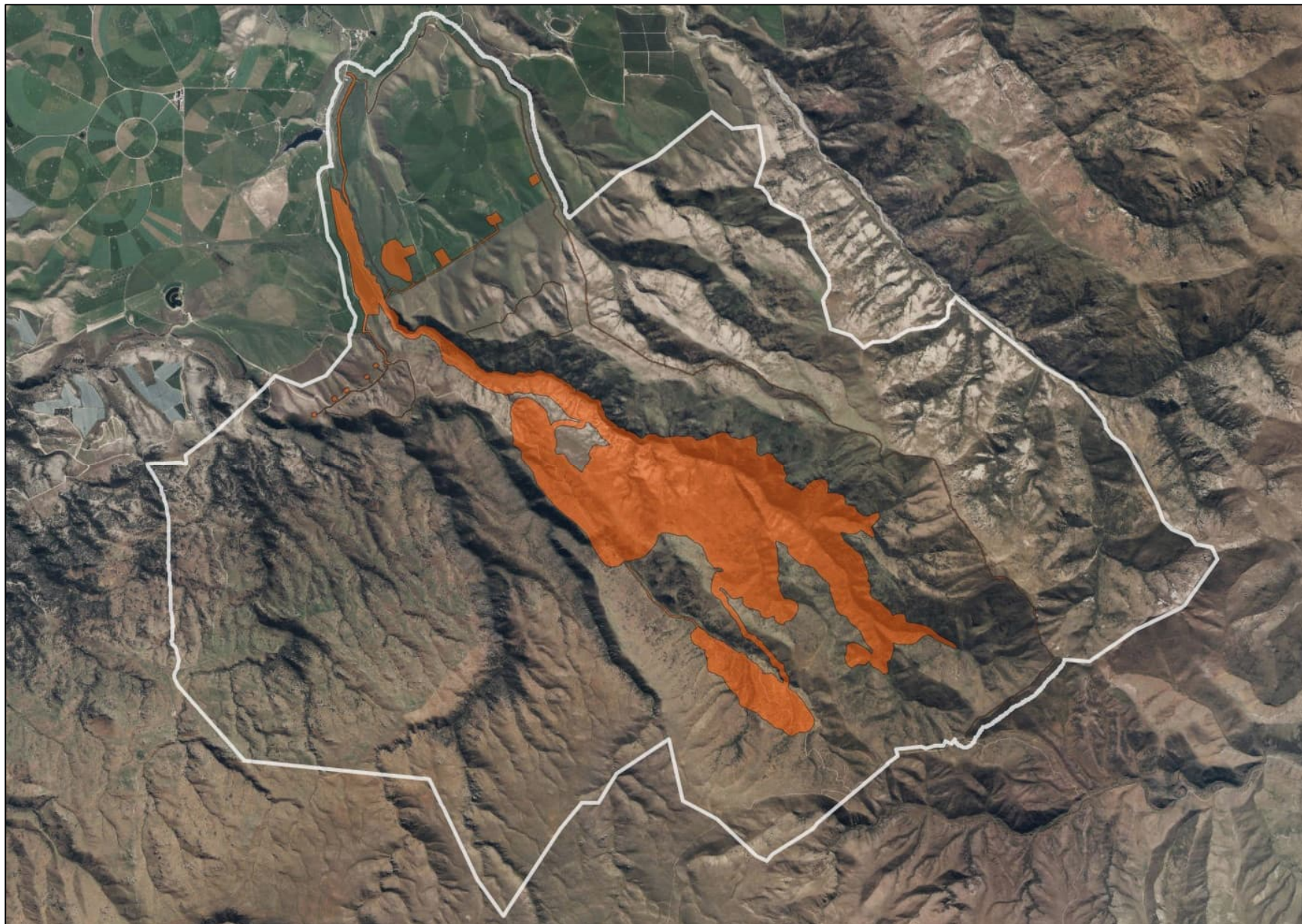


Figure 2. Direct Disturbance Footprint (DDF) (orange polygon) within the Ecological Study Area (ESA) (white border).

1.3 Ecological study area

The ESA covers 5,386 ha (Figure 2). The extent of the ESA was developed to allow for ecological investigations to extend beyond the DDF and in doing so aid understanding of the wider landscape and the relative value of features within the DDF³.

The ESA includes both agricultural and conservation land. It includes a mix of private, leasehold Crown land, and Crown land administered by the Department of Conservation (DOC). The present vegetation communities are a result of environmental conditions as well as disturbances both contemporary and historical, and both natural and human-induced. The terrain has a range in elevation from the Lindis River alluvial terrace at 270 m above sea level (asl) to Mt Moka at 1,222 m asl. The lower elevation vegetation communities are comparably more disturbed than the higher elevation communities, near Thomson Saddle, along the south-eastern edge of the ESA.

The DDF is completely contained within the ESA. The DDF is approximately 610 ha and encompasses the proposed BOGP gold mining and ancillary activity areas⁴, Ardgour Rise (Thomson Gorge Road realignment)⁵, and the construction zone for the proposed predator proof fences⁶. We understand that the DDF has been designed to account for potential minor changes in the DDF over future revisions due to engineering and design alterations, referred to as 'contingency areas'. We have assumed vegetation clearance and / or earthworks will occur in the entirety of the DDF.

In addition to surveys of lizards within the ESA, we also conducted additional manual timed searches for lizards and systematic search for lizards within locations around the Bendigo Loop Road area within or adjoining horticultural, agricultural or road reserve land, and also within low hill country overlooking Lake Dunstan.

1.4 Baseline state

The baseline state is the current state of the site at the time of the ecological field investigations, which took place between October 2023 and January 2025, except for impacts associated with the exploratory phase of the project which include earthworks, vegetation clearance, and the construction of roading and drill platforms, which are also included as the pre-exploratory phase state of the environment as part of our values assessment.

We understand that these effects are addressed as part of the Assessment of Ecological Effects that has been prepared by Alliance Ecology Limited (2025).

³ Note that the spatial extent of the ESA is consistent across the RMA Ecology Ltd values reports (vegetation, wetlands, birds, lizards), but may be different for other values reports as a result of the differing investigative requirements of those reports.

⁴ Shapefile provided to RMA Ecology Ltd by Matakanui Gold Limited on 14 April 2025.

⁵ Shapefile provided to RMA Ecology Ltd by Matakanui Gold Limited on 15 April 2025.

⁶ Shapefile provided to RMA Ecology Ltd by Matakanui Gold Limited on 7 April 2025 (as a polygon for the sanctuary itself). The construction corridor for this fence (5 m width) was advised by Habitat NZ Ltd on 9 March 2025.

1.5 Weather and climatic conditions

The Vegetation Values Assessment report prepared by RMA Ecology Ltd⁷ includes an analysis of weather data from the site and surrounds to understand the degree to which ecological survey data were collected in normal or abnormal conditions.

A summary of that analysis is as follows:

- The temperature during the two survey years (2023, 2024), in which most of the ecological site investigations were conducted, was relatively typical.
- There were three months (January, July, September 2023) that were warmer than the historical average by more than one standard deviation.
- There were also three months (March, May, July 2024) that were cooler than the historical average by one standard deviation. The remaining months were all within one standard deviation of the historical average.
- Precipitation over the same period has generally been within expected levels. However, there were three months that had higher rainfall than the historical average by more than two standard deviations. September 2023 exceeded the historical average by three standard deviations; September 2024 exceeded the historical average by four standard deviations; and October 2024 exceeded the historical average by nearly three standard deviations⁸.
- Because of these precipitation spikes, by September 2024, soil moisture levels were above normal in Central Otago and persisted to the end of November⁹. Although November had less rainfall than average, the soil moisture levels still remained high. Additionally, on 13 September 2024, snow fell at low elevations for inland Otago, and on 26 October 2024, heavy snow fell in the South Island's high elevation terrain¹⁰.
- Overall, the temperature and precipitation in 2024 were generally consistent with long term trends, although there were precipitation spikes in both spring 2023 and spring 2024. The implications of these conditions preceding the field survey are most relevant to annual species which may in part be reliant on particular conditions at certain periods of the year.

The implications of this for lizard populations and for lizard survey are that it reinforces the choices that we made to undertake lizard survey during the November to March period as the period in which most lizards are basking, active, reproductively active, and their foods are also abundant in the landscape. We avoided survey during the months of April – October, although fieldwork undertaken by our teams on other aspects of ecology in April and May still found some lizards active (but most were inactive under refuges).

⁷ RMA Ecology Ltd. June 2025. Bendigo-Ophir Gold Project: Vegetation Values Assessment. Report prepared for Matakanaui Gold Ltd. 101 pages + appendices.

⁸ On 4 October, the Government announced a medium-scale adverse event classification for the Clutha District, after persistently wet conditions over the previous five weeks caused considerable challenges for farmers.

⁹ Regional weather for 2024 from Aotearoa New Zealand Climate Summary; Issued 8 January 2025 (NIWA).

¹⁰ Regional weather for 2024 from Aotearoa New Zealand Climate Summary; Issued 8 January 2025 (NIWA).

2.0 Methods

The methods employed to investigate the lizard communities of the ESA can be categorised into five stages, which were undertaken roughly sequentially:

1. Desktop assessment;
2. Classification and nomenclature;
3. Lizard survey;
4. Data analysis; and
5. Assessment of ecological value and significance.

RMA Ecology herpetologists spent approximately 620 person hours on the ground undertaking searches for lizards across the ESA and associated areas. Many more hours were expended reviewing site photos, drone video, and data collected from the site.

2.1 Desktop assessment

A desktop assessment of the ecological context and known lizard values of the ESA and the surrounding Central Otago Ecological Region was undertaken.

Sources included:

- Historic and present-day aerial images from sources such as Retrolens;
- iNaturalist records;
- DOC's national herpetofauna database 'Herpetofauna' for site-specific records; and
- Journal articles and other publications including tenure review reports.

The conservation status of lizard species was checked against the regional (Jarvie *et al.*, 2025¹¹) and national (Hitchmough *et al.*, 2021¹²) conservation status lists for lizards.

ArcGIS Online and the companion Field Maps Application for use on hand-held mapping devices were used extensively to collect, analyse, and display data.

2.2 Classification and nomenclature

The lizard fauna of the Central Otago region is well studied with threat classification lists prepared for species at a national and regional scale. Division of species complexes have increased the diversity of lizard species recorded in the region. The Bendigo/ Dunstan Mountain area is one of several where geographic boundaries between species within complexes have been drawn, although site-specific study of morphotypes or genetically distinct assemblages is limited to a few areas.

¹¹ Jarvie, S., Knox, C., Monks, J.M., Purdie, S., Reardon, J., Campbell, C. (2025). Regional conservation status of reptile species in Otago. Otago Regional Council, Otago Threat Classification Series, 2025/3

¹² Rod Hitchmough, Ben Barr, Carey Knox, Marieke Lettink, Joanne M. Monks, Geoff B. Patterson, James T. Reardon, Dylan van Winkel, Jeremy Rolfe and Pascale Michel. 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35.

Based on the regional lists and provisional mapping of lizard distributions in the Bendigo/ Dunstan Range area, the species that could be present at the site include those listed in Table 1.

For two groups of similar species amongst those listed in Table 1, we have adhered to current convention and adopted the naming and divisions between similar species advocated in recent literature.

These are:

1. For the common skink complex, we have followed the division proposed by Jewell 2022¹³, which separates common skink Clade 5 in the northern part of its range from the tussock skink in the southern part. The proposed zone of contact between the species is located just north of the study site. We have adopted the precautionary approach also adopted by Jarvie *et al.* 2025 that the two morphological groups could represent different species, and have followed the descriptions of morphological characteristics listed in Jewell 2022 when assessing 'common skinks' caught for this investigation.

We checked species caught on site against morphological characteristics listed by Jewell 2022 and concluded that all 'common' skinks within the ESA and DDF are tussock skinks.

2. For the common gecko complex (*Hoplodactylus maculatus*) group we have followed the recognised divisions into schist gecko, Kawerau gecko and korero gecko, and used the dichotomous keys in Jewell 2006¹⁴, the descriptions provided in Winkel *et al.* 2018¹⁵, and the descriptions and keys provided in Purdie 2022¹⁶. Updated morphological differences published on the Herpetological Society of New Zealand web pages¹⁷ were also used.

When resolving the identification of geckos in the field, we used the primary characteristics of canthal stripe and distal phalanges to confirm species identity, together with eye colour, tongue colour and rostral scale interaction with the nasal cavity. We checked species caught in low and high altitudes, and across the approx. 15 km width of the ESA and surrounding areas sampled. All specimens of ground dwelling 'common gecko' found were Kawerau gecko.

The Dunstan Mountain area potentially supports several species of *Oligosoma* skink that are of similar habit, habitat use, size and colouration. We paid particular attention to accurately discriminating between potentially similar species, including Nevis skink, tussock skink, southern grass skink, and McCann's skink.

Resolving differences between tussock skink and southern grass skink in the field was extremely difficult based on morphometrics alone, and we elected to defer to the distributional maps which show the Bendigo area well within the known range of tussock skink, with southern grass skink restricted to locations well to the north of the site.

Accurately distinguishing between tussock skink and McCann's skink was also challenging for some specimens, as the characteristics usually used to diagnose between the species intergrade in this location. This is a well-known issue for the Central Otago area¹⁸, and on this site the level of conformity to dorsal patterning, chin speckling, lateral stripe colouration and distinctiveness, and the how faithful the occurrence of supraorbital scales touching the front-parietal scale, made some identifications difficult. Where there was

¹³ Jewell T. 2022. Discovery of an abrupt contact zone supports recognition of a new species of grass skink in southern New Zealand. Jewell publications: occasional publication #2022B, pages 10-16.

¹⁴ Jewell T. 2006. Identifying geckos in Otago. Published by Science and Technical Publishing, Department of Conservation, Wellington 60 pp.

¹⁵ Winkel D, Baling M, and Hitchmough R. 2018. Reptiles and amphibians of New Zealand: a field guide. Auckland University Press.

¹⁶ Pudie, S. 2022. A naturalist's guide to the reptiles and amphibians of New Zealand. John Beaufoy Publishing. 176 pp.

