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HERPETOFAUNA SURVEY & ASSESSMENT

MACRAES PHASE 4 PROJECT

21 MARCH 2024

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MACRAES PHASE 4 PROJECT

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1 EXECUTIVE SUMMARY

- OceanaGold (New Zealand) Limited is proposing to extend the life of mine ("LOM") at its Macraes Gold Project ("MGP"). The Macraes Phase 4 ("MP4") Stage 3 Project is an extension to the existing consented projects and would extend the LOM to around year 2030. The MP4 Project is comprised of ten Project Components ("PCs"), each of which represents an area of mine that would be subject to development, including the construction of new haul roads, realignment of existing roads, mining pit and waste rock stack expansions and rehandling of an area of waste rock.
- Native herpetofauna surveys of the MP4 Project area were undertaken by a herpetologist in April 2022 and September 2022 to inform an assessment of herpetofauna values and effects. Three species of native lizards (*Oligosoma maccanni*, *Oligosoma chionochloescens*, and *Woodworthia* "Otago/ Southland large") were identified in areas subject to direct and/ or indirect impacts as a result of the proposed MP4 activities. All three species are legally protected, and the latter two species are listed at 'At Risk—Declining' under the New Zealand threat classification system.
- Ten broad habitat types were identified in the MP4 Project area. The value of these habitats for lizards varied markedly, as some (e.g., mine workings) offered no habitat for lizards while others (e.g., rock tors, tussock) offer high quality habitat. A habitat suitability score for each of the PCs was assigned and these ranged from Very Low to High.
- The MP4 Project will have direct adverse impacts on a potentially large, but unquantified, number of native lizards and on approximately 90 ha of suitable or potentially suitable lizard habitat. Indirect adverse impacts may extend over an additional 79 ha of suitable or potentially suitable lizard habitat immediately adjacent to areas of direct impact and may affect to a lesser degree a similarly large number of native lizards. The magnitude of effects on native lizards, considering timescale, permanence, cumulative effects, and climate change impacts, were assessed as Negligible to Moderate.
- The levels of effect on native lizards (in the absence of mitigation measures), which accounted for ecological value and magnitude of effect, were considered to range from Very low to High depending on the nature of the PC.
- Mitigation measures that follow the mitigation hierarchy (avoid, remedy, mitigate, offset, or compensate) are required to reduce the level of impact on native lizards for MP4. Such measures are recommended but not outlined in this report and are addressed specifically in accompanying mitigation and impact management reports prepared by Ahikā Consultants and the Lizard Management Plan prepared by Bioresearches.

2 INTRODUCTION

2.1 MP4 STAGE 3 PROJECT OVERVIEW

OceanaGold is proposing to extend the life of mine ("LOM") at its Macraes Gold Project ("MGP"). The Macraes Phase 4 ("MP4") Stage 3 Project (hereafter "MP4 Project") is an extension of existing consented projects (e.g., Macraes Phase 3 [MP3]) and would extend the LOM to around year 2030. The primary development activities associated with the MP4 Project include open mining pit expansions (Coronation Pit Stage 6, Innes Mills Pit Stages 9–10, and Golden Bar Stage 2 Pit), waste rock disposal (in pit backfilling and extending the Golden Bar Waste Rock Stack), rehandling waste rock from Northern Gully Waste Rock Stack, ore stockpiling, a minor road realignment of Golden Bar Road.

The MP4 Project covers a total area of approximately 537 ha (i.e., Zone of Impact; "ZOI"), which includes a 296 ha impact footprint area (where mining activities will take place) and a 240 ha buffer zone (a 100 m buffer area surrounding the impact footprint where indirect effects of mining activities may be realised). The 537 ha project area is divided into ten[1] Project Components ("PCs"), each of which represents an area of mine that would be subject to development. The PCs range in size and are distributed widely across the OGL landholdings (Figure 2.1). Existing resource consent (consented under Macraes Phase 3, "MP3") is held by OGL for mining activities over most (307 ha or 57%) of the 537 ha MP4 Project area. Stage 3 seeks to obtain resource consent for an extension of mining activities over the differential 229 ha of land, which includes 124 ha of land directly impacted by mining and 105 ha in a surrounding buffer zone where indirect effects are anticipated (i.e., some of the areas within the ZOI are already consented and therefore, effects on those areas have already been considered and addressed elsewhere) (Table 2.1; Figure 2.1).

Ecological impacts (both direct and indirect) arising from the MP4 Project are expected to occur within each of the identified PCs. Due to the presence and potential number of protected native lizards within the project area, potential adverse effects on lizards and their habitats are anticipated. This herpetofauna survey and impact assessment describes the herpetological values within and surrounding the MP4 Project area and identifies potential impacts of the proposed development activities on those values.

The report should be read and interpreted alongside similar ecological assessments prepared for vegetation and avifauna (Ahikā Consulting, 2024a) and terrestrial invertebrates (Bioresearches, 2024a) of the MP4 area. In addition, lizard mitigation is detailed in the Lizard Management Plan prepared by Bioresearches (Bioresearches, 2024b) and a summary of the overall values and effects on terrestrial ecology is provided by Ahikā Consulting (2024b).

Also contributing to the MP4 LOM plan, is the Top Tipperary Tailings Storage Facility ("TTTSF") RL570m raise project. The TTTSF was consented as part of MPIII and there was a requirement to secure additional tailings storage capacity at TTTSF until early 2025. To enable increased capacity, an embankment raise from RL568 to RL570 to create an additional 3.05 Mm^3 of storage capacity (equating

[1] For the purposes of this document the Frasers Backfill and Frasers WRS are combined into a single Frasers BF/WRS project component as these features will have very similar effects (being earthworks associated with excavation or deposition of rock) with large areas of overlap.

to approximately 8 months of tailings storage) is proposed. The ecological (including herpetological) effects of this project are addressed by separate consent application (see Bioresearches, 2022) and therefore, are not addressed as part of the current herpetofauna assessment. Similarly, the Innes Mills 8 Pit expansion part of the Consent Continuity Project has been detached from Stage 3 and a separate resource consent is being sought.

Areal extent measurements

Areal extent measurements (in hectares, "ha") of Project Component footprints and buffer zones were taken from shape files supplied by OceanaGold Limited and using high-definition aerial photographs (i.e., LINZ aerial basemaps and high-definition drone images) in the GIS programme, QGIS (v. 3.34.3). Similarly, the areal extents of various identified habitat types were mapped based on the most recently available (2020–2023) aerial imagery.

While all measurements were regarded as accurate at the time of report delivery, it is acknowledged that variations in areal extents across this and other technical reports are expected due to mapping inconsistencies by authors. Any discrepancies will be minor and should be considered immaterial given the landscape scale of the MP4 Stage 3 project.

Table 2.1. Macraes Phase 4 Project Components (PCs) and their areal extents (in ha), total area inside the footprints and 100 m buffers of all PCs combined (non-overlapping), and the overall area of the Zone of Impact (ZOI) (i.e., all PCs combined excluding PC overlap).