¹⁷ <https://www.reptiles.org.nz/herpetofauna/native/complex/woodworthia>

¹⁸ Tocher M and Reardon JT. 2003. Diagnostic morphometrics of the skink species, *Oligosoma maccanni* and *O. nigriplantare polychroma* from South Island, New Zealand. DOC Science internal series 105.

doubt, we classified a specimen based on the predominance of features found that are typical of that species. However, for most tussock skinks, the presence of a pale-yellow belly and marked dorsal chocolate-coloured stripes was readily diagnostic.

Table 1. Lizard species known from the Central Otago area, and their likelihood of presence within the ESA and DDF for this project.

2.3 Lizard survey

2.3.1 Design

The ESA contains a mosaic of vegetation communities which are associated with botanical values and histories of land use, in particular farming and historic mining. The seven vegetation communities¹⁹ identified in the botanical assessment for this project were used as the primary basis for designing the lizard survey programme. The key features discriminating vegetation types are typically structural complexity (tiers/height), and indigenous dominance/ diversity, which are also the key factors that others have found determines abundance for common Otago skinks²⁰.

Within each of the vegetation types, several central sampling locations were located as the primary design for lizard sampling. The locations were obtained by placing a 800 m x 800 m grid over the ESA and wider landscape, identifying the central points (centroids) of the 800 m x 800 m grid squares, and selecting centroids within the general area of the DDF (as it was known at preliminary design stage at that time) and companion sites outside of the DDF on Bendigo and Ardgour Stations adjoining the site, as well as ensuring that a range of low, medium and higher altitudes were also sampled. This provided a master set of 20 centroids that represented the vegetation types, gross altitudinal range, and within and outside of the general area of the DDF (see Figure 3).

The resulting centroid points formed the basis for systematic lizard survey areas. At each centroid, Artificial Cover Objects (ACOs) were laid out on the corners of a 10 m x 10 m square set with the centroid at its centre, and then additional ACOs laid out 10 m from those ACOs in a north, east, south, west direction to give a 'cross' arrangement (8 ACOs in total; systematically placed ACOs; see Figure 4). An additional 12 ACOs were laid out in groups of three (i.e. four clusters; 'satellite ACOs'; see yellow dots on Figure 4) within 200 m of the centroid within deliberately selected locations that supported complex habitat, such as rock tors, screes, or dense understorey shrubland, such as to target our perception of 'best locally available' lizard habitat (selectively placed ACOs). The centroids also formed part of the overall set of manual timed searches undertaken across the DDF and ESA.

The placement of individual ACOs within vegetation types and the representativeness of this sampling across the vegetation types mapped in the DDF and ESA is presented in Table 2. Large parts of the ESA and DDF comprise a complex mosaic of vegetation types, which means that the vegetation type at a centroid location may be different to that encountered where satellite ACOs are placed, especially those under the systematic placement method.

¹⁹ See RMA Ecology Ltd. June 2025. Bendigo-Ophir Gold Project: Vegetation Values Assessment. Report prepared for Matakau Gold Ltd. 101 pages + appendices.

²⁰ Walker, S., Wilson, D. J., Norbury, G., Monks, A., & Tanentzap, A. J. (2014). Effects of secondary shrublands on bird, lizard and invertebrate faunas in a dryland landscape. *New Zealand Journal of Ecology*. 38: (2) 242-256.

Table 2. Placement of Artificial Cover Objects (ACOs) within vegetation types, as determined by systematic means (randomised), and by selective means (purposeful micro-placement). ACOs were not placed in wetlands; however, we placed in tussock areas surrounding wetlands and on margins in vegetation types surrounding wetlands.

Vegetation type	Area of vegetation type within DDF (ha) (% of total area)	No. ACOs placed in vegetation type in ESA and DDF		% ACOs placed in vegetation type	
		Systematic	Selective	Systematic	Selective
Exotic pasture or herbfield	79.3 (13.0 %)	0	3	0	1.3
Mixed depleted herbfield (cushionfield) and grassland	103.8 (17.0 %)	27	52	16.9	21.7
Mixed tussock shrubland and exotic grassland	187.4 (30.7 %)	52	72	32.5	30
Mixed scrubland	124.1 (20.1 %)	31	46	19.4	19.2
Native dominant tussockland	25.3 (4.2 %)	26	37	16.3	15.4
Native herbfield and shrubland	1.9 (0.3 %)	12	21	7.5	8.8
Native dominant scrubland	85.6 (14.0 %)	12	9	7.5	3.8
Wetlands	3.13 (0.5 %) (DDF) 2.37 (0.4 %) (DDZ)	nil	nil	nil	nil
Total	610 ha	160 ACOs	240 ACOs	100 %	100 %

A secondary basis for the lizard survey design was the presence of local (c.f. landscape) scale features that may have held habitats that favoured the local persistence of lizard species.

These included:

- Rock tors;
- Rock screes/ rocklands;
- Valley bottoms that support dense low tussock, shrubland or lightly graze rank pasture; and
- Dense native shrubland within native dominated shrubland mosaics.

At those locations timed searches were undertaken, and Gee's minnow and pitfall live trapping were installed on five transects (traps set 20 m apart along a transect line).

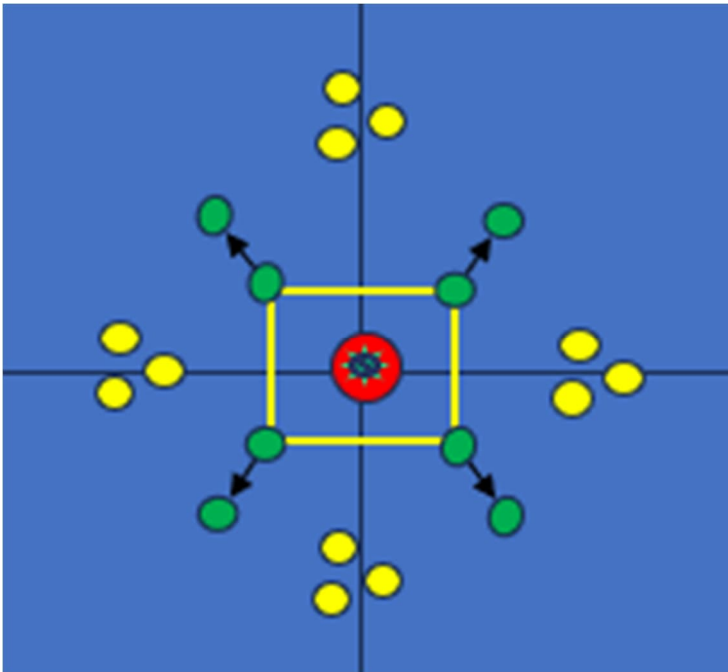


Figure 4. Illustration of a centroid (red circle) with ACOs laid out around it (green dots; distance between pairs is 10 m)) as systematically set out ACO sampling points, and satellite ACO clusters (yellow dots) as selective sampling locations within best locally available lizard habitat within 200 m of the centroid.

In addition, large rock tors were selected within the DDF (all that were available, as occurrence was few within the DDF) and outside of the DDF (more abundant on the Bendigo Station side of the site) as search locations for large bodied skinks. Methods of searching included visual search for basking lizards using Steiner Observer 10 x 42 binoculars, and by examination of potential basking crevices and platforms with a Mavic 3 Pro drone with 28x zoom that allowed video and still images of excellent quality from several hundred meters distance.

Arboreal geckos were searched for within the densest areas of shrubland – containing divaricating species if available – that were available within the DDF (few) and surrounding ESA (greater number). All shrubland areas in and around the site are young, and most of the oldest shrubland is associated with tor systems in gullies.

Therefore, many of the best areas to search for large bodied skinks in creviced rock systems, and arboreal geckos in shrubland systems, were gully systems rather than valley sides, spurs or ridges, which typically supported no or very young or sparse native woody vegetation.

2.3.2 Methods

Table 3 summarises the vegetation and habitat types that were the focus of the lizard survey with the target species and methods used in each location. Some lizards in dryland Otago locations are ubiquitous (e.g. McCann's skink and geckos of the common gecko complex), so our survey programme instead focussed on assessing potential differences between habitats for these assumed ubiquitous species, as well as determining whether other species that are less common regionally, and which have a higher threat classification, may have also been present.

These 'less common' species included lakes skink, jewelled gecko, Otago skink, Nevis skink, and grand skink, given that potential habitat exists for all of these species within the DDF and the ESA.

Table 3. Vegetation communities and habitat types that were surveyed for lizards in the DDF and ESA.

Vegetation and habitat types surveyed	Target species	Survey methods used
Vegetation types in general: • Exotic pasture or herbfield • Mixed depleted herbfield (cushionfield) and grassland • Mixed tussock shrubland and exotic grassland • Mixed scrubland • Native dominant tussockland • Native herbfield and shrubland • Native dominant scrubland	McCann's Skink Kowarau Gecko Nevis Skink Tussock skink	ACO clusters; Visual encounter slow walk transect; Timed search visual encounter (crevice search, cover object lifting, counts of active lizards).
Rock tors	Jewelled Gecko Grand Skink Otago Skink Kowarau Gecko	ACO clusters; crevice searches; drone survey.
Valley bottom dense tussock/ ground vegetation	Lakes Skink	Live capture pitfall trap; Live capture Gee's minnow trap; Visual encounter slow walk transect; Timed search visual encounter (crevice search, cover object lifting, counts of active lizards).
Rock screes	Lakes Skink	Live capture pitfall trap; Live capture Gee's minnow trap; Visual encounter slow walk transect; Timed search visual encounter (crevice search, cover object lifting, counts of active lizards).
Dense native shrubland/ divaricating shrubland	Jewelled Gecko	Slow walk/ transect search daytime visual encounter foliage search; Basking search with binoculars; Basking search with drone.

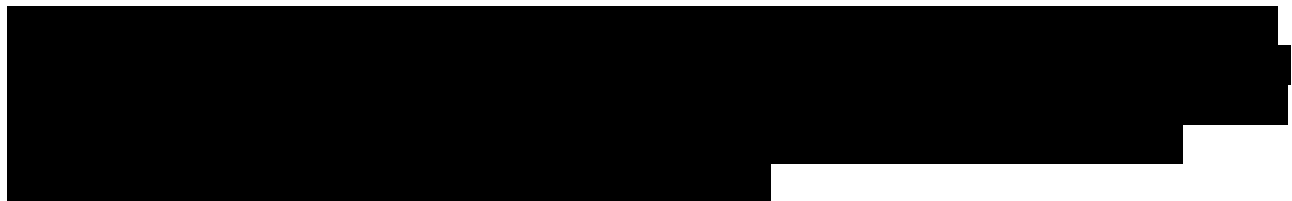
Multiple methods were employed to survey lizards (and any incidental sightings of frogs) throughout the DDF, and across comparable, representative, areas of the surrounding ESA, including the use of active and passive methods during late spring 2023, summer 2024, autumn 2024, and spring 2024.

A description of the application of these methods is provided in Table 4, with locations where each method was applied illustrated in Figures 3, 4 and 5. Representative photos of survey methods are provided in Plates 1-6. Representative photographs of each habitat and vegetation type are included in the Results section of this report.

Table 4. Methods used for the survey of lizards within the DDF and ESA.

Method	Description	Sampling intensity	Sampling season
Artificial Cover Objects (ACOs):	Installed on site December 2023. 20 x centroid sites at which 20 x ACOs installed as 8 x ACOs at systematic placement and 12 ACOs at selective placement Each ACO is a 400 mm x 350 mm square of Onduline, triple stacked with spacers.	400 Onduline triple stacks (20 ACOs x 20 centroid sites) across DDF and ESA checked twice during each sampling season	summer (Feb) and spring 2024
Pitfall trapping	4 L plastic pail buried to lip with ACO cover over top; traps set for 4 nights	5 transect lines, each with 20 traps	summer 2024
Gee minnow funnel traps	3 mm gauge mesh size metal funnel trap with modified entrances for lizards.	5 transect lines, each with 4 traps	summer 2024
Arboreal gecko basking daytime search	6 ca. 1 ha sites by binocular search and foliage search,	Searched once a day over two days (i.e. each area searched twice)	summer 2024
Drone aerial survey of tors	12 large tors within the DDF and nearby to detect basking skinks in	Searched once in sunny conditions in morning/ when sun was shining on tors	spring 2024
Tor/rock area large skink basking survey	6 aggregate sites surveyed by binoculars	Each tor searched on foot twice	summer 2024
Manual timed search	Ca 0.4 ha blocks within vegetation types searched– visual search for active lizards, cover object lifting, crevice searches.	79 sites spread across the DDF, Ardgour Station and Bendigo Station. Each area searched once.	Searches spread over summer 2024, spring 2024, and summer 2025

For Otago and grand skinks, where the survey method relied upon visual assessment of potential basking areas, and inspection of refuge crevices, it was important to establish that the timing of the surveys was within the 'active seasonal period' for those species.



That gave us confidence that the results obtained from the DDF and ESA study areas would be more likely to reflect actual presence (or absence) of Otago and grand skinks, rather than climatic conditions potentially unfavourable for animal activity.



Plates 1-4. Methods used for the survey of lizards. Artificial Cover Object (ACO) triple stack in grassland (top left) and on a rock tor (top right). Gee's minnow trap set amongst exotic shrubland (bottom left). Pitfall trap with single ACO cover (bottom right).



Plates 5-6. Methods used for the survey of lizards. Mavic 3 Pro drone showing flight tracks (yellow) and target tors (green circles (left), and a typical still picture from drone survey of basking lizard sites (right; photo taken from 100 m away using live zoom feature).

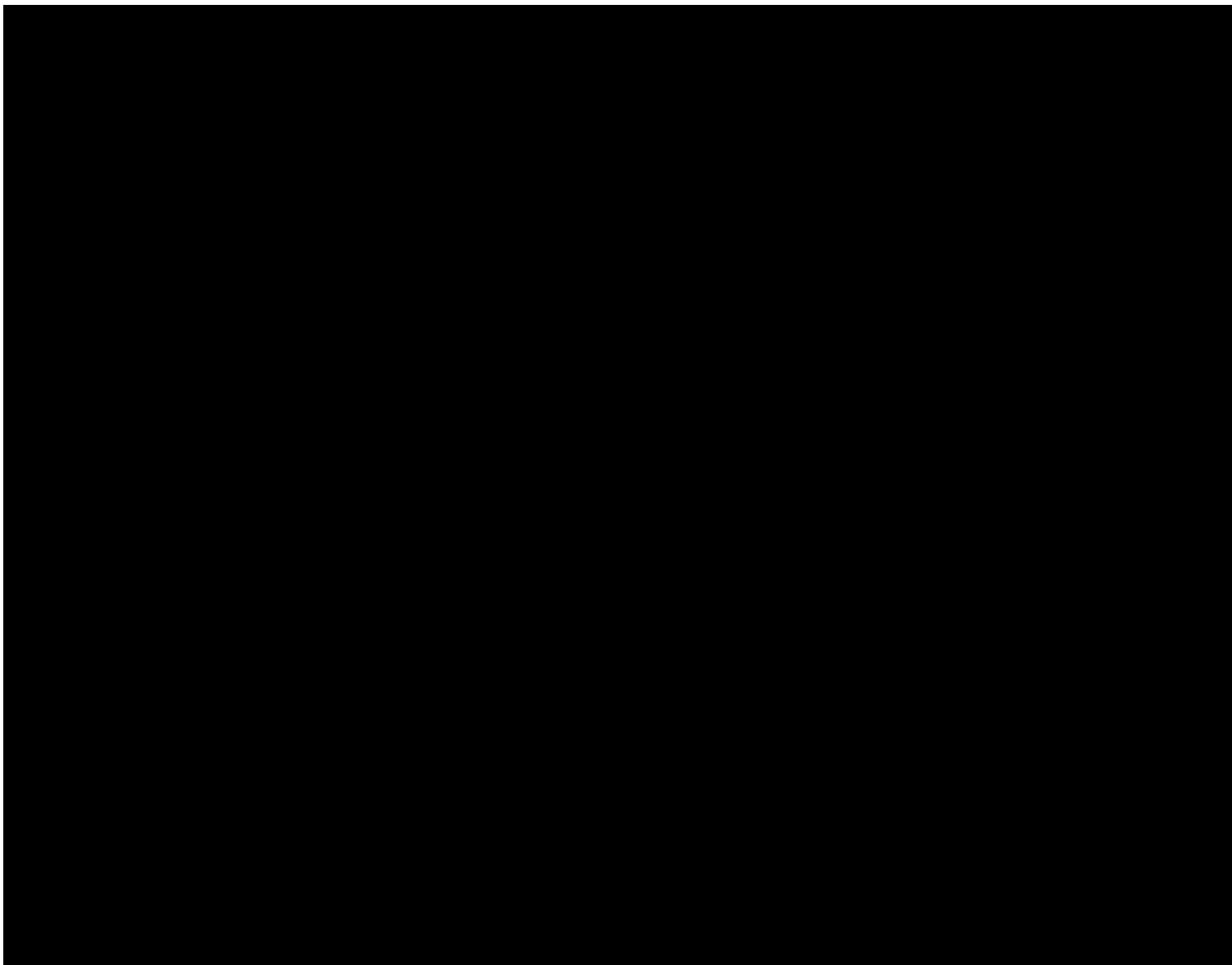
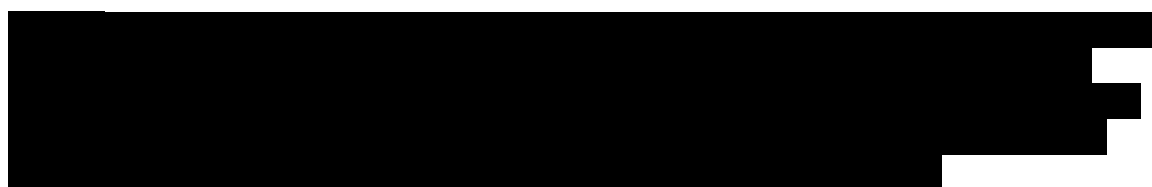
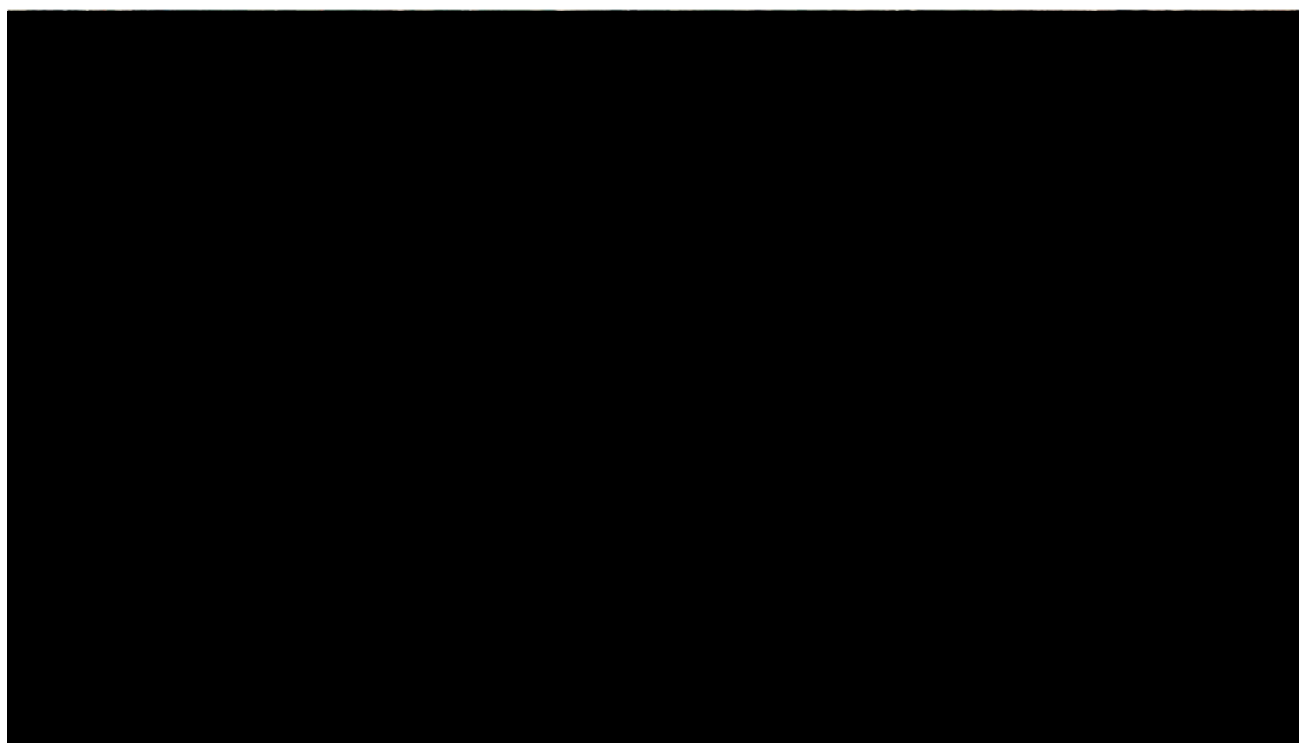
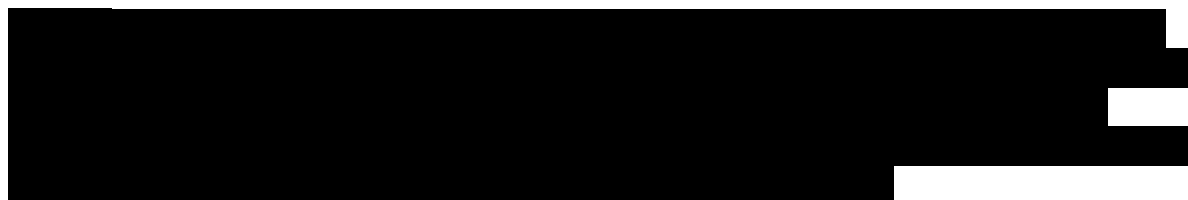




Figure 5. Example layout of ACOs using the centroid point as the anchor location (marked as the turquoise star numbered 14A on this figure). At each centroid, 20 triple stacked ACOs were deployed, with eight being laid out at 10 m intervals from the centroid point on north, east, south, west bearings (to form a cross), and the other 12 set as four groups of three ACOs within the most complex available habitat close to the centroid (e.g. mixed scrub/ long grass or rock tor).

Frogs were not specifically targeted during the surveys, although individuals were noted if found. No native frogs were expected on the site as none are present in the wild in the South Island. Exotic lizards were also not specifically surveyed for, although the only naturalised species in New Zealand is the plague skink (*Lampropholis delicata*) which prefers dry, hot environments within exactly the type of environments that we were surveying. We would have detected plague skinks if they were established at this site.

In addition to the sites surveyed within the ESA and DDF, several nearby areas were also assessed for lizards to add a broader context to the site-specific survey results.



2.4 Lizard handling and data collection

All lizard work on the site was undertaken by personnel experienced in the handling of native lizards. Handling of lizards was necessary to confirm species identification, and for ACO and pitfall trap monitoring, to obtain body measurements. Handling protocols followed best practice in terms of safe handling, temporary confinement during processing, and release back to individual capture sites.

Data collected from individual animals included:

- Species
- Gender
- Snout-vent length
- Tail length
- Regenerated tail (if any)
- Life stage (juvenile, sub-adult, adult)
- For ACO captured animals, individuals were marked with a non-toxic marker pen to ensure rapid identification on repeat capture.

Reporting to the Department of Conservation on the numbers and species of lizards caught and handled from this survey has been undertaken by Matakanui Gold Ltd in accordance with the requirements of Wildlife Act Authority 108620-FAU.

2.5 Assessment of ecological value and significance

The ecological value of the DDF for lizards was assessed based on whether lizard species were present or not present and the threat status of species present within that location. Species with a higher threat status qualified an area for a higher value, with categories nil (no native lizards), Low (only Not Threatened species present), Moderate (uncommon or distinctive species), High (Nationally At Risk species) and Very High (Nationally Threatened species).

Habitat quality for native lizards was assigned to parts of the site based on the complexity of habitats present, and the relative abundance of lizards detected from this survey, with categories assigned as Low, Moderate, High and Very High habitat value.

Ecological significance was assessed against the set of criteria listed in the operative and proposed Otago Regional Council Regional Policy Statement.

2.6 Wildlife Act Authority

All survey for, and handling of, native lizards for this values assessment was undertaken under Wildlife Act Authority 108620-FAU granted to Matakanui Gold Ltd, and under named personnel Dr Matt Baber or other suitably qualified personnel under the supervision of Dr Baber.

The work undertaken for this survey was supervised by Dr Baber, and was undertaken by Dr Graham Ussher and experienced staff at RMA Ecology Ltd under the direct supervision of Dr Ussher. Dr Ussher has 35 years experience with native lizards in New Zealand and currently holds approx. 15 Wildlife Act Authorities for the survey or salvage/ relocation of native lizards across New Zealand.

3.0 Results

3.1 Summary of results

Three species of native lizards were recorded in the ESA – Kawerau gecko, McCann's skink, and tussock skink. The same lizard species were found within the DDF as were found from surveys elsewhere within the ESA, including other parts of Ardgour station and Bendigo station, and within Bendigo Scenic Reserve and Bendigo Historic Reserve and nearby. No frogs or exotic lizards were detected within or adjoining the DDF, or within areas searched for lizards within the wider ESA.

The extent of distribution and relative abundance across the DDF was: McCann's skink (Nationally and Regionally Not Threatened; abundant), Kawerau gecko (Nationally and Regionally At Risk; common) and tussock skink (Nationally and Regionally At Risk; sparse). No other species of native lizard were detected from the surveys, including other species of native gecko, or species of cryptic or large native skink, despite methods and considerable search effort specifically applied to detect these species.

Lizard values within the DDF are high for Kawerau gecko and tussock skink, and low for McCann's skink, while habitat quality for these species varies from poor quality to very high quality, driven largely by structural complexity (e.g. tors) and the diversity of low-growing plant communities (e.g. cushionfield or mixed tussock/ taramea herbfield). The presence of Kawerau gecko and tussock skink qualify the DDF and the SL as significant habitat of indigenous fauna in the operative Otago Regional Policy Statement (RPS) and the proposed RPS.

Comprehensive survey was undertaken for cryptic, large-bodied or very rare lizard species, including green skink, jewelled gecko, Otago skink, Nevis skink, and grand skink. None of these species were detected, despite multiple methods being applied, and multiple visits within seasons and between seasons. From this, we conclude that neither the DDF, nor other parts of Ardgour or Bendigo Stations extensively surveyed, support Otago skink, grand skink, Nevis skink, green skink, or jewelled gecko.

Relative abundance of lizards - as measured through catch per unit effort for ACOs and unit effort manual searches – varied between species and vegetation communities. General patterns noted – and which are supported by multiple lines of evidence including replicated searches, traplines, and other methods - include:

- McCann's skink is the most widely distributed lizard within the DDF and occupies all vegetation communities (including closely grazed exotic pasture). Abundances were greatest within taramea communities and where mixed shrubland was sparse and included rank grassland or rockland.
- Kawerau gecko is also widely distributed within the DDF and occupies all vegetation communities. Numbers can be locally very abundant where rock exists in scattered piles or tors, with noticeably fewer individuals found in communities that lack rock crevices or other suitable refuges.
- Tussock skink was found within most vegetation types within the DDF, but at low abundance relative to other species. Tussock skink captures were greatest in valley bottoms and other

places where ground cover and moisture were most likely to persist over the summer months.