	Project Component name	Acronym	PC footprint area (ha)	PC buffer area (ha)	Unconsented PC footprint area (ha)	Unconsented PC buffer area (ha)
1	Coronation 6 Pit	CO6 Pit	25.0	27.1	5.5	7.1
2	Coronation North Backfill	CN BF	37.6	30.5	0.05	2.1
3	Northern Gully Waste Rock Stack	NGWRS	21.2	0[2]	21.2	0
4	Golden Bar Stage 2 Pit	GB2 Pit	22.7	20.1	22.7	20.1
5	Golden Bar Waste Rock Stack	GB WRS	48.0	32.8	48.0	32.8
6	Innes Mills Stage 9 Pit	IM9 Pit	5.6	15.6	5.6	6.1
7	Innes Mills Stage 10 Pit	IM10 Pit	5.9	16.3	5.9	8.2
8	Frasers Backfill/Waste Rock Stack	Frasers BF/WRS	91.1	47.1	0	0.4
9	Golden Bar Road realignment (indicative)	GB RR	1.2	16.6	1.2	16.6
10	Golden Point Backfill Buttress	GP BB	38.1	40.1	14.2	17.1
	Total area inside footprints and buffers (non-overlapping)		**296.4**	**240.2**	**124.3**	**105.3**
	Total area inside ZOI		**536.6**		**229.6**	

[2] It should be noted that the NGWRS footprint area is highly conservative. That is, the actual extent of the impact associated with the rehandling of waste rock will be smaller the PC outline. Therefore, the 100 m buffer has not been applied and instead, the PC outline represents an estimate of the total area of impact inclusive of a buffer zone.

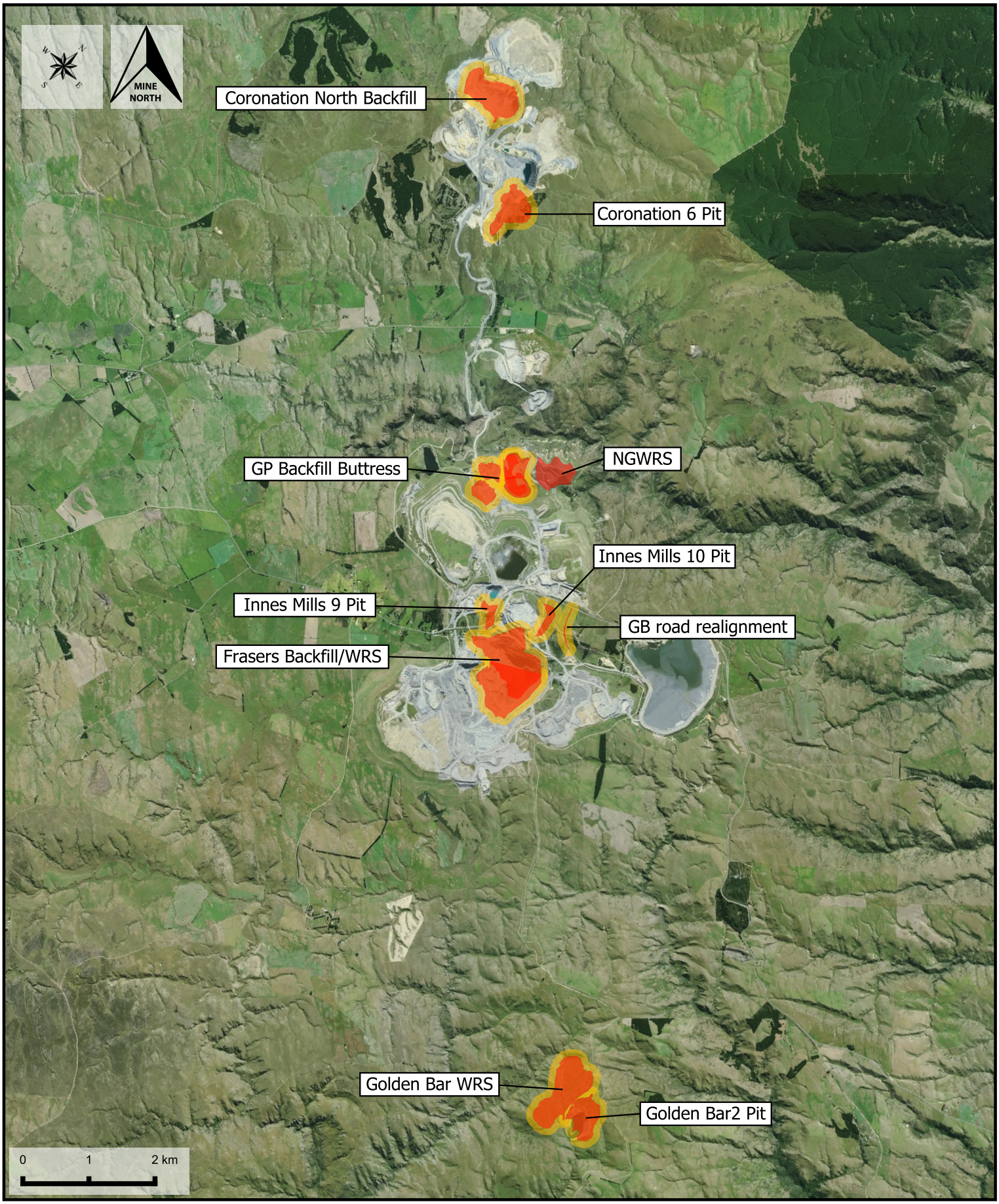

Figure 2.1
Macraes MP4 Stage 3: Zone of Impact (ZOI)

CLIENT / PROJECT
OceanaGold Limited

13 February 2024

MAP PROJECTION:
NZGD2000 / New Zealand Transverse Mercator 2000

SOURCES:
LINZ Basemap aerial

SCALE **@ A4 1:75,000**

61130#BEE09

Legend

MP4 Zone of Impact
Project Components

Impact areas (direct impact)

100 m buffer (indirect impact)

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

2.2 PURPOSE AND OBJECTIVES OF THE HERPETOFAUNA ASSESSMENT

The purpose of the assessment was to document and describe the herpetofauna community and herpetofauna habitats present within the MP4 Project area, to understand the potential effects of the proposed activities on protected native lizards.

More specifically, the objectives of the assessment included:

1) Describing the presence and relative abundance of native lizards within the ZOI;
2) Identifying and quantifying areas of suitable native lizard habitat in the ZOI; and
3) Assessing the herpetological values and potential adverse effects on those values within the ZOI in the context of legislation (Resource Management Act 1991; Wildlife Act 1953), policies (National Policy Statement for Indigenous Biodiversity; Otago Regional Policy Statement), and plans (Waitaki District Plan).

2.3 STATUTORY CONTEXT

This section summarises the legislation, policy, plans and strategies relevant to the protection, conservation and enhancement of the herpetofauna community and herpetofauna habitats associated with the project area. The ecological values described in this report allow significant ecological issues and adverse effects to be identified as they relate to the RMA. The identification of significant values are consistent with standards and objectives of the following legislative, policy statement and regional plan documents.

2.3.1 Legislation

2.3.1.1 Resource Management Act 1991 (“RMA”)

The purpose of the RMA is to achieve sustainable management. Important elements of this are the maintenance of indigenous biodiversity and protection of significant indigenous vegetation and habitats. The RMA requires that any adverse effects of development be avoided in the first instance, and where avoidance is not reasonably practicable, impacts should be minimised, remedied, or mitigated. These elements are given effect in Sections 5, 6 and 7, and Schedule 4 sets out the requirements for effects assessments.

2.3.1.2 Wildlife Act 1953

The Wildlife Act (1953) provides statutory protection for all native wildlife, excluding those species listed in Schedules 1–5. All native reptiles and amphibians are protected under the Act.

2.3.2 National Policy Statement for Indigenous Biodiversity (2023)

The National Policy Statement for Indigenous Biodiversity (“NPSIB”) sets out objectives, policies, and implementation requirements to manage natural and physical resources to maintain indigenous biodiversity (i.e., the maintenance and at least no overall reduction in biodiversity and where

necessary, restoration and enhancement of ecosystems and habitats) under the RMA. It outlines a system for the management of biodiversity outside of public conservation land. Appendix I of the NPSIB sets out the criteria for identifying significant indigenous vegetation or significant habitats of indigenous fauna, to determine whether an area qualifies as a Significant Natural Area.

2.3.3 Regional Policies, Plans and Acts

This project is situated within the Waitaki District Council ("WDC") territorial boundary. It is also within the jurisdictional boundaries of the Otago Regional Council ("ORC") and Department of Conservation's Kā Moana Haehae/ Alexandra Office.

2.3.3.1 Partially Operative Otago Regional Policy Statement (2019)

The Partially Operative Otago Regional Policy Statement ("POORPS") provides a policy framework that aims to achieve long term environmental sustainability by integrating the protection, restoration, enhancement, and use of Otago's natural and physical resources. The POORPS gives effect to the statutory requirements set out in the RMA, as well as other statutes, national direction instruments and iwi authority planning documents. Regional and district plans must give effect to the POORPS.

Under the POORPS, the following objectives and policies apply to the MP4 Project:

Objectives

- 3.1 The values (including intrinsic values) of ecosystems and natural resources are recognised and maintained, or enhanced where degraded;
- 3.2 Otago's significant and highly valued natural resources are identified, and protected or enhanced where degraded;
- 4.2 Otago's communities are prepared for and able to adapt to the effects of climate change.

Policies

- 3.1.9 Ecosystems and indigenous biodiversity;
- 3.1.13 Environmental enhancement;
- 3.2.1 Identifying significant indigenous vegetation and habitats;
- 3.2.2 Managing significant indigenous vegetation and habitats; and
- 4.2.2 Climate change.

Criteria for the identification of areas of significant indigenous vegetation and habitat of indigenous fauna are provided in Schedule 4 of the POORPS.

2.3.3.2 Proposed Otago Regional Policy Statement (2021)

The Proposed Otago Regional Policy Statement ("PORPS") is a new RPS that will implement the National Planning Standards and respond to a range of new national direction introduced in 2020, including the National Policy Statement for Freshwater Management. It will set the direction for future management of Otago's natural and physical resources.

Under the PORPS, the following objectives and policies would apply to the MP4 Project:

Objectives:

- ECO–O1 – Indigenous *biodiversity*: Otago's indigenous biodiversity is healthy and thriving and any decline in quality, quantity and diversity is halted;
- ECO-02 – Restoring or enhancing: A net increase in the extent and occupancy of Otago's indigenous biodiversity results from restoration or enhancement; and
- ECO-03 – *Kaitiakiaka* and stewardship: *Mana whenua* are recognised as kaitiaki of Otago's indigenous biodiversity, and Otago's communities are recognised as stewards.

Policies:

- ECO-P1 – *Kaitiakitaka*: Recognise the role of Kāi Tahu as kaitiaki of Otago's indigenous biodiversity;
- ECO-P2 – Identifying *significant natural areas* and taoka;
- ECO-P3 – Protecting *significant natural areas* and taoka,
- ECO-P4 – Provision for new activities: Maintain Otago's *indigenous biodiversity* by following the sequential steps in the effects management hierarchy set out in ECO–P6;
- ECO-P6 – Maintaining indigenous *biodiversity*: Maintain Otago's indigenous *biodiversity* (excluding the coastal environment and areas managed under ECO–P3) by applying the following *biodiversity* effects management hierarchy in decision-making on applications for *resource consent* and notices of requirement; and
- ECO-P8 – Enhancement: The extent, occupancy and condition of Otago's indigenous *biodiversity* is increased.

As well as

- APP2 – Significance criteria for indigenous *biodiversity*,
- APP3 – Criteria for *biodiversity* offsetting, and
- APP4 – Criteria for *biodiversity* compensation.

2.3.3.3 Waitaki District Plan (2010)

The Waitaki District Plan ("WDP") sets out the objectives, policies, and rules governing the use of land within the district to achieve integrated and sustainable management of the district's resources and achieve the purpose of the RMA.

Specifically relevant to the MP4 Project, are objectives and policies pertaining to the extraction of minerals in a way that avoids, remedies, or mitigates adverse effects on the environment (Objective 6, Policies 6) and the maintenance of biological diversity, nature conservation values, and ecosystem functioning within the district. Policy 16.9.3 lists criteria to identify areas with significant indigenous vegetation or significant habitats of indigenous fauna.

Furthermore, the WDP includes a mapped area entitled "Proposed Skink Management Area in Waitaki District. Version November 2004" (Annexure 1 of the WDP). The mapped area is comprised of six, discrete, non-overlapping areas that encircle important habitat for 'Nationally Endangered' grand and Otago skinks (Townsend *et al*., 2008; Hitchmough *et al*.,

2021). Rules relating to the Skink Management Area are found in Chapter 4 Rural Zones of the operative Waitaki District Plan and include prohibition of earthworks, indigenous vegetation clearance, and exotic tree planting in the area.

The Skink Management Area overlays areas of OceanaGold landholdings; however, it does not extend into the MP4 ZOI. Thus, it has no relevance to the current assessment other than acknowledging its presence and purpose.

2.3.3.4 Draft Waitaki District Plan (2022)

The Draft Waitaki District Plan (DWDP) represents a review of the existing WDP 2010 in line with the RMA, which requires that all Councils review their District Plan every 10 years. Once operative, the new plan will replace the WDP 2010. Under the DWDP, the following objectives and policies would apply to the MP4 Project:

Objectives

- ECO-01 – Halt the decline of indigenous biological diversity;
- ECO-2 – Identify and protect Significant Natural Areas; and
- ECO-03 – Restore or enhance Significant Natural Areas.

Policies

- ECO-P1 – Evaluation of Significant Natural Areas;
- ECO-P2 – Protection of Significant Natural Areas;
- ECO-P3 – Appropriate activities within Significant Natural Areas;
- ECO-P4 – Inappropriate activities within or near to Significant Natural Areas;
- ECO-P5 – Managing indigenous vegetation outside Significant Natural;
- ECO-P6 – Supporting the maintenance, restoration, and enhancement of indigenous biodiversity;
- ECO-P7 – National priorities for protection;
- ECO-P8 – Impacts of climate change on resilience of ecosystems;
- ECO-P9 – Hutia te Reo: Recognise the role of mana whenua as kaitiaki of indigenous biodiversity within their rohe, providing for mana whenua involvement in the management of indigenous biodiversity and ensuring that Hutia te Rito is recognised and provided for.

As well as:

- APP3 – Criteria for evaluating the significance of indigenous vegetation and habitats of indigenous fauna.

3 HERPETOFAUNA SURVEY

3.1 SURVEY METHODS

3.1.1 Literature review/ desktop assessment

To investigate the diversity and distribution of herpetofauna within ZOI and surrounding landscape, a desktop assessment involving a review of all available herpetofauna records held in governmental organisation, citizen science, and private databases was undertaken. Databases reviewed included the Department of Conservation ("DOC") Bioweb Herpetofauna database, iNaturalistNZ (*https://inaturalist.nz/*)[3], and records either held by the author or extracted from unpublished technical reports (Ecogecko, 2015; Bovill, 2018; LizardExpertNZ, 2021).

3.1.2 Systematic searches

Systematic searches, also known as visual encounter searches ("VESs") (Whitaker, 1994; Lettink & Hare, 2016), were undertaken by D. van Winkel during two site visits in April 2022 (2–4 April and 18–20 April). Systematic searches were used to collect information on lizard presence and relative abundance using catch-per-unit-effort indices (e.g., lizards/ person search hour).