- The impact of introduced mammalian predators on native lizards is highlighted by the occurrence of native lizards in the diets of feral cats and ferrets (tussock skink and McCann's skink), and hedgehogs (McCann's skink), as reported in the Mammalian Pest Survey report for this project²¹.
- The proportion of lizards that had lost tails and regrown them can be used as an indicator of predator pressure²². All captured lizards from ACOs were assessed for regenerating tails. Tail regeneration occurrence was: McCann's skink 25.7 %; tussock skink 22.6 %; Kawerau gecko 25.2 %. Tail loss (and regeneration) for Kawerau geckos recorded in the ESA from these investigations is similar to the rate of tail loss recorded for a similar species of gecko studied at Alexandra in the presence of uncontrolled introduced predators (23.8 %)²³. This suggests that geckos (if not also skinks) within the ESA and DDF are experiencing pressure from uncontrolled levels of introduced mammalian predators.
- Methods used to survey lizards are not suitable for accurately estimating abundance within the DDF; however, based on our time on site and the results of the various methods employed, our coarse estimate of abundance of lizard species within the DDF is:
 - o McCann's skink low 100,000s
 - o Tussock skink low 1,000s
 - o Kawerau gecko High 10,000s

Numbers of these native lizards in the ESA are likely to be proportional to the additional area of the ESA – that is, around 10 x greater. Numbers in the surrounding landscape outside of the ESA, within less disturbed non-agricultural or horticultural areas of the Dunstan Mountains are likely to be hundreds of times greater than the numbers estimated within the DDF, simply because there is similar or better quality habitat available outside of the ESA, and the density of native lizards is assumed to be similar.

3.2 Ecological context

The following descriptions of the local environment and the vegetation units within the ESA and DDF have been sourced from the vegetation values assessment report prepared by RMA Ecology²⁴, with that text edited for conciseness, and notes added, where relevant, regarding native lizards. A more fulsome description of the vegetation history and current vegetation types, including citations, is provided in the Vegetation Values Assessment report.

²¹ Habitat NZ Ltd. (2025). Bendigo-Ophir Gold Project: Mammalian Pest Survey. Habitat NZ Ltd, Auckland. 55 Pages.

²² Turner and Norbury, 2023. Population responses of common lizards inside a predator-free dryland sanctuary. New Zealand Journal of Zoology 47 (1) 1-6

²³ Ibid

²⁴ RMA Ecology Ltd. June 2025. Bendigo-Ophir Gold Project: Vegetation Values Assessment. Report prepared for Matakanui Gold Ltd. 103 pages + appendices.

3.2.1 Central Otago environment

The project area is located on the northwestern side of the Dunstan Mountains and is generally northwest facing (i.e., highly exposed to drying influences) and lies between 400 and 800 m elevation. The underlying geology comprises variably schistose quartzofeldspathic sandstones and related rocks of the Rakaia Terrane, which generates exposed rock outcrops (tors) with high levels of segregation resulting in crevice formation and abundant surface schist slabs that offer refuge for lizards.

The climate of the Dunstan Mountains is semi-continental, characterized by relatively low precipitation, warm summers and cold winters.

3.2.2 Central Otago vegetation

The current vegetation of Central Otago, and the Dunstan Mountains in particular, is very different to what would have been present in the past.

For most of the project area, Hall's tōtara, mountain celery pine, and bog pine (*Halocarpus bidwillii*) would have been important forest species prior to human settlement, with kāpuka (*Griselinia littoralis*) and mountain fivefinger (*Pseudopanax colensoi*) probably common. Local stands of matai and other tall podocarps may have occurred in deep gullies, as well as on fertile fans and talus slopes given its relative drought-tolerance. Kōwhai (*Sophora microphylla*) probably occupied bluffs, cliffs, stream banks, and lakeshores.

These kōwhai dominated forests appear to have included several shrub and liane species, many of which are still locally common. *Kunzea* spp. and tūmatakuru / matagouri (*Discaria toumatou*), which are common today, are rare in historical records. Some researchers argue that the spread of these shrubs (and mānuka (*Leptospermum scoparium*)) and the formation of prolific 'grey scrub' is a consequence of disturbances associated with human settlement.

There is some evidence to suggest that grassland may have been part of a mosaic of woody and non-woody communities in the pre-human vegetation, especially on valley floors and lower elevation hill slopes. The present-day persistence of spring annual herbs provides significant evidence that the forest canopy was never complete. These herbs tend to require disturbed and open habitats. These open habitats could have been induced and maintained by infrequent fire events, pre-human avifaunal disturbance, patchiness of habitat substrate such as rocky outcrops or saline soils, or other geomorphological or climatic disturbance regimes.

It seems likely that the pre-human vegetation was heterogeneous with species composition driven by microsite, elevation, aspect and disturbance. This vegetation would have included closed-canopy forest, woodland, shrubland, wetland, and open dry sites (including areas where spring-annuals could persist). *Kunzea* spp. were likely a minor component of the pre-human vegetation, while other common species today (such as in the genera *Coprosma* and *Olearia*) were likely a secondary component of these pre-human woody communities.

The mosaic nature of the vegetation communities and geology would have provided a range of micro-climatic conditions and structural complexity (e.g. woody arboreal habitats) that favoured, or at least would have supported, species with saxicolous preferences, arboreal species (e.g. jewelled gecko) and heliophilous species such as the day-active skinks.

3.2.3 Changes in vegetation with human settlement

The charcoal record tells of unprecedented and repeated burning throughout the period of Māori occupation, which would have resulted in the rapid depletion of woody vegetation. Periods of regeneration would have been further set back by fire, with woody vegetation quickly restricted to fire-free refugia. At the same time, tall tussock grassland expanded downslope from higher elevations, while short tussocks and a range of other herbaceous species would have also greatly expanded their ranges in lower, drier environments cleared of fire-sensitive woody species.

The sum change to vegetation communities from burning, grazing, rabbits, and stock has resulted in severe contraction of woody vegetation habitats for lizards (such as those for arboreal geckos), and probably emphasised the importance of rocky tor systems as fire and stock refuges for ground-dwelling geckos and skinks.

During the 1850s, gold miners removed remaining wood for fuel and structures, and then a rapid 'cleaning out' of palatable species occurred alongside further retraction of fire-sensitive species as European sheep farming began.

The continued presence of rabbits and sheep meant that plant stature recovered only slowly, if at all, protracting desertification. Repeated rabbit plagues and resultant cushionfields were widespread below about 700 m through much of the twentieth century.

Extensive oversowing and topdressing, mainly by aircraft, commenced after WW2, along with more fencing and associated differentiation of land use by blocks. It is likely that cover of exotic grasses, clovers and (inadvertently) also shrubs were able to be increased on darker (moister) faces, creating vegetation less suitable for rabbits.

However, on sunny, NW-facing drought-prone slopes the replacement of cushionfield with sward grasses was slower and less certain, probably dictated by year-to-year variations in weather, rabbits, merino stocking rates, concurrently waves of annual and herbaceous weeds (including viper's bugloss (*Echium vulgare*), sheep's sorrell (*Rumex acetosella*), St John's wort (*Hypericum perforatum*), and thistles) have boomed at times and then settled back again. More recently, the introduction of cattle has severely damaged the wetlands and streambeds they prefer, collapsing stream banks, and opening shrublands, especially on gentler relief.

The earliest available aerial imagery of the site and its surrounds from 1958 shows woody vegetation mostly confined to steep-sided gullies, although sporadic shrubs elsewhere likely played an important part in the increase in woody cover that followed to present. Therefore, the oldest stands of woody vegetation are at least 70 years old.

In recent decades there has been some expansion of native vegetation including woody elements in some areas. Some of this is likely due to changing grazing management including retirement of areas from grazing (e.g., through tenure review) or changing stock type or timing of grazing. In the project area notable examples include the expansion of *Kunzea serotina* shrubland in Bendigo Scenic Reserve and the expansion of *Olearia-Coprosma*-tūmatakuru / matagouri shrubland across Ardgour Station and elsewhere in the Lindis Valley.

It is very likely that the current distribution of lizards on the site represents an expansion of novel habitats that have formed since regular burning ceased and since tussock, woody vegetation, cushionfields and low-growing native shrublands have expanded across the site.

3.2.4 Vegetation communities

Seven vegetation communities have been identified across the ESA (Table 5; Figures 7 and 8). A brief description of these is provided below, both to clearly explain the basis for vegetation classification, and to describe the key botanical elements of each vegetation type – as this is central to the capacity of parts of the site to provide habitat for native skinks and geckos, both by providing fruits and insect as food, and for providing structural complexity for refuges for lizards. This is important, as it is well established through casual observation and through studies in Otago that communities with a greater complexity of vegetation types, and physical complexity – for example through rock availability and gradient types – support a greater diversity and abundance of native lizards.

Throughout most of the DDF, several of these communities form a complex mosaic such that discriminating clear boundaries between communities is not feasible.

Instead, nominal boundaries are illustrated for the purpose of mapping and estimating areas of each.

Table 5. Area of each vegetation community within the ESA and DDF. Wetland areas also include the distinction between the DDF and the DDZ.

Vegetation community	Area within ESA (ha)	Proportion within ESA	Area within DDF (ha)	Proportion within DDF
Exotic pasture or herbfield	1147.21	21.30 %	79.31	12.99 %
Mixed depleted herbfield (cushionfield) and grassland	552.69	10.26 %	103.82	17.01 %
Mixed tussock shrubland and exotic grassland	1391.53	25.84 %	187.44	30.71 %
Mixed scrubland	457.41	8.49 %	124.09	20.33 %
Native dominant tussockland	1025.54	19.04 %	25.33	4.15 %
Native herbfield and shrubland	161.60	3.00 %	1.86	0.30 %
Native dominant scrubland	638.60	11.86 %	85.62	14.03 %
Wetlands	11.30 ²⁵	0.21 %	3.13 (DDF)	0.51 % (DDF)
			2.37 (DDZ)	0.39 % (DDZ)
Total	5385.88	100.00 %	610.60 ²⁶	100.00 %

²⁵ Note that wetlands were not comprehensively mapped within the entire ESA and that this figure represents only the mapped wetlands.

²⁶ The total DDF is 610.59 ha. The minor inconsistency here is due to rounding error.

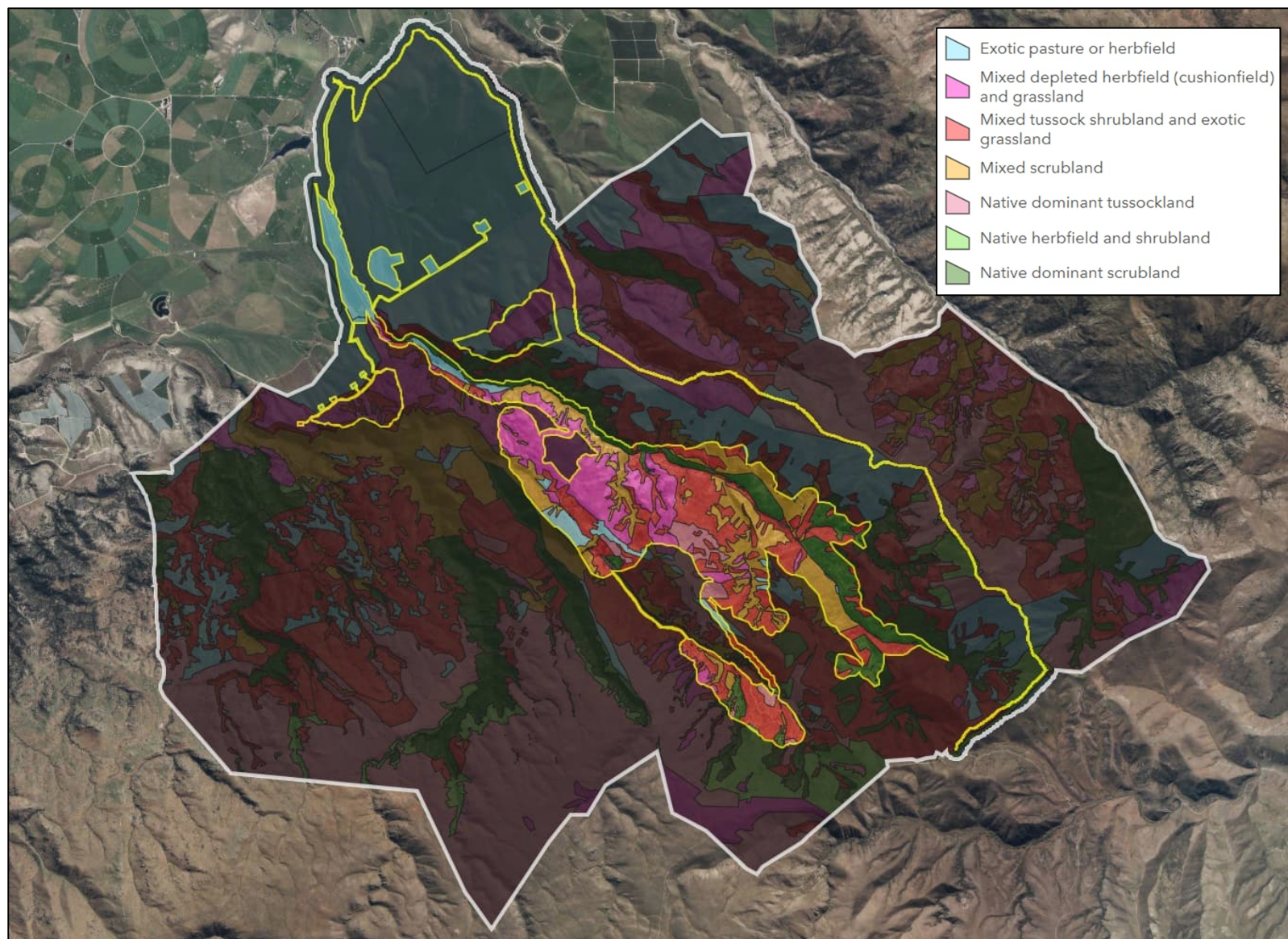


Figure 7. Vegetation communities within the DDF (yellow border). The ESA is bordered in white.