Searching involved systematically moving through the PCs and visually and/ or hand searching habitats for lizards. Specifically, the following methods were used.

1) **Rock-scanning**
   Tors and rock piles were sought out in the landscape and a standardised rock-scanning method was used to search for skinks (Patterson, 1992). First, the observer stood stationary 10 m away from the rock surface and used binoculars to scan the rock feature from left to right, top to bottom. If no skink was seen, the observer then moved five metres forward and scanned once more with binoculars. If still no skink was seen, the observer then moved right up to the rock and thoroughly searched each surface and crevice, sometimes with the aid of a torch. In addition to rock tors, areas supporting complex native shrubland were also searched using this technique, primarily to detect arboreal jewelled geckos (*Naultinus gemmeus*).

2) **Habitat searches**
   Habitat searches entailed physically searching features in the landscape (e.g., rocks, woody debris, rock slabs) but lifting or moving them aside to reveal inactive refuging lizards. All habitat features were carefully lifted to not harm occupants and all features were replaced in the same position in which they were found.

3) **Opportunistic visual encounters**

[3] iNaturalist is a website that serves the purpose of sharing information about identification, distribution, and biodiversity of all organisms, and is used worldwide by a variety of individuals from amateurs to specialists. iNaturalist provides useful information into the distribution of species in New Zealand and provides insight into the species observed in the Macraes ED. Records were scrutinised by Bioresearches ecologists, and only used to inform the assessment when certainty could be given regarding the identification (i.e., identified by a known New Zealand expert).

Visual searches were undertaken while walking through the landscape and all opportunistic encounters of disturbed, fleeing, and sun-basking lizards were noted.

Search routes were recorded continuously on a hand-held GPS (GARMN GPSMAP® 64sx) and all lizard observations were also recorded on a GPS. Lizard sign (i.e., scat, sloughed skin) was noted where found.

Searches were carried out during the daytime, typically between 0900 hrs and 1800 hrs. Nocturnal searching was not undertaken because overnight temperatures during the survey periods were considered too low (≤ 10°C) for reliable gecko activity.

All systematic search data were standardised to a catch per unit effort ("CPUE") metric, by correcting for person search effort. No attempt was made to estimate the lizard population size in the PCs because the observational data collected during the survey was relatively coarse and because of the high uncertainty around detection probabilities and habitat occupancy of local lizard taxa.

Six of the PCs (CN BF, NGWRS, IM9 Pit, IM10 Pit, Frasers BF, and GP BB) were not visited nor searched for herpetofauna during the survey[4]. The reason being that most of the land within these PCs consisted of operational mine workings that do not provide suitable habitat for lizards, and because survey time constraints meant that the highest quality habitats (e.g., tussock, rock tors) needed to be prioritised over lower quality habitats (e.g., exotic pasture). The herpetofauna values in relation to the unvisited areas were determined via a desktop exercise, involving a review of high-definition aerial imagery and ground-based photographs to quantify habitat values. In addition, information on lizard presence/ relative abundance obtained from visited areas of the MP4 Project were used to inform likely herpetofauna presence and community composition in unvisited PCs (i.e., lizard presence in unvisited PCs was not ignored nor discarded).

3.1.3 Habitat mapping and suitability assessment

During the site visits, broad habitat types were identified in the footprint and 100 m buffer zone areas, and the areal extents (hectares; "ha") of these were subsequently mapped. For PCs that were not visited by the Project herpetologist, recent (2022) high resolution aerial drone photographs and ground-based photographs were viewed and used to map broad habitat types.

The quality of each habitat type for native lizards was determined through a qualitative process that considered observations of lizards in specific habitats, habitat age and complexity, habitat availability relative to the surrounding landscape, and habitat irreplaceability. Habitats were ranked in order from highest to lowest quality for native lizards.

In addition, quantitative assessments of rock tor habitat and lizard occupancy of tors within each of the visited PCs were carried out. This was achieved by counting the total number of discrete rock tors/ rock tor complexes within each PC based on ground-truthing and/ or high-definition aerial imagery and assigning each visited rock tor a binary score to describe lizard occupancy.

[4] IM9 Pit, IM10 Pit, and NGWRS were subsequently visited by Ahikā Consulting staff in early 2024 and habitat descriptions and ground-based photographs shared with the author, to assist with the current lizard assessment.

Assigned binary lizard occupancy scores included:

a) "Unoccupied" = scored "0" if no lizard(s) nor lizard sign was observed, or
b) "Occupied" = scored "1" if a lizard(s) or lizard sign was observed.

The proportion of rock tors visited within each PC area was estimated and the proportion of "Occupied" versus "Unoccupied" tors compared.

Based on high-definition aerial photographs, no rock tors were identified in the CN BF, NGWRS, IM9 Pit, IM10 Pit, Frasers BF, GB RR, and GP BB PCs. Therefore, lizard occupancy for tors in these PCs was irrelevant.

A similar approach was taken with respect to rock pile availability and lizard occupancy. However, it was too difficult to quantify the total number of rock piles within each PC either through ground-truthing or visualising aerial imagery, due to the high abundance or rock piles. Instead, the number of visited rock piles was recorded and the proportion of those occupied by a lizard(s) noted. For PCs not visited by Project herpetologist, rock pile availability and lizard occupancy was not assessed (see section 3.3.4 "Limitations").

3.1.4 Implementing (project) herpetologist

This survey was implemented by an experienced and Department of Conservation-authorised herpetologist, Dylan van Winkel, under WAA (37604-FAU).

3.2 SURVEY RESULTS

3.2.1 Desktop assessment

Herpetofauna (reptiles and amphibians) comprise a significant component of New Zealand's terrestrial fauna. Lizards, including skinks and geckos, are represented by over 125 endemic taxa[5] (van Winkel *et al*., 2018; Hitchmough *et al.,* 2021; Purdie, 2022) and of these, more than 89% are assigned conservation threat statuses of 'Threatened' or 'At Risk' of extinction (Hitchmough *et al.,* 2021). All native herpetofauna are legally protected under the Wildlife Act 1953 (and subsequent amendments) and significant habitats[6] of indigenous fauna (including lizards) are protected under Section 6(c) of the Resource Management Act 1991. Resource Management Act protections are covered by significance criteria in relevant regional and district plans. These protection measures do not extend to introduced herpetofauna (e.g., introduced Australian frogs).

The Otago Region is renowned for its high lizard diversity and abundant lizard populations due in part to the nature of the schist rock, which tends to form horizontal crevices and large flat pancake-like stacks of rock slabs that provide habitat and refuge for lizards. The region currently supports 31 native

[5] The term "taxa" is used instead of "species" because many New Zealand lizards, including some present within the project area, have not been formally described to species level.
[6] The term 'significant' is not defined by the RMA but for the purpose of this assessment, "significant habitats" has been interpreted as habitat that provides all the necessary needs for persistence of lizard populations in an environment (i.e., food, shelter, areas for reproduction). It is weighted more heavily towards habitats for Threatened or 'At Risk' species.

lizard taxa and two introduced frogs. Macraes Ecological District ("Macraes ED"), which covers an area of 1.14 M ha, supports a much lower herpetofauna diversity; represented by seven[7] lizard taxa and one introduced and naturalised frog species (Table 3.2). Macraes ED is the strong-hold for populations of threatened grand (*Oligosoma grande*) and Otago skinks (*O. otagense*).

A review of historical herpetofauna records from the landscape surrounding OceanaGold landholdings (within a radius of 20 km) revealed records for eight native lizard taxa[8] and one introduced frog species (Table 3.2). Observations of all eight taxa have been reported within the last 1–7 years. Worthy of note is that the land on which the DOC Grand and Otago Skink (GAOS) Recovery Programme is located, fell within the 20 km radius zone and as a result some of the lizard records (e.g., Otago green skink) are from within the mammalian predator exclusion fences established to assist in the recovery of threatened lizards.

Of the eight lizard taxa from the wider landscape, two are listed as 'Nationally Endangered', five as 'At Risk – Declining', and one as 'Not Threatened' under the New Zealand Threat Classification System (Townsend *et al.,* 2008; Hitchmough *et al*., 2021) (Table 3.2).

A considerable amount of work focussed on herpetofauna has been undertaken at Macraes Mine over the last four decades. This has included numerous surveys and, in some cases, salvage-relocations, associated with resource consent applications for mine expansion. The most recent work was undertaken between 2018 and 2020 and involved surveys and a salvage-relocation programme for lizard populations affected by the Deepdell North III Project. Four lizard taxa, including korero gecko, McCann's skink, tussock skink, and herbfield skink were impacted by the Deepdell North III project (Thorsen, 2019). A total of 1,268 lizards were captured and relocated into protected habitats elsewhere on OceanaGold landholdings (LizardExpertNZ, 2021).

Of note is the potential presence of two 'Nationally Endangered' lizard species, Otago (*Oligosoma otagense*) and grand skink (*O. grande*), and a large 'At Risk-Declining' species, the Otago green skink (*Oligosoma* aff. *chloronoton* "Eastern Otago" [Clade 3b; Greaves *et al.,* 2007]). These species are known to occur in the surrounding landscape (DOC Herpetofauna database; Ecogecko*,* 2015) but all are rare, probably because they are large and more heavily impacted by exotic mammalian predators. The most recent committed attempt to locate Otago green skink on OceanaGold landholdings at Macraes was unsuccessful (Ecogecko*,* 2015). However, recent (2023) observations of this taxon in the Deepdell Station Ecology Covenant (M. Tocher, pers. comm. 31/01/2024) indicate this taxon may persist at low densities elsewhere on the landholdings. Two individual Otago skinks were recorded during the 2015 Otago green skink survey, and these records are notable as they were made within 2.3 km of the Golden Bar2 Pit and Golden Bar WRS project component areas in the adjacent stream catchment to the west (Ecogecko*,* 2015). Furthermore, the remains of grand skinks were reported from deconstructed rock tors in the Deepdell North III Project area in 2021 (LizardExpertNZ, 2021) and two individual grand skinks were observed in the proposed Redbank Ecological Covenant on OceanaGold

[7] There are few records of jewelled geckos (*Naultinus gemmeus*) in the wider surrounding landscape, most of which occur to the northeast in the Waianakarua Ecological District. One "suspect" *Naultinus* sp. was reported from the southern extent of the Macraes ED (approximately 40 km southwest of the OceanaGold Macraes operation) in 1980. See further discussion on *Naultinus gemmeus* in the main text below.

[8] The 20 km radius extends outside of the Macraes ED to the north and captures records of *N. gemmeus* hence the eight lizard taxa, compared to seven recorded within the Macraes ED.

landholdings, approximately 6.5 km west of Golden Bar WRS and 4.5 km southwest of IM9 Pit, in December 2023 (L. Sherwood, Ahikā Consulting; pers. obs., 01/12/2023). These records indicate that remnant populations of rarer threatened species (grand and Otago skink) occur in the surrounding landscape, and potentially within the buffer zones of some MP4 PCs (e.g., Golden Bar WRS) where suitably complex rock tor habitat occurs.

The tussock skink (*Oligosoma chionochloescens*) is a member of the *Oligosoma polychroma* species complex. Liggins *et al.* (2008) distinguished five deep genetic clades ('Clade 1' through to 'Clade 5'), which have subsequently been treated as distinct species (van Winkel, *et al*., 2018; Hitchmough *et al*., 2021). The southern grass skink (Clade 5) represents the southern lineage of this species complex with populations distributed from central and southern Canterbury (including around Christchurch and on Banks Peninsula), Otago and Southland, and across the Foveaux Strait to Stewart Island/ Rakiura. More recently, *O*. aff. *polychroma* Clade 5 has been split into two separate entities, including tussock skink *Oligosoma chionochloescens* (Jewell, 2022a) (recognising the southern population or lineage of *O*. aff. *polychroma* Clade 5), while the remaining populations (those north of the Ida Range) are retained under entity *O*. aff. *polychroma* Clade 5. The tussock skink is a widely distributed species that occurs at high population densities in suitable habitats across its range. In the Macraes ED, this taxon is most frequently associated with dense vegetation and areas of damper ground (e.g., seeps, depressions, gullies) but it is also found in association with rocky habitats.

The herbfield skink (*Oligosoma murihiku*) is a recently recognised member of the cryptic skink (*O. inconspicuum*) species complex (Jewell, 2019; Hitchmough *et al.,* 2021; Jewell, 2022b) and in 2022, it was elevated to full species (Jewell, 2022b). Herbfield skink is widely distributed across the south-eastern areas of the South Island, from Macraes southwards and eastwards to Tiwai Peninsula in Southland. Herbfield skinks are in decline across their entire range and populations seem especially vulnerable to habitat modification such as land conversion for agriculture, draining of wetlands, and possibly weed incursion (Jewell, 2022b).

The jewelled gecko (*Naultinus gemmeus*) is an uncommon and sparsely distributed species in dryland ecosystems of Central and Eastern Otago. Indeed, Jewell & McQueen (2007) reported that the jewelled gecko may be close to extinction in dry parts of Otago due to habitat removal and modification by post-settlement fire and pastoralism. While recent (2017–2019) records of jewelled geckos are known within 20 kms of the OceanaGold Macraes landholdings, these records are all from Waianakarua Scenic Reserve, which is located approximately 20 km northeast of MP4 Project area, north of Shag River in the Waianakarua Ecological District. One historical record of a *Naultinus* sp. (presumably *N. gemmeus*) from 1980 exists at the southern extent of the Macraes ED (approximately 40 km southwest of OceanaGold Macraes landholdings). This record is labelled as "suspect" in the DOC Herpetofauna database. The reason for the 'suspect' designation is unknown but may be because there are no existing photographs of the individual to verify *Naultinus* and/ or due to a lack of other verified *Naultinus* records from the Macraes ED. None of the historical surveys or salvages undertaken on OceanaGold landholdings to date have detected the presence of jewelled geckos and while it is considered highly unlikely that this species occurs in the MP4 Project area its absence cannot be dismissed completely. Jewelled geckos are highly cryptic and do persist in small pockets of habitat in dryland Otago. Site characteristics that are considered to have contributed to the persistence of jewelled geckos in Central Otago include refugia from historic fires (boulder fields and bluffs),

persistence of diverse and woody vegetation, dense and/ or tall vegetation and rocks, and warm basking sites and refugia from extreme cold during winter (Jewell & McQueen, 2007). Some of these habitat characteristics are found in the MP4 Project area.

Table 3.2. Herpetofauna of the Macraes Ecological District, corresponding NZ threat status (Hitchmough *et al.*, 2021), and status (✓ = recorded; x = not recorded) within 20 km of MP4 Project area and the Macraes ED.