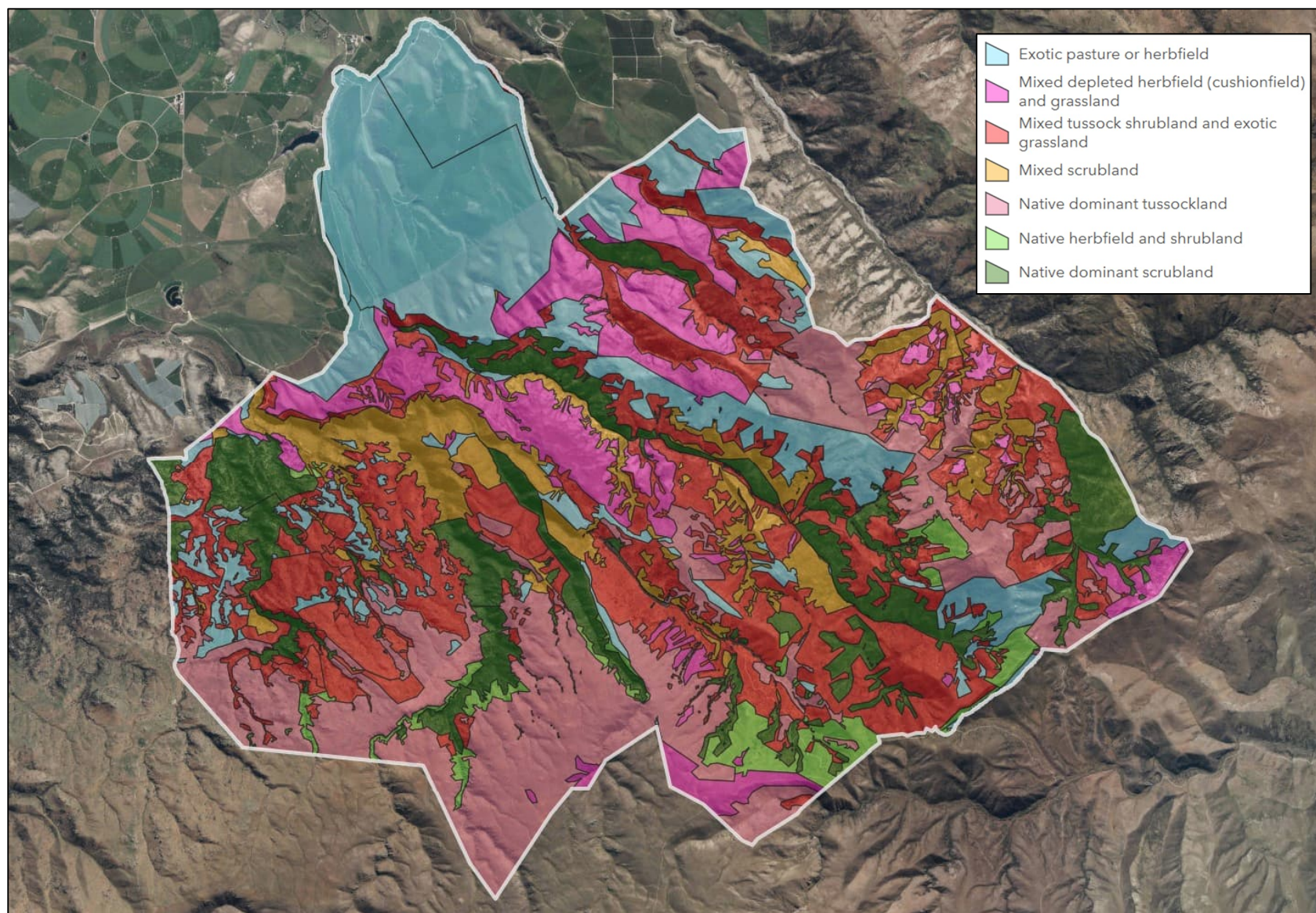


Figure 8. Vegetation communities within the ESA (white border).

3.2.4.1 Exotic pasture or herbfield

This vegetation type occurs widely across the lower elevation parts of the ESA, but also at higher elevations. Below 400 m and on gentle slopes, most areas of exotic pasture have been cultivated (Plate 7), but at higher elevations the main management inputs have been seed and fertiliser application, mainly by aircraft (termed aerial oversowing and topdressing (“AOSTD”)) (Plate 8).

Structurally, this vegetation type is low-growing exotic grassland with exotic herbs often locally dominant (e.g., around stock camps and at higher elevations) and relatively little bare ground (except during dry summers). Exotic pasture is maintained by regular inputs of fertiliser, seed, cultivation and grazing – by sheep and cattle, although possums, rabbits and hares are also important grazers in these exotic grasslands.

Exotic pasture grasses are dominant (50 % cover²⁷) with considerable variation in pasture grass species depending on management inputs and location. Woody vegetation (native or exotic) is rare and confined to uncultivated microsites such as gully slopes where sparse native tussocks can also occur.

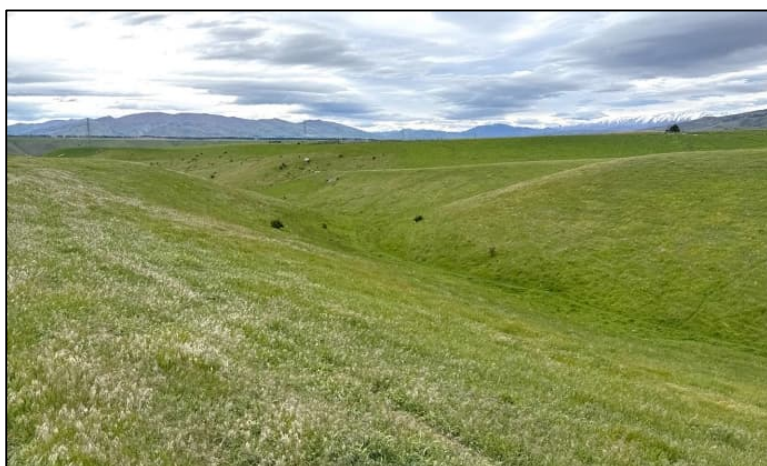


Plate 7. Cultivated exotic pasture at lower elevation.



Plate 8. AOSTD exotic pasture with scattered shrubs at higher elevation.

3.2.4.2 Mixed depleted herbfield (cushionfield) and grassland

This vegetation community occurs mainly on moderate to steep northwest to northeast facing slopes between 400 and 800 m elevation, although small areas also occur on similar slopes at higher elevations (>1,000 m asl) (Plate 9). Overall, this vegetation type is of relatively limited extent in the ESA (10 %) but is

²⁷ This metric is the average coverage of the structural class (e.g., grass) across all plots in the vegetation community.

more widespread within the DDF (17 %). Structurally, this depleted vegetation type has the highest proportion of bare ground and rocks of all vegetation types (average 38 % cover), with otherwise sparse low growing grasses and herbs dominating. Woody species are rare. Although sporadically grazed by sheep, the major grazer in this vegetation type is likely rabbits which help maintain the open condition. It is likely that this vegetation type has been induced by historic overgrazing by both sheep and rabbits, coupled with soil loss and high moisture stress.

Often large cushions of scabweed (mainly common scabweed (52 % freq.) or *Raoulia beauverdii* (43 % freq.) (Plate 10)) are the most distinctive element in this vegetation community, although many are senescent with marked dieback. Exotic grasses, mainly sweet vernal (78 % freq.), are also abundant (18 % cover) (Plate 11), but native tussocks are rare.



Plate 9. 'Mixed depleted herbfield (cushionfield) and grassland' in the foreground on a north facing slope, with a mosaic of 'Exotic pasture or herbfield', 'Mixed tussock shrubland and exotic grassland', and 'Native dominant scrubland' in contrast on the south facing slope in the background.



Plate 10. 'Mixed depleted herbfield (cushionfield) and grassland' where *Raoulia beauverdii* is prevalent – covering most of the slope and easily distinguished from common scabweed (center).



Plate 11. 'Mixed depleted herbfield (cushionfield) and grassland' where exotic grasses and herbs are more prevalent.

3.2.4.3 Mixed tussock shrubland and grassland

This is a low to mid elevation vegetation type which is the most widespread through both the ESA (26 %) and the DDF (31 %). Structurally, this vegetation type is predominantly exotic grassland, but with a moderate component of native tussocks, and with scattered to patchy shrubland through it (Plate 12).

This is a less developed version of 'Exotic pasture' that has likely had an ongoing history of AOSTD and sheep and cattle grazing, but no cultivation and less recent woody vegetation control (herbicide application or burning), hence the higher woody component.

Depending on management history, especially woody vegetation control and grazing pressure, scattered to small clumps of shrubs are also present with native tūmatakuru / matagouri (60 % freq.) and exotic sweet briar (81 % freq.) the most common, although shrubs are never dominant (19 % cover). There is a moderate amount of bare ground (11 % cover).



Plate 12. Exotic pasture species form a dense groundcover with scattered native and exotic shrub species in 'Mixed tussock shrubland and grassland'.

3.2.4.4 Mixed shrubland

This vegetation community occurs predominantly in gullies and on moderate to steep north facing slopes between 400 and 800 m elevation. Although overall this vegetation type is of relatively limited extent over the ESA (9 %), it is considerably more widespread within the DDF (20 %).

Structurally, this vegetation type is dominated by often dense scrubland (39 % cover), with exotic grassland (34 % cover) and bare ground (11 % cover) between the scrub patches. Occasionally this vegetation type occurs adjacent to rock outcrops.

This vegetation type is even less developed than 'Mixed tussock shrubland and grassland' as reflected by the high shrub cover. Livestock grazing is likely to be limited, although the shrubs can be important for stock shelter especially when close to more open grassland (e.g., in 'Mixed tussock shrubland and grassland'). There is little evidence for recent woody vegetation control (herbicide application or burning) in this vegetation community.

The scrubland is dominated by both native and exotic species, in contrast to 'Native dominant scrubland' where native species are much more important than exotic species. The main shrub species are the native tūmatakuru / matagouri (63 % freq.) and exotic sweet briar (88 % freq.) (Plate 13), with the native *Coprosma propinqua* (6 % freq.) a less important component that is most common around rock outcrops.

With increasing elevation and on more shady aspects, this vegetation type grades into native scrubland where sweet briar is less abundant and a greater diversity of native shrub species are present. With appropriate management (no fertilizer and modification of grazing patterns), 'Mixed scrubland' may transition into more diverse 'Native dominant scrubland'.



Plate 13. 'Mixed shrubland'. Sweet briar is the lighter green and native species – mostly tūmatakuru / matagouri – is darker green.

3.2.4.5 Native dominated tussockland

This is a higher elevation vegetation community (600-1,200 m, but mainly above 800 m) that occurs across a variety of slopes and aspects, especially in the south of the ESA. This vegetation type is structurally herbaceous, with grasses, tussocks and herbs dominant (80 % cover) (Plates 14 and 15). Shrubs (8 % cover) are a minor component. Management inputs are likely to be less than at lower elevations, but this vegetation type will have had a long history of extensive sheep grazing and been subject to AOSTD from time to time.

'Native dominated tussockland' is an induced vegetation type in that historically it would have supported woody vegetation and because of its higher elevation and farming history, invasion of woody species is slower.



Plate 14. 'Native dominated tussockland' with mostly herbaceous interstitial spaces and occasional shrubs.



Plate 15. 'Native dominated tussockland' with predominantly exotic pasture covering interstitial spaces.

3.2.4.6 Native herbfield and shrubland

This is a minor vegetation type in both the ESA (3 %) and the DDF (<1 %), being largely confined to the highest parts of the study area (800-1,100 m elevation). This vegetation type is structurally herbaceous (86 % cover), including native tussocks, exotic grasses, native and exotic herbs, and moss. The native mega-herb *taramea* is distinctive. Shrubs are a distinctive but only locally common component (10 % cover).

The most distinctive feature of this vegetation type is the often-extensive areas of the native mega-herb *taramea* (75 % freq.) growing within grass and herbs with scattered short tussocks (hard tussock, silver tussock, and blue tussock) (Plate 16). *Tūmatakuru* / *matagouri* is locally abundant (63 % freq.) (Plate 17), and porcupine shrub (*Melicytus alpinus*) and *Pimelea oreophila* subsp. *lepta* are also locally present.

Like 'Native dominated tussockland', this is an induced vegetation community in that historically it would have supported a woody canopy. With removal of grazing pressure and time, 'Native herbfield and shrubland' will develop into a woodier state with *tūmatakuru* / *matagouri* likely dominant, at least initially.



Plate 16. *Taramea* is the distinctive structural feature of 'Native herbfield and shrubland' where native shrubs can be occasional to common.



Plate 17. *Tūmatakuru* / *matagouri* is a locally common feature of 'Native herbfield and shrubland' where it grows to approximately 1 m in height.

3.2.4.7 Native dominant scrubland

This vegetation type occurs across a range of elevations and landforms through the study area. It is of similar abundance within the DDF (14 %) as it is across the ESA (12 %), and is common in gullies and on south facing slopes. Structurally, this is dense shrubland dominated by native shrubs.

The form of scrubland occurring across most of the ESA (except in the very west) is dominated by tūmatakuru / matagouri (91 % freq.) and scented tree daisy (64 % freq.) forming a closed canopy 2-3 m tall (Plate 18). *Coprosma propinqua* is a distinctive, although less abundant (36 % freq.) element that is usually concentrated around rocky outcrops where relict plants survived repeated burning or where bird dispersed seed was deposited and managed to establish in the presence of grazing. The main exotic shrub is sweet briar (63 % freq.), but it is less dominant here than in 'Mixed scrubland'.

This vegetation community has expanded since large scale anthropogenic burning essentially ended within the ESA several decades ago. Aerial imagery shows an increase of 10-60 % in woody vegetation cover in suitable locations (i.e., some existing woody vegetation, and not north facing) over an 18-year period between 2003 and 2021 in grazed (Dry Creek Conservation Area) and ungrazed areas (Ardgour Station).



Plate 18. Steep-sided gully covered by tūmatakuru / matagouri 'Native dominated scrubland'.

3.3 Distinctive features

Distinctive vegetation features also occur at a finer scale than the mapped communities, and are not specific to any one vegetation community. These include rock tors, areas of continuous dense low vegetation, and areas of dense divaricating native shrubland – all of which are important features for supporting lizard by providing refuge, foraging, basking and breeding sites.

3.3.1 Tors

Rock is a visually dominant feature of the ESA landscape. Exposed rock occurs at all scales – from extensive gully rocklands in the upper gullies of the Bendigo Historic Reserve, to individual clusters of rock as outcrops/tor amongst tussock and improved pasture (Plates 19 and 20), and through to single large rocks in the middle of areas devoid of exposed outcrops. Amongst these is scattered individual flakes of rock and small boulders that have been dislodged from surrounding tors, or which have been created, discarded or moved from historic and recent mining or resource exploration activities.

Gully rocklands exist only outside of the DDF (Plate 21). Where they do exist (Bendigo Historic Reserve upper gully and north-east parts of Ardgour Station) the quality of refuges for lizards varies greatly. In the Bendigo Historic Reserve gullies, the rock is more competent and likely to develop cleanly cleaved horizontal and vertical crevices, which suit basking lizards, including large bodied skinks such as Otago and grand skinks. Screes that develop comprise small and medium size granules (from ca. 50 mm to 300 mm diameter; Plate 22) which form deep drifts of excellent habitat quality for small bodied lizards. In contrast, rocklands in Ardgour Station have far fewer crevices and appear to comprise concretions that do not develop horizontal splits. Screes in this part of the ESA comprise far larger material – boulder fields, rather than small rock screes.

Rock tors are prominent on ridges and spurs as isolated clusters or lone formations of exposed rock (Plate 23). The larger tors have a greater association with woody vegetation, perhaps because as tors are larger, they prevent stock access and browse to all parts. Tors within the DDF and Bendigo Station areas support a range of large schist flakes, and deep narrow crevices which provide excellent lizard refuges.

Smaller tors exist as single exposed rocks throughout the landscape (Plate 24). Smaller boulders and rocks dislodged from larger rock areas over time are present throughout slope and valley areas. Even the smallest of these (100 mm flakes) on soil can provide adequate habitat as lizard refuges.

Medium and large rock tors (from 5 m wide and larger) offer unique conditions that support a distinctive assemblage of plants. These conditions include sunlight variability, protection from grazing, protection from fire or other vegetation clearance, and thin soils and often support nodes of woody vegetation and also have a concentration of native diversity and higher native dominance. Plant species that provide nectar or small fruits for lizards around tors include creeping pōhuehue (*Muehlenbeckia axillaris*), tūmatakuru / matagouri, *Coprosma propinqua* and porcupine shrub (*Melicytus alpinus*).



Plates 19 and 20. Aerial view of top section of Bendigo gully above the Bendigo Historic Reserve outside of the DDF (top) showing extensive exposed tor systems and regenerating shrublands. By comparison, tors (yellow boxes) are far less frequent within the DDF (bottom) with both tor size and number are considerably fewer than outside of the DDF.



Plates 21 – 24 (clockwise from upper left). Top left - rockland gully with a very high occurrence of exposed rock amongst native dominated scrubland. Top right- boulder scree habitat. Bottom right – depleted herbfield/ cushionfield with solitary tor (yellow box, note sheep for scale). Bottom left – large tor system.

3.3.2 Dense low vegetation

Within any of the shrubland or scrubland vegetation types there is considerable localized variation in the prevalence, diversity and density of low growing vegetation (Plates 25 and 26).

Patches of dense tussock with low-growing shrubs or vines, especially around small tors and on unstable small slope screes provide excellent quality patches of habitat for ground dwelling skinks, including tussock skink, Nevis skink, and potentially lakes skink. These types of habitat patches were targeted for placement of pitfalls and Gee's minnows along the lizard transect lines. Some of the many ACOs in the centroid grids were also laid out within dense habitat patches, where available.

The occurrence of these habitats patches is uncommon within the ESA and especially so within the DDF, as most gully bottom have been heavily trampled and grazed by stock, leading to an absence of dense habitat, and instead support closely grazed pasture, pugged valley bottoms and occasional sparse tussock or taramea.



Plates 25 and 26. Dense low tussock, scree and low vegetation along gully bottoms are uncommon within the DDF and the ESA. Where they do occur, they offer excellent habitat for ground dwelling lizards.

3.3.3 Dense divaricating shrubland

Dense divaricating shrubland offers the best quality habitats within the DDF for arboreal geckos (jewelled gecko). Most shrubland within the native or exotic dominated shrubland areas is sparse and comprises species not normally associated with jewelled geckos, including briar rose and matagouri (largely as solitary shrubs).

In a few places, lack of cattle access has resulted in particularly dense shrubland areas (Plates 27 and 28), and in some cases, these are connected by shrubland to remnant shrubland and more mature scrubland within gullies (in particular the upper reaches of the Bendigo Historic Reserve). In other cases, divaricating species form dense cover around large tors where plant diversity and growth has been protected from fire and grazing.

The few areas of dense divaricating shrubland within the DDF were included in daytime arboreal gecko searches, as well as a selection of dense shrubland areas within gully systems in the ESA that offered the greatest opportunity of supporting arboreal geckos.



Plates 27 and 28. Dense shrubland (left – yellow box) within the upper edge of Bendigo Historic Reserve, adjoining the DDF, and a typical example of a divaricating shrub (right) with abundant fruit (*Coprosma propinqua*).

3.4 Introduced predators of lizards

A survey of mammalian pests was undertaken over the ESA and DDF by HabitatNZ with the objective of documenting the presence and relative abundance of pest species across the site.

Four mammalian pest survey methods were used across the ESA to establish mammalian pest species' presence, relative abundance and dietary constituents. These included:

- Chewcard lines - targeting mice, possums and rats
- Camera traps - targeting cats, mustelids and hedgehogs
- Aerial surveys - targeting ungulates such as feral deer, goats and pigs

Mammalian pests were found across the ESA. Known predators of native lizards elsewhere that were detected within the ESA include feral cats (*Felis catus*), feral pigs (*Sus scrofa*), hedgehogs (*Erinaceus europaeus*), mice (*Mus musculus*), mustelids (ferrets - *Mustela putorius furo*, stoats - *M. erminea*, and weasels - *M. nivalis*), possums (*Trichosurus vulpecula*), and rats (species unknown although assumed to be *Rattus rattus* and/or *Rattus norvegicus*)²⁸.

All species were detected across the ESA, except for weasels and rats which were found only in areas outside of the DDF.

3.5 Habitat quality

Habitat quality for lizards varies considerably across the site, with predictable patterns.

The lowland plains support the lowest quality habitat, as structural complexity has been almost entirely removed through clearing of the land, and raking to remove rocks, woody materials and clumping plants (e.g. tussocks). Where the areas are used for agricultural crops, there is a low likelihood of lizards being present, although both McCann's skink and Kawerau gecko were present in immediately adjoining agricultural fields within grass clumps along fencelines, within piles stones recovered from fields and stored nearby in 'waste stacks', and under individual stones used to weigh down rabbit proof fencing.

²⁸ Habitat NZ Ltd. (2025). Bendigo-Ophir Gold Project: Mammalian Pest Survey. Habitat NZ Ltd, Auckland. 55 Pages.

Degraded cushionfields and weather worn north facing slopes supported surprisingly complex habitats with rabbit burrows, small erosion scree, slabs of rock across the ground, and grass clumps under briar rose bushes where stock could not reach.

Mixed scrubland and shrubland was more complex again with south-facing slopes supporting patches of rank grass or tussock, and north facing slopes – especially steeper slopes – supporting accumulations of multi-layered small rocks against shrub trunks, and occasionally, grass patches. As shrub cover increases, the availability of grass clumps as refuges for lizards and sun-exposed areas for basking decreases, such that overall habitat quality for lizards declines as woody vegetation cover increases.

Native tussockland is typically patchy and sparse on the site with grazed pasture grasses between offering low quality habitat - which is better for skinks than it is for geckos. The dense tussock plant bases provide secure refuges for McCann's and tussock skink; however, are unlikely to appeal to Kawerau gecko.

Native herbfield where taramea is present is by far the most superior habitat for skinks, as the taramea provides multi-level habitat amongst the foliage, as well as protection from stock browse and predation.

Sitting over all of these vegetation types is the presence of rock tors, rocklands, and scree slopes. Where these are present the habitat quality for lizards – both skinks and geckos – is considerably greater due to the far greater complexity of crevices, splits, refuges, and food sources, all of which typically occur in locations that are exposed to sunlight and therefore basking opportunities.

Habitat quality for geckos and for skinks is summarized in Table 6. An assessment of habitat quality for all lizards that could be present on the site has been made - even for species where the likelihood of their present due to past land modification or uncontrolled predators makes this unlikely (e.g. jewelled gecko, grand skink and Otago skink).

Representative photos of habitat quality are shown in Plates 29-37.

Table 6. The quality of lizard habitats within the ESA and DDF. Quality scores are nil (absent), Low, Moderate, High, Very High.

Habitat	within ESA	within DDF	Notes
Quality ->			
Exotic pasture or herbfield	Low	Low	Only habitat present along fencelines and within discarded stone piles for small skink and Kawerau gecko
Mixed depleted herbfield (cushionfield) and grassland	Moderate	Moderate	Complex habitats for both smaller skinks and ground-dwelling geckos
Mixed tussock shrubland and exotic grassland	Moderate	Low	Open mosaic of ground refuges. Far more rock and tors within ESA than in DDF
Mixed shrubland	Moderate	Moderate	Open mosaic of ground refuges. Far more rock and tors within ESA than in DDF
Native dominant tussockland	Moderate	Low	Grazed between sparse tussocks throughout, except ESA has tors amongst, while DDF has very few smaller tors
Native herbfield and shrubland	Very High	High	Amongst tors in the ESA, and mostly without tor or rock refuges in the DDF

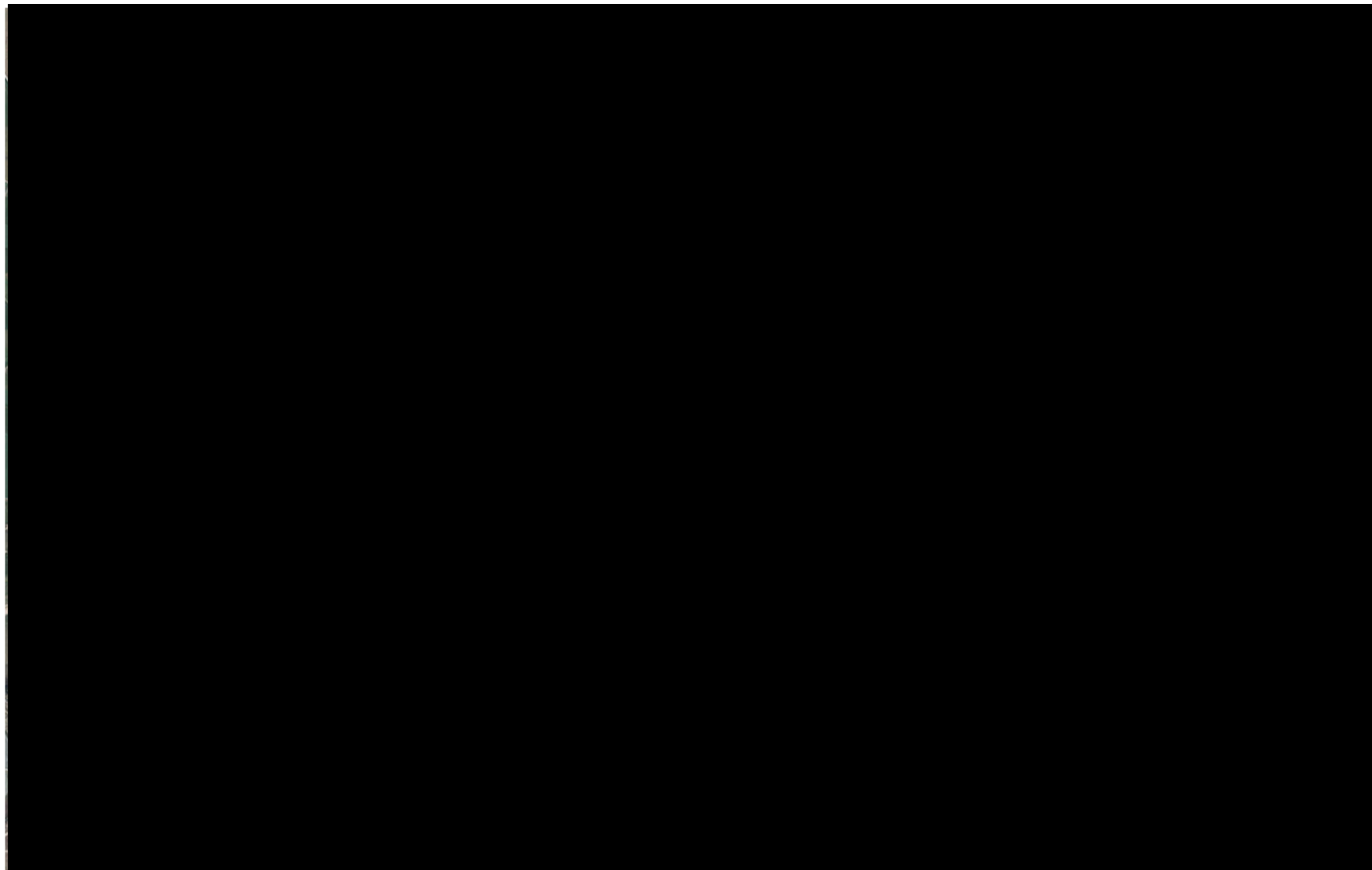
Native dominant scrubland	Moderate	Low	Grazed in both areas with abundant tors in the ESA, and few if any tors in the DDF
Rocklands (gullies)	Very High	None	Extensive, with high quality crevices and refuges in Bendigo Station; none in DDF
Tors	High	Moderate	Abundant tors across Bendigo Station, less so across parts of Ardgour, and very few within DDF (ca. 10 large tors, and ca. 300 smaller tors)
Dense low shrublands	High	Low	Restricted to 3-4 small locations in the DDF as all others are pugged, burned or grazed
Divaricating shrublands	High	Low	Restricted to only 2-3 small areas within the DDF, and all are young (>60 years old) c.f. Bendigo Historic Reserve gullies where scrublands are extensive and older

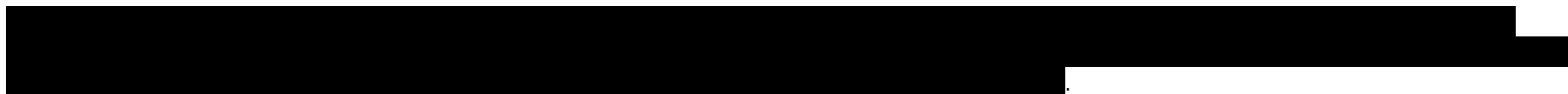


Plates 29- 32 (clockwise from top left). Lizard habitats within the DDF. Top left – low quality pasture and crops. Top right – moderate value; mixed depleted herbfield showing bare ground, scattered stones and tussock bases as refuges for skinks and geckos. Bottom right – moderate quality mixed shrubland with scattered rock and grass patches around matagouri and briar rose. Bottom left - rock outcrops provide higher quality habitat within the low quality exotic pasture.