	Common name	Scientific name	NZ threat status*	Date of most recent record	Recorded in Macraes ED	Reported within 20 km
Native	Otago skink	*Oligosoma otagense*	Nationally Endangered	2016	✓	✓
	Grand skink	*Oligosoma grande*	Nationally Endangered	2023[A]	✓	✓
	Korero gecko	*Woodworthia* "Otago/ Southland large"	At Risk – Declining	2023	✓	✓
	Jewelled gecko	*Naultinus gemmeus*	At Risk – Declining	2019[B]	?[A]	✓
	Tussock skink	*Oligosoma chionochloescens*	At Risk – Declining	2024	✓	✓
	Herbfield skink	*Oligosoma murihiku*	At Risk – Declining	2019	✓	✓
	Otago green skink	*Oligosoma* aff. *chloronoton* "eastern Otago"	At Risk – Declining	2023[C]	✓	✓
	McCann's skink	*Oligosoma maccanni*	Not Threatened	2024	✓	✓
Exotic	Whistling tree frog	*Litoria ewingii*	Introduced & Naturalised	2023	✓	✓

[A] In December 2023, two grand skinks (a juvenile and an adult) were observed on rock tors in the proposed Redbank Ecological Covenant on OceanaGold landholdings, approximately 6.5 km west of GB WRS and 4.5 km southwest of IM9 Pit (L. Sherwood, Ahikā Consulting; pers. obs., 01/12/2023).

[B] Single record from Waianakarua Scenic Reserve, located north of Shag River and approximately 17.5 km northeast of MP4 Project area.

[C] In January 2023, a tracking tunnel print believed to be from an Otago green skink was recorded in the base of a valley in Deepdell Station Ecology Covenant, approximately 5.6 km due west of the Coronation 6 Pit PC (M. Tocher, unpub. data). This record was later (late 2024) verified by the observation of a live Otago green skink close to the location of the tracking tunnel that recorded the print (M. Tocher, pers. comm. 31/01/2024).

3.2.2 Systematic searches

Seventy-two individual lizards comprising three taxa (McCann's skink, tussock skink, and korero gecko) were detected during the survey (Figure 3.1). In addition, four individual whistling tree frogs were detected (Figure 3.1). Mapped herpetofauna records for each PC are shown in Appendix I.

Differences in species diversity (total number of individuals and species composition) and relative abundance of lizards across the PCs was observed (Figures 3.2 and 3.3). Golden Bar WRS had the highest diversity (three taxa), number of lizards (n = 44), and relative lizard abundance (11.9 lizards/ person hour, incl. all three taxa). Only one species (McCann's skink) was recorded in the Golden Bar2 Pit, though it was found in relatively high abundance. Differences in diversity and relative abundance across the PCs is probably a function of habitat availability, i.e., a higher diversity of habitat types and

abundance of refuges (e.g., rock piles, pine tree logs) correlates to a higher lizard diversity and abundance.

Three whistling tree frogs (*Litoria ewingii*) were recorded in pond, riparian vegetation, and rock pile habitats at Golden Bar2 Pit and Golden Bar WRS. This species is likely to be common in the landscape and because it is an introduced species and not protected, it is not considered further in this assessment. None of the other species known to occur in the surrounding landscape (grand skink, Otago skink, herbfield skink, and jewelled gecko) were detected during the survey despite targeted searching for them (e.g., rock tor scanning for Otago and Grand skinks, searches of damper grassland habitat for Otago green skink, searches of woody herbs for herbfield skink, and shrubland scanning for jewelled gecko). Notwithstanding the dedicated attempt to find these species, search effort was relatively low for the extent of available habitat and thus, their absence in the ZOI cannot be confirmed with any level of confidence.

A comprehensive lizard baseline (pre-impact) monitoring programme scheduled to commence in April 2024 will collect additional information on the lizard species diversity and population abundances within some of the MP4 impact and buffer areas. This information will improve the understanding of lizard populations potentially affected by the MP4 project. The baseline monitoring programme is described in detail in the MP4 Stage 3 Lizard Management Plan (Bioresearches, 2024b).

Figure 3.1. Examples of herpetofauna recorded during the survey; upper left: korero gecko; upper right: tussock skink; lower left: McCann's skink; lower right: whistling tree frog.

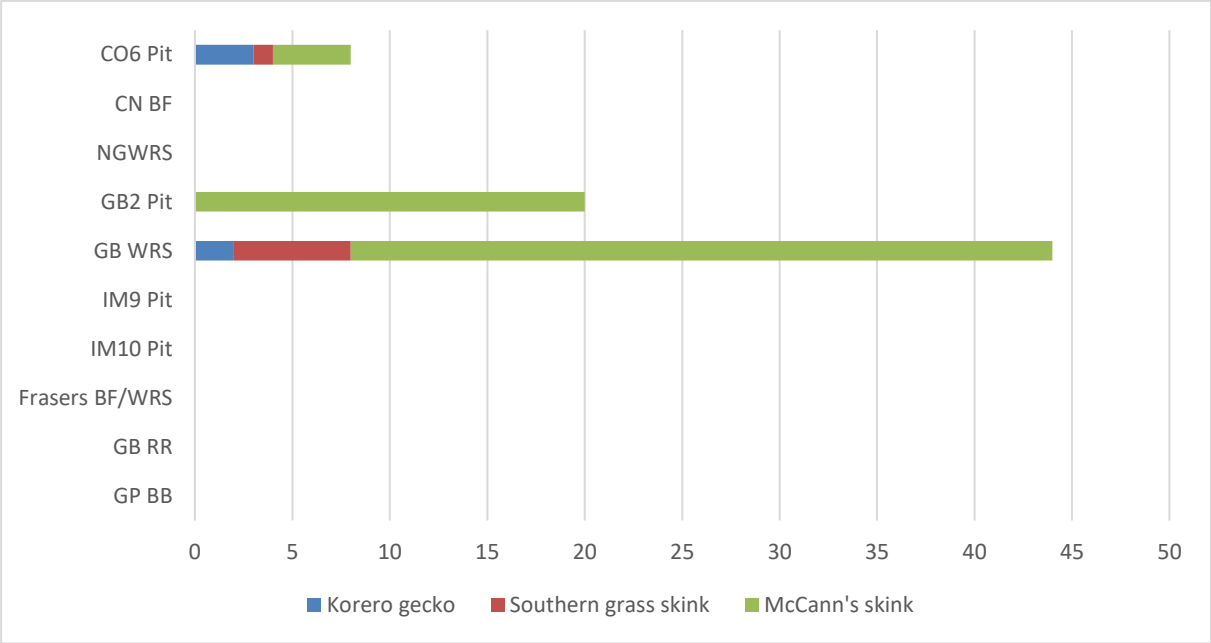

Figure 3.2. Species diversity within the MP4 Project area as recorded during the survey, showing the species composition for each of the Project Components. Coronation North Backfill, IM9 Pit, IM10 Pit, Frasers Backfill/WRS, Golden Bar Road realignment, and Golden Point Backfill Buttress were not surveyed (see Section 3.3.2 Systematic searches), hence no values are presented.