3.6 Species diversity

3.6.1 Search effort

The total estimated effort expended on searching for lizards on the DDF and ESA is presented in Table 7. This represents the time taken to undertake manual searches, check ACOs, process caught lizards, drone inspection, and undertake binocular and visual surveys for basking lizards. Time to review drone photographs and video of rock tor areas is not included in this estimate.

The effort was split over several seasons and over two separate years, which adds to the robustness of the results as the potential for missing species or individuals is lessened.

Overall, we regard this effort as extensive, and the survey of lizards in the parts of the ESA surveyed, and across the entirety of the DDF to be robust and accurate.

The total estimated search effort is 620 person hours. Nearly half of the total was expended on ACO checks and lizard processing – which is understandable given that ACOs were the most widely used, intensively used, and most likely to generate quantitative information of all of the approaches used for this study.

Table 7. Effort allocated to different methods for detecting native lizards in the ESA and DDF. Does not include time travelling between sites or setting up for survey.

Method	Estimated effort (person hrs)	Target species
Artificial Cover Objects (ACOs):	370	Small skinks and saxicolous geckos
Pitfall trapping	80	Small skinks and saxicolous geckos
Gee minnow funnel traps	40	Small skinks and saxicolous geckos
Arboreal gecko basking daytime search	25	Jewelled gecko (and large lizards in some areas where dense shrubland overlapped with rock tors)
Drone aerial survey of tors	20	Large lizards - Grand skink, Otago skink
Tor/rock area large skink basking survey	25	Large lizards - Grand skink, Otago skink
Manual timed search	60	Small skinks and saxicolous geckos
TOTAL HRS	620 person hrs	

3.6.2 Species detected in the ESA and DDF

Kawerau gecko, tussock skink, and McCann's skink are found throughout the DDF and ESA (Plates 38 – 50).

At least one of these three lizard species, and often all three, were detected in each of the seven vegetation communities within the DDF, as well as within the ESA (Table 8) and in areas opportunistically surveyed outside of the ESA. Only gravel roads did not support lizards, although roadside margins, including recently bulldozed berms, did support lizards. Even parts of agricultural fields supported one or more species, especially if there were rock areas within the fields, or on the margins.

Of the six other locations outside of the ESA that were briefly assessed for lizards, all three lizard species were found at three sites (Sites 1, 4 and 5), and Kawerau gecko and McCann's skink were easily found at the others. This confirms that the species of native lizard found within the DDF are not only widespread across the ESA but are also in the wider landscape, including sites more modified than the DDF (roadside margins and vineyard margins), and those of a similar farmed state to the ESA/ DDF.

As illustrated in Table 8, most species were caught by several different methods, further reinforcing the effectiveness of the survey at detecting resident lizards. While fewer methods may have sufficed for the survey, the results also show (when paired with the relative abundance estimates in Section 3.7) that different species appear to have different detectabilities, and no one method is effective at portraying a complete picture of the lizard community at the site.

What is clear is that the lizard fauna of the DDF is neither novel, nor is it special, nor specific to this local area.

Table 8. Presence/absence by habitat type, and method of confirmed detection for lizard species recorded in the ESA and DDF. Shaded cells signify that lizards were not detected at that location/ habitat despite targeted survey.

Habitat	Kawerau gecko	McCann's skink	Tussock skink
Confirmed detection method --->			
Exotic pasture or herbfield	ACO/ Manual search	ACO/ Manual search	nil
Mixed depleted herbfield (cushionfield) and grassland	ACO/ Manual search	ACO/ Manual search	ACO/ Manual search
Mixed tussock shrubland and exotic grassland	ACO/ Manual search	Pitfall trap/ ACO/ Manual search/ Gee's minnow	Pitfall trap/ ACO/ Manual search
Mixed shrubland	ACO/ Manual search	Pitfall trap/ ACO/ Manual search/ Gee's minnow	Pitfall trap/ ACO/ Manual search/ Gee's minnow
Native dominant tussockland	ACO/ Manual search	Pitfall trap/ ACO/ Manual search	Pitfall trap/ ACO/ Manual search
Native herbfield and shrubland	ACO/ Manual search	Pitfall trap/ ACO/ Manual search	Pitfall trap
Native dominant scrubland	ACO/ Manual search	Pitfall trap/ ACO/ Manual search	Pitfall trap/ ACO/ Gee's minnow
Rocklands (gullies)	ACO/ Manual search	Manual search/ binoculars/ basking survey	nil
Tors	ACO/ Manual search/ binoculars/ basking survey	Manual search/ binoculars/ basking survey/ Gee's minnow/ drone survey	nil
Dense low shrublands	ACO/ Manual search	Pitfall trap/ ACO/ Manual search	nil
Divaricating shrublands	n/a (not searched for)	binoculars/ basking survey	n/a (not searched for)



Plates 38 – 41. Clockwise from top left. Top left and right; Kawerau geckos showing distal phalange that narrows abruptly before the subdigital lamellae (white arrows) – a diagnostic feature of Kawerau gecko when used in conjunction with geographic location. Bottom left and right – Kawerau geckos showing typical dorsal and lateral patterns.



Plates 42 – 46. Clockwise from top left. Pale yellow belly of tussock skink. Chocolate brown dorsal stripes of tussock skinks. Lateral view of head of a tussock skink showing four numbered supraorbital scales and three (numbers 2, 3 and 4) that are touching the frontoparietal scale (F-P) (two different individuals bottom left and bottom right).



Plates 47 – 50. McCann's skinks showing typical checker-board dorsal surface, and showing colour variation between individuals across the site.

3.6.3 Species not detected in the ESA and DDF

Despite widespread sampling across the DDF using multiple methods, only three species of lizards were found.

None of the other target species were found in the DDF or the wider ESA – these included Nevis skink, grand skink, Otago skink, lakes skink, and jewelled gecko.

Particular effort was put into searching apparently suitable habitat for Otago skink, lakes skink, grand skink and jewelled gecko.

The quality of habitat for these species within the DDF was overall moderate to poor, and outside of the DDF (with the ESA) was moderate and high quality (deep vegetated fire refuge gullies, and extensive gorge rocklands and tor systems).

These species have disappeared from almost all other parts of the landscape, and it is therefore not a surprise that they are absent here; however, a thorough search was necessary to confirm this. Repeated burning, lack of animal pest control, and long-term stock grazing and destruction of vegetation along wetter valley bottoms have all probably contributed to the absence of these species from the site, as the site is within the historic range of most of those species.

We undertook a check to ensure that the absence of records from our site surveys for these key species was actually likely to be due to the absence of the species, rather than a lack of activity of the species due to weather conditions or a lack of detection due to observers not surveying correct habitat.

[REDACTED] During our visit we readily and easily observed basking Otago skinks, and active grand skinks (adults and juveniles) (Plates 51 & 52) – both by eye and by binocular spotting. Grand skinks especially were very active across rock tors and platforms, including when observers were within several meters.

Our main survey for basking large lizards and arboreal jewelled geckos took place shortly after the visit to [REDACTED], in similar climatic conditions.

From this we conclude that that neither the DDF, nor other parts of Ardgour or Bendigo Stations within the ESA extensively surveyed, support Otago skink or grand skink. Our surveying was extensive in the known habitats (as much or as little existed in the DDF) also for Nevis skink, lakes skink and jewelled gecko. Our lack of records for those species is concluded to be a reflection on the true absence of those species from this site.

During our surveys we were also alert to the possible presence of exotic species, in particular plague skink (*Lampropholis delicata*), which is not known from locations south of Blenheim/ Havelock; however superficially, suitable habitat exists through the Otago region for the species. We did not detect plague skink on this site.



3.7 Population characteristics

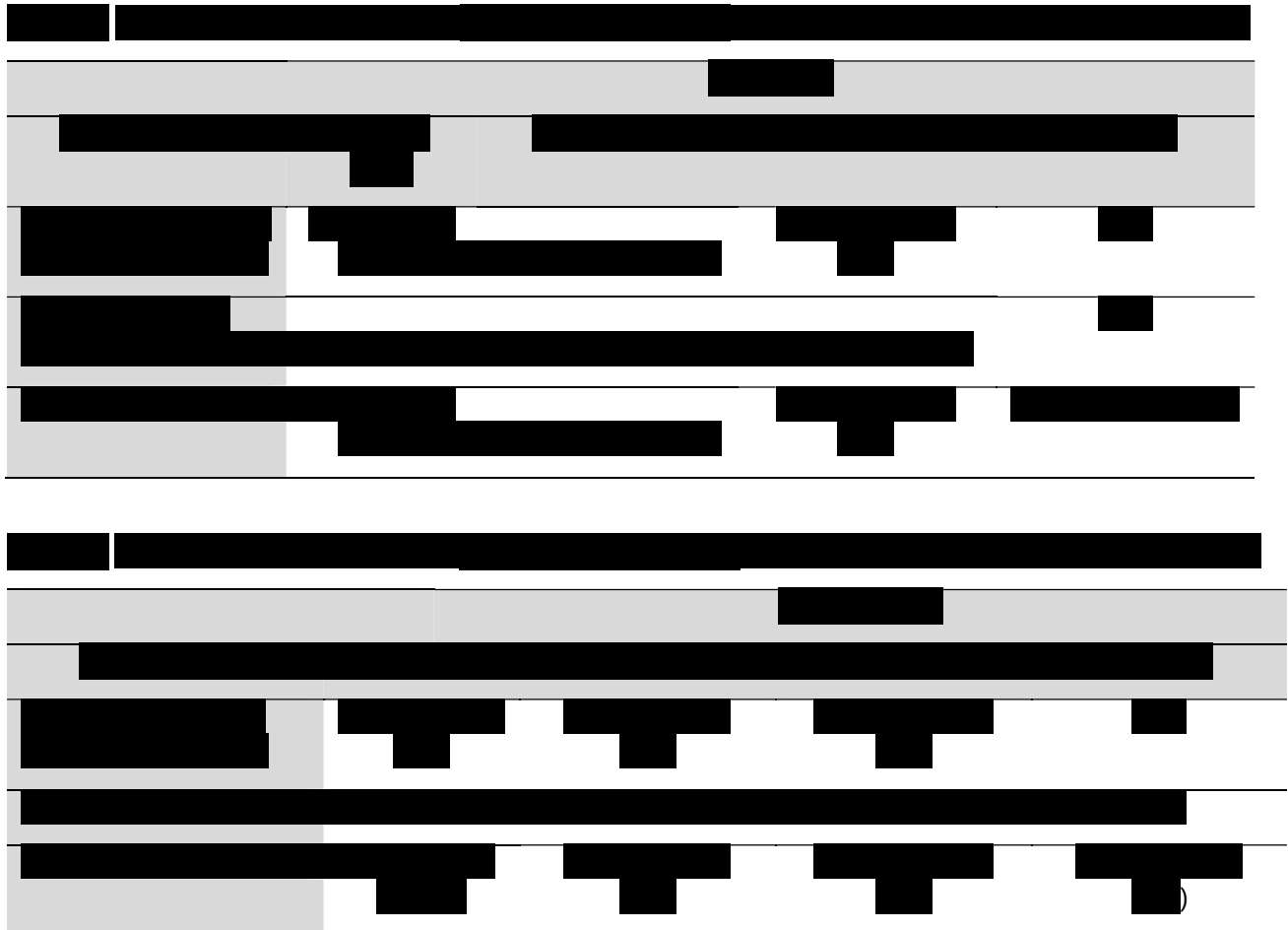
3.7.1 Occurrence

All three lizard species were found within the DDF and within the surrounding ESA. Table 9A and 9B provide a summary of lizard presence at each of sampling sites as relative occurrence within the areas at which ACOs, manual search, and pitfalls were undertaken.

Overall, the conclusion from this data is that:

- The number of sites surveyed that did not detect lizards was very small – amounting to around 10 % of sites whether within the DDF or outside of the DDF in the wider ESA. Most of those sites without lizards were in the agricultural basin area within pasture fields where habitat was lacking for lizards, and where sites were heavily disturbed on a seasonal basis;
- Kawerau gecko is found across the site, in particular where rock tors and rock refuges exist. They were most reliably detected using ACOs;
- McCann's skink is found across the site in almost all habitats and using all methods, apart from the center strip of regularly used roads;
- The many small areas intensely sampled using different methods show that Kawerau gecko and McCann's skink are throughout available habitats – they are not patchily distributed, but rather appear throughout capture devices/ methods and throughout micro-habitats within sampled habitats.

- Tussock skinks are more localized on the site and are found mostly within valley bottoms, on riparian margins or in areas where moisture could be expected to persist into the drier months of the year, and hence are represented in a far narrower range of sites sampled over the DDF and the ESA;
- No lizards are found within the center strip of regularly used roads or in closely grazed pasture or cropping areas where there is an absence of rock; and
- Both McCann's skink and Kawerau gecko were found in agricultural fields where rock is present, for example existing rock slabs or small tors within fields, or within loose rock piled on the perimeter of fields (e.g. rocks picked off fields and stored on the outer edge of worked areas).



3.7.2 Relative abundance

We assessed relative abundance for two methods – ACOs and manual timed searches.

ACOs (Tables 10 and 11) recorded all three lizard species, and illustrated a pattern seen across sampling methods - that of McCann's skink being present across all vegetation types, and being abundant (up to 1.44 lizards per ACO) in most of those. Abundance of McCann's skink was lowest in habitats that were most shaded (native scrubland) and those that lacked complex structure (exotic pasture).

Tussock skink was recorded at the lowest abundance of the three lizards, with individuals detected by ACO in five of the seven vegetation types. Numbers at each site as recorded by ACOs were very low.

For Kawerau gecko, numbers were very high where rock and habitat mosaics were abundant with numbers up to 3.6 geckos per ACO recorded in areas where ACOs were selectively placed in areas that were deemed good quality habitat for lizards.