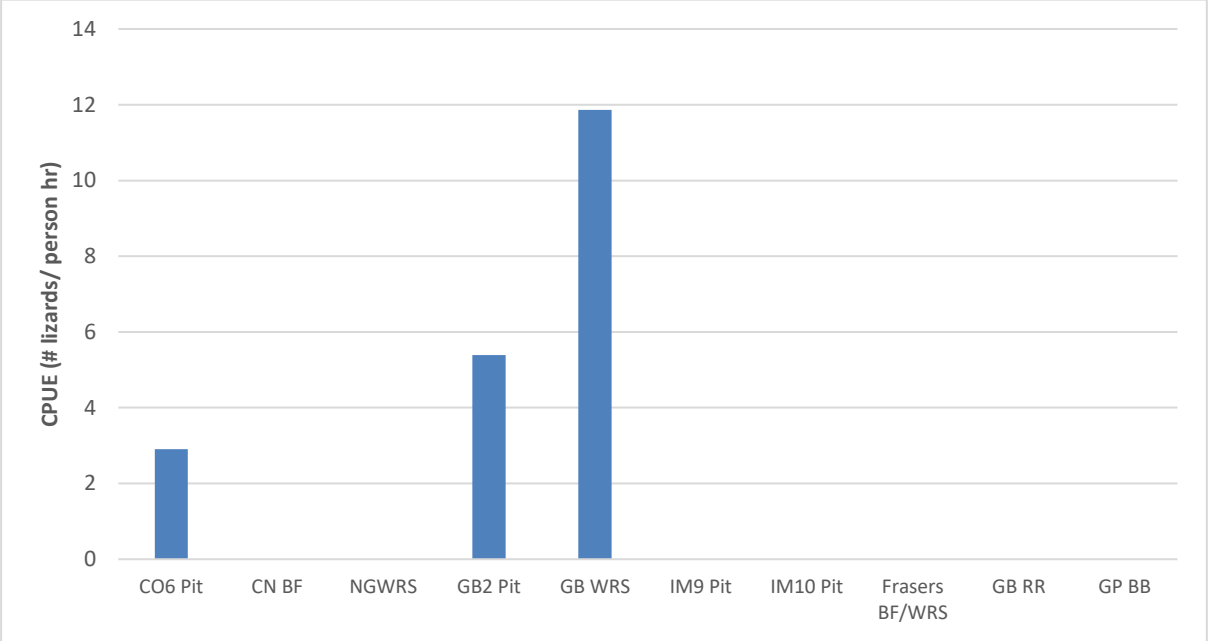

Figure 3.3. Lizard relative abundance recorded within the PCs. Coronation North Backfill, IM9 Pit, IM10 Pit, Frasers Backfill/WRS, Golden Bar Road realignment, and Golden Point Backfill Buttress were not surveyed (see Section 3.3.2 Systematic searches), hence no values are presented.

3.2.3 Habitat suitability

3.2.3.1 Habitat types

Ten broad potential habitat types were identified within the ZOI, including rock tors/ tor complexes, shrubland, tussockland, riparian vegetation, exotic grassland (including rank and grazed pasture), ephemeral wetlands, exotic treeland (e.g., pine plantation, shelterbelts), felled pine, mine workings[9], and open water (ponds) (Figure 3.4). The aerial extent of these habitats varied markedly. Mine workings covered the largest land area, and exotic grassland and tussockland comprised the largest vegetation categories. Rock tors and open water (ponds) represented the smallest areal extents (Table 3.3). The mapped habitat types for each PC are shown in Appendix I.

Native lizards were recorded in six (60%) of the 10 habitat types (Table 3.4) and two habitat types (mine workings and open water) were not considered to provide any habitat for native lizards. No lizards were recorded in ephemeral wetland and exotic treeland habitats, although, search effort in these habitats was minimal to none, due to time constraints and prioritisation of higher quality habitats. The potential occurrence of lizards (specifically McCann's, tussock, and possibly herbfield skinks) in ephemeral wetland and exotic treeland habitats is likely. The dense vegetation cover growing around the fringes of ephemeral wetlands could offer suitable habitat for skinks, and even the interiors of wetlands during dry weather could provide habitat. Indeed, ephemeral wetland areas may even be attractive to lizard species that prefer damper soils (e.g., tussock and herbfield skink). The edges of exotic treeland and areas of felled pine were littered with woody debris that provide ample lizard refuge sites.

[9] Mine workings are defined as areas of land where visibly recent or currently active mine activities were occurring.

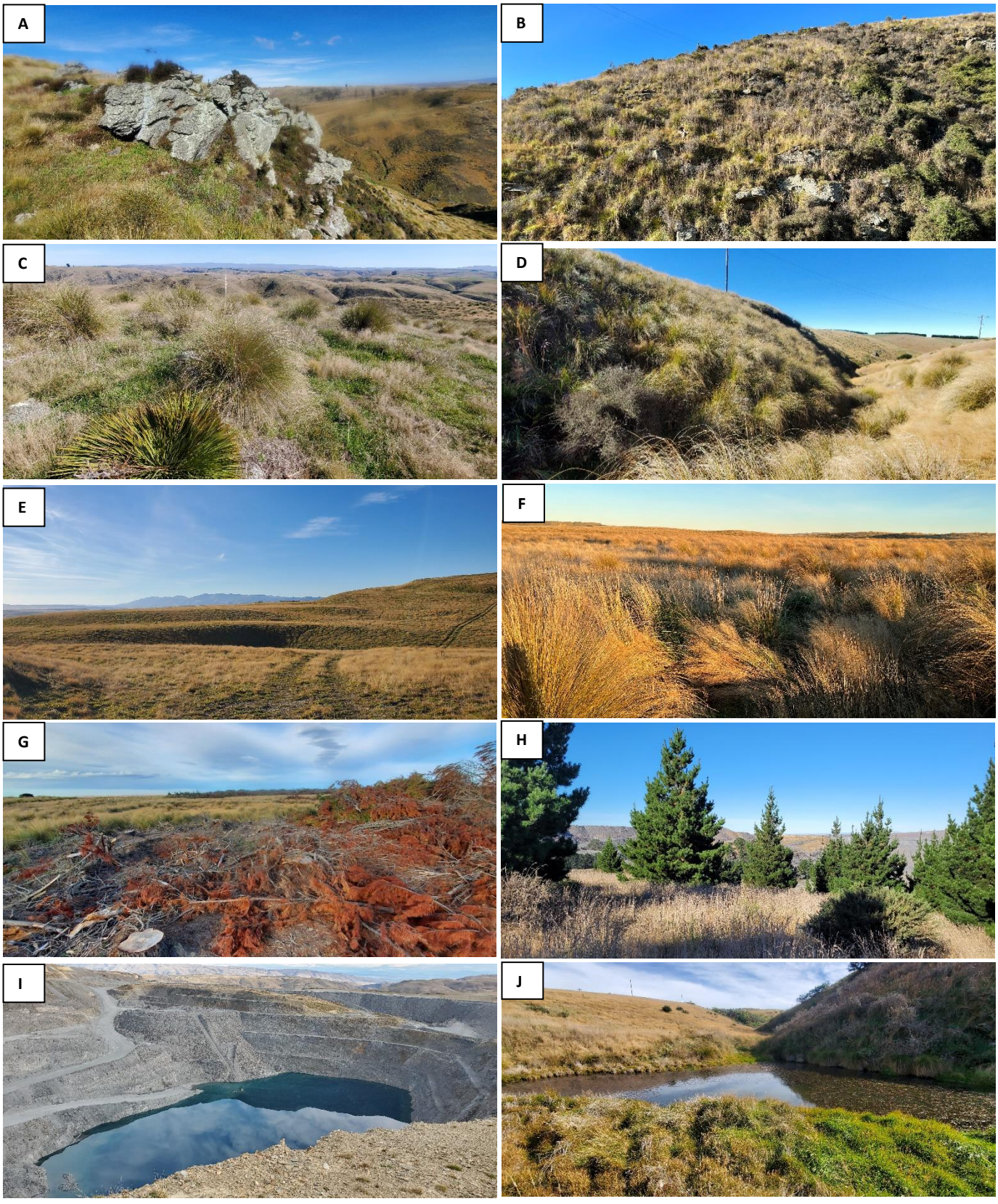

Figure 3.4. A selection of photographs of showing the potential habitat types identified within the ZOI. A: rock tors; B: shrubland; C: tussockland; D: riparian vegetation; E: exotic grassland; F: ephemeral wetland; G: felled pine; H: exotic treeland; I: mine workings; and J: open water.

Table 3.3. Areal (ha) and proportional (%) extents of each potential habitat type across the ZOI (note: habitat extents of PCs do not overlap). Lizard habitat value rank: 1 = highest quality, 10 = lowest quality.

Habitat rank	Habitat type	Area (ha)	Proportion (%) of ZOI area
1	Rock tors/ tor complexes	0.06	0.03
2	Shrubland	0.5	0.2
3	Tussockland	68.7	30.0
4	Riparian vegetation	1.3	0.6
5	Exotic grassland	92.2	40.3
6	Ephemeral wetland	0.9	0.4
7	Exotic treeland (incl. pine)	1.1	0.5
8	Felled pine	4.8	2.1
9	Mine workings	59.7	26.1
10	Open water (ponds)	0.2	0.10
	Total	**229**	**100**

Table 3.4. Broad habitat types identified in the ZOI and the recorded presence (✓) of lizard taxa. Actual suitable lizard habitat shown as green shading. Lizard value rank: 1 = highest quality, 10 = lowest quality. Crossed out cells = not assessed/ not relevant.

		Taxa recorded		
Habitat rank	Habitat type	McCann's skink	Tussock skink	Korero gecko
1	Rock tors/ tor complexes	✓	✓	✓
2	Shrubland	✓	✓	✓
3	Tussockland	✓	✓	✓
4	Riparian vegetation	✓	✓	
5	Exotic grassland	✓		
6	Ephemeral wetland			
7	Exotic treeland (incl. pine)			
8	Felled pine	✓		
9	Mine workings			
10	Open water (ponds)			

3.2.3.2 Rock tors

Eighty-three rock tors were identified within the ZOI based on ground-truth assessments and high-definition aerial photography. The number of identified rock tors is likely to be an underestimate of the total available since not all areas were ground-truthed during the survey and smaller tors may not have been discernible even using high-definition aerial imagery.

Of the 83 identified rock tors, twelve (14.5%) were located inside the footprint areas (i.e., directly impacted by the development). Forty-four (53%) tors were physically inspected for lizard occupancy and 12 of these occurred inside the footprints. Across all inspected rock tors, lizard occupancy was typically high, ranging from 0.93[10] (in the buffer areas) to 1 (in the footprint areas) (Table 3.5). That is, almost all rock tors that were inspected in the footprint and buffer areas were occupied by lizards.

Three species of lizards (McCann's skink, tussock skink, and korero gecko) were observed on rock tors, though McCann's skink and korero gecko were the species most frequently encountered.

Table 3.5. The number of rock tors identified and visited within the PCs and ZOI, and associated lizard occupancy rates. "-" = none visited/ recorded.

Project Component (PC)	No. tors identified in PC ZOI	Proportion (%) of tors in PC visited	No. tors visited		Tor occupancy	
			Footprint	Buffer	Footprint	Buffer
Coronation 6 Pit	2	100	1	1	1	1
Coronation North Backfill	-	-	-	-	-	-
NGWRS	-	-	-	-	-	-
Golden Bar2 Pit	18	61	6	5	1	1
Golden Bar WRS	67	46	5	26	1	0.93
IM9 Pit	-	-	-	-	-	-
IM10 Pit	-	-	-	-	-	-
Frasers Backfill	-	-	-	-	-	-
Golden Bar Road realignment (indicative)	-	-	-	-	-	-
Golden Point Backfill Buttress	-	-	-	-	-	-
Total	**83**	**53**	**12**	**32**		

3.2.3.3 Rock piles

Twenty-five discrete rock piles were inspected within the PCs. Of those, over half (64%) occurred inside the footprints of the PCs. Across all inspected rock piles, lizard occupancy was invariably 1 (i.e., all visited rock piles were occupied by lizards) (Table 3.6).

Three species of lizards (McCann's skink, tussock skink, and korero gecko) were observed using rock piles, though McCann's skink was by and large the species most frequently encountered under rocks.

[10] An occupancy value of 0.93 means that lizards were recorded at 93% of the tors that were visited.

Table 3.6. The number of rock piles visited within the PCs and ZOI and lizard occupancy rates. "-" = none visited/ recorded.

Project Component (PC)	Total rock piles visited in PC	No. rock piles visited		Rock pile occupancy	
		Footprint	Buffer	Footprint	Buffer
Coronation 6 Pit	1	1	0	1	0
Coronation North Backfill	-	-	-	-	-
NGWRS	-	-	-	-	-
Golden Bar2 Pit	8	4	4	1	1
Golden Bar WRS	16	11	5	1	1
IM9 Pit	-	-	-	-	-
IM10 Pit	-	-	-	-	-
Frasers Backfill	-	-	-	-	-
Golden Bar Road realignment (indicative)	-	-	-	-	-
Golden Point Backfill Buttress	-	-	-	-	-
Total	**25**	**16**	**9**	-	-

3.2.3.4 Summary of lizard ecology within the PCs.

Table 3.7 provides a summary of the ecological characters associated with lizard taxa found to be present in the PCs.

Table 3.7. Presence of native lizard taxa in PCs, relative abundance, and important habitats.

Common name	Scientific name	Presence in PCs of ZOI	Relative abundance	Key habitats
Korero gecko	*Woodworthia* "Otago/ Southland large"	• Coronation 6 Pit • Golden Bar WRS	High in suitable habitats (rock tors), low–moderate in lower value habitats (e.g., disturbed rock piles).	Rock tors and rock piles/ accumulations in tussockland and exotic grassland.
tussock skink	*Oligosoma chionochloescens*	• Coronation 6 Pit • Golden Bar WRS	High in suitable habitats, moderate elsewhere.	Tussockland and exotic grassland, particularly dense vegetation and where ground was damp (e.g., seeps, depressions, gullies). Also found associated with rock tors.
McCann's skink	*Oligosoma maccanni*	• Coronation 6 Pit • Golden Bar2 Pit • Golden Bar WRS	High	Pasture, tussockland, exotic grassland, rock tors, rock piles/ accumulations, inorganic debris piles.

3.2.4 Limitations

Several limitations to the lizard survey are worth mentioning. These include:

- Surveys were undertaken at the end of the generally accepted 'lizard season' (i.e., during April), when temperatures were approaching the lower threshold for lizard activity. During the initial survey period (2–4 April) daytime temperatures typically remained above 15°C (at times reaching ~20°C) and lizards were frequently observed basking. However, daytime temperatures during the follow-up survey period (18–20 April) were markedly lower (<14°C), which may have influenced lizard detection rates; though, active basking lizards were still recorded during the survey. Overall, we considered daytime temperatures to be suitable for detecting lizards. Nighttime temperatures were typically below 10°C throughout April survey and despite kōrero geckos having been recorded active on nights when air temperatures were less than 1°C (Chukwaka *et al.,* 2023), it was determined that any nocturnal lizard data collected during the April surveys could be interpreted as being too unreliable; hence, nocturnal surveys were not undertaken.

- Survey methods were limited to systematic searches because time constraints meant that the survey had to be implemented and completed by the end of April and the survey needed to cover a relatively large area. Other standard lizard survey methods such as artificial cover objects, Gees minnow (funnel) traps, and pitfall traps are more time consuming because equipment needs to be installed in the field (often requiring a period of settling) and then repeatedly reinspected. Time constraints precluded the use of these other detection/ capture techniques. Systematic searches are extensively used for surveying New Zealand lizards (Lettink & Monks, 2016; Lettink