[REDACTED]

[illegible]

juveniles caught of tussock skink is most likely due to the small sample size than a lack of recruitment.

- Maximum lengths (SVL) were in general accordance with the literature.
- Maximum weight of Kawerau geckos were 9.6 grams, 4.7 grams for tussock skink, and 5.2 grams for McCann's skink.
- All three species of lizard had a proportion of individuals that had lost their tails and regrown. The percentage of tail regrowth is discussed in Section 4.3; however, broadly, the percentage of tail loss observed on the site is similar to that found at [REDACTED]

[illegible]

Table 14. Summary statistics of lizards caught across the ESA and DDF by ACOs and pitfall traps. As well as the individuals caught listed in this table, an additional 23 unidentified lizards or identified skinks were noted as well – all of which were either basking on ACO covers or ACO pitfall covers and eluded capture (most instances), or escaped capture when ACO triple stacks were processed for lizards (few instances).

		Artificial Cover Object (ACO)				Pitfall traps		
Variable	Measure	Kawerau gecko	Tussock skink	McCann's skink		Kawerau gecko	Tussock skink	McCann's skink
Age class	Juvenile	142	0	20		0	0	0
	Subadult	111	2	28		0	3	2
	Adult	308	11	298		0	14	23
	Unclassed	11	1	6		0	0	0
Net weight (g)*	Minimum	0.4	0.9	0.4		0	0.4	0.9
	Maximum	9.6	4.1	4.9		0	4.7	5.2
	Average	3.34	3.13	2.82		0	2.87	3
Snout-vent length (SVL mm)*	Minimum	22	38	30		0	39	42
	Maximum	74	63	68		0	65	69
	Average	47.3	55.3	53.1		0	54.3	54.1
Total tail (mm)*	Minimum	0	43	0		0	25	11
	Maximum	74	69	76		0	70	71
	Average	45.9	57.6	56.8		0	53	54.6
Miscellaneous	Regenerating tail	144	5	90		0	2	7
	Gravid	25	2	39		0	0	0
	Dropped tail at capture	9	0	2		0	0	0
Total number over all seasons		572	14	352		0	17	25

* Data collected from only summer 2024 catch data, comprising 287 Kawerau gecko, 31 tussock skink, and 256 McCann's skink.

3.7.4 Estimated numbers within DDF

The methods used to assess the lizard fauna for this project combined location-intensive assessment with broad-scale less intensive survey. None of the methods employed were designed to provide a robust quantitative assessment of lizard population density or absolute abundance, rather relative abundance counts and survey techniques were the focus.

Despite this, we spent considerable time on the site, and covered most parts of the DDF (and looked intensively at parts of the ESA as well) including undertaking timed searches and per-area observational counts throughout all habitats. This has given us a good understanding of the likely abundance of the three species and their distribution across the DDF.

While our results show that the lizard populations at this site are representative of the relative abundance of the same species seen outside of the DDF, it is useful to also understand the numbers of lizards that may be present in the various parts of the DDF.

The primary reason for this information is so that an appropriate salvage and relocation programme – which may be required under the Wildlife Act - can be designed and resourced appropriately given the numbers of lizards that may be present.

As is discussed earlier in this report the abundance of lizards is not evenly distributed across the site; some areas have far more and different species in concentration than other areas.

This should be taken into consideration both when planning salvage efforts, and also for any detailed engineering design work that may be undertaken post granting of resource consents, which may offer opportunities to further avoid effects on higher concentration areas of native lizards.

Our coarse estimate of abundance of lizard species within the DDF is presented below.

- McCann's skink low 100,000s
- Tussock skink low 1,000s
- Kawerau gecko High 10,000s

Numbers of these native lizards in the ESA are likely to be proportional to the additional area of the ESA – that is, around 10 x greater. Numbers in the surrounding landscape outside of the ESA, within less disturbed non-agricultural or horticultural areas of the Dunstan Mountains are likely to be hundreds of times greater than the numbers estimated within the DDF, simply because there is similar or better quality habitat available outside of the ESA, and the density of native lizards is assumed to be similar.

4.0 Assessment of ecological value and significance

Assessments of ecological value and significance are best undertaken for an area (rather than for an isolated part of a community) and for all aspects of biological and physical diversity (rather than for only lizards) – however, there is also value in assessing how parts of an ecosystem may disproportionately trigger higher overall values or trigger planning criteria for ecological significance, especially if that helps refine an activity that seeks to remove or modify parts of the environment.

This section is intended to identify the relative ecological value of parts of the DDF in terms of lizard fauna, and to comment on whether the presence of native lizards at the site triggers any of the criteria for assessing ecological significance in the Central Otago District Council Regional Policy Statement (Operative or Proposed versions).

4.1 Assessment of ecological value

We have assessed ecological value at the scale of the lizard community, rather than individual species, given that all three species occupy intertwined vegetation communities across the major part of the DDF.

We have however, separated out the Hilly Landscape Unit from the cultivated Basin Landscape Unit (see section 4.2 of the Vegetation Values assessment report by RMA Ecology for further details), as the lizard fauna and habitat quality is sufficiently different in terms of abundance and diversity of the three lizard species between the two geographic areas.

Our assessment of ecological values takes into consideration the lizard species within the site under consideration, the apparent state of the populations, and the quality of the habitat in which they occur.

Ecological value has been assessed using the following matters: representativeness; rarity/distinctiveness; diversity and pattern; and ecological context. These matters are assessed on a four-point scale (very low, low, moderate, high). These scores are then combined to provide an overall score, which is then interpreted in the context of very low – very high overall ecological value.

Overall, the hilly areas of the DDF have a moderate level of ecological value for the native lizard fauna, such that the area is likely to be important at the level of the Ecological District.

In contrast, the lowland cultivated basin has low ecological value for the native lizard fauna, to the extent that its only value for lizards is as local habitat for species that are tolerant of intensive, human-related disturbance.

The assessment is provided in Table 15.

Table 15. Assessment of ecological value for lizard communities within the Hilly Landscape Unit and Cultivated Basin Landscape unit within the DDF.

Criteria	Hilly Landscape Unit	Cultivated Basin Landscape Unit
Representativeness	Habitats are modified but are typical of hill country stations in the region. The lizard community is in part representative of a less modified environment, although it lacks large bodied and arboreal species, and probably several smaller habitat specialists. Moderate value	Habitats are mostly modified or novel, with few areas of rock outcrops or unmodified grassland. The lizard community is only weakly representative of the community diversity that exists in lowland areas that are less modified. Low value
Rarity/ Distinctiveness	Three native lizards exist, including two that are listed as At Risk. Populations are widespread across the hilly landscape unit. High value	At least two native lizards exist, including one that is listed as At Risk. Populations are restricted to least modified areas comprising much less than 20 % of the available cultivated landscape unit. Moderate value
Diversity and pattern	Compared to unmodified hilly areas nearby, the lizard community is reduced in diversity although probably not in extent. Patterns of habitat use reflect the available landforms, although patterns of use are most probably affected by the presence of pest animals through predation affecting abundance and behaviour. Moderate value	Compared to unmodified lowland areas nearby, the lizard community is much reduced in diversity and extent. Patterns of habitat use do not reflect the available landforms due to human modification and most probably pest animals Very Low value
Ecological context	The existing lizard community in this location fills some niches and functions – day active and nocturnal roles, but the lack of other species (large bodied, arboreal) probably severely constrains roles in some ecosystem contexts. The communities present provide part of a continuous band of lizard populations across the Dunstan Mountain north slopes, and most probably contribute to gene flow, and integrity of lizard communities across this local area. Moderate value	The existing degraded lizard community in this location fills some niches and functions – day active and nocturnal roles, but the lack of other species (large bodied, arboreal) probably severely constrains roles in some ecosystem contexts, both as prey items and as pollinators and predators. Low value
Overall value	Moderate	Low

4.2 Assessment of ecological significance

Three species of native lizards have been recorded from within the DDF. Of those, two are listed as Nationally and Regionally At Risk (tussock skink and Kawerau gecko).

The Operative Otago Regional Policy Statement and the Proposed Otago Regional Policy Statement contain a criterion that relates to Rarity, such that the presence of an At Risk classified species may trigger the Rarity criterion (under certain circumstances). For both the Operative and Proposed Regional Policy Statements, only one criterion needs to be met for an area to be deemed ecologically significant.

Table 16 and Table 17 provide an assessment against the rarity criterion.

Our conclusion is that the lizard fauna for the DDF meets the criterion for rarity in an assessment of ecological significance in respect of the Operative Otago Regional Policy Statement and the Proposed Otago Regional Policy Statement.

Table 16. Assessment of ecological significance against Schedule 4 of the Operative Otago Regional Policy Statement 2019.

Criteria	Definition from RPS	Meets this criterion?
Rarity	<i>An area that supports:</i> a. <i>An indigenous species that is threatened, at risk or uncommon nationally or within an ecological district or coastal marine biogeographic area;</i> b. <i>Indigenous vegetation or habitat of indigenous fauna that has been reduced to less than 20 % of its former extent nationally, regionally or within a relevant land environment, ecological district, coastal marine biogeographic region, or freshwater environment including wetlands;</i> c. <i>Indigenous vegetation and habitats within originally rare ecosystems.</i>	The DDF supports established populations of two nationally and regionally At Risk listed lizard species. Parts of the lowland agricultural areas within the DDF are within a LENZ class of <10 % indigenous cover remaining, however, while these support At Risk lizards, these do not support indigenous vegetation cover and presumably do not qualify under clause b) of this criterion. Overall, meets this criterion

Table 17. Assessment of ecological significance against Appendix 2 of the Proposed Otago Regional Policy Statement 2021.

Criteria	Definition from RPS	Meets this criterion?
Rarity and distinctiveness	<i>Attributes of rarity and distinctiveness</i> <i>(6) An area that qualifies as an SNA under this criterion has at least one of the following attributes:</i> <i>(a) provides habitat for an indigenous species that is listed as Threatened or At Risk (declining) in the New Zealand Threat Classification System lists;</i> <i>(b)...</i> <i>Explanation:</i> <i>(2) 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 the species is widespread in at least three other regions, the area does not qualify as an SNA unless:</i>	The DDF supports established populations of two nationally and regionally At Risk listed lizard species. The DDF provides habitat for more than a single species of lizard that is classified as nationally and regionally At Risk. Neither of the exclusions listed as (2)(a) or (2)(b) apply because, although neither tussock skink nor Kawerau gecko are rare in the region (both are common, and are very common at the site and surrounding landscape), neither species is widespread in at least three other regions (Kawerau gecko is restricted to Otago region, and tussock skink is restricted to Southland and Otago regions).

(a) the species is rare within the region or ecological district where the area is located; or

Overall, meets this criterion

(b) the protection of the species in that location is important for the persistence of the species as a whole.

4.3 Predator pressure

There is a partial control programme in place for ferrets, but no other introduced predators of lizards across the DDF or the ESA. Occasional shooting is undertaken for rabbits, which may also kill feral cats or pigs on occasion.

Therefore, it is assumed that introduced predator populations are present, are not controlled by human activities, and are likely to have wide-ranging impacts on lizards across the ESA.

During the survey of introduced pests across the site, HabitatNZ also assessed diets by analysing the stomach contents of pest mammals through eDNA sampling. In total, 66 animals were sampled for (see below).

- 5 feral cats
- 13 feral pigs
- 25 ferrets
- 6 mice
- 8 hedgehogs
- 9 possums

Of the 66 animals sampled, lizard DNA was found within seven of the gut samples, belonging to feral cat (1), hedgehog (3), and ferret (3).

The feral cat and ferrets had consumed tussock skink and McCann's skink, and the hedgehogs had consumed McCann's skink.

While the incidence of predation appears low, the context for this is important, as introduced predators will feed near daily, and native lizards are slow to reproduce.

Observations of feral cat predation of native lizards elsewhere in New Zealand have recorded up to 49 skinks in a feral cat stomach (Otago record 2025), highlighting that even low numbers of introduced mammalian pests can potentially have an enormous impact on lizards.

The proportion of lizards that had lost tails and regrown them (tail regeneration) can be used as an indicator of predator pressure. All captured lizards from ACOs and pitfall traps were assessed for regenerating tails.

Tail regeneration occurrence was:

- McCann's skink 97 out of 377 skinks (25.7 %);
- Tussock skink 7 out of 31 skinks (22.6 %);
- Kawerau gecko 144 out of 572 geckos (25.2 %).

Tail loss (and regeneration) for Kawerau geckos recorded in the ESA from these investigations is similar to the proportion of tail loss for a similar species of gecko at Alexandra, south of the Matakanui site, in the presence of uncontrolled introduced predators (23.8 %) from a recent study²⁹.

This suggests that geckos (if not also skinks) within the ESA and DDF are experiencing pressure from uncontrolled levels of introduced mammalian predators.

²⁹ Turner S and Norbury G. 2023. Population responses of common lizards inside a predator free dryland sanctuary. NZ Journal of Ecology: 47 (1)

5.0 Potential adverse ecological effects

In this section, the potential effects on lizard values are outlined to assist with the ecological effects assessment that has been prepared separately by Alliance Ecology Ltd.

These potential effects are indicative only, based on our experience, and should be considered in that context as they inform the more detailed assessment.

Prior to mitigation, the project will result in the following direct effect on lizard values:

- Temporary loss of approx. 610 ha of lizard habitat within the DDF, with restoration through rehabilitation of most habitat types and development of viable habitat capable of supporting lizard populations as is outlined in the Landscape and Ecological Rehabilitation Management Plan;
- Net loss of some lizard habitats that may not be able to be replicated in the rehabilitation areas, such as herbfield-cushionfield;
- Disruption to lizard communities through salvage and relocation of lizards from the DDF prior to habitat clearance, and release into neighbouring areas of Ardgour station set up for the management of native lizards; and
- Injury and death to some small portion of native lizards within the DDF that are not relocated prior to habitat removal, or which do not survive the relocation and release process.

Note, this section does not represent a comprehensive effects assessment, but rather an indicative list of effects considerations to guide the preparation of a full effects assessment report by Alliance Ecology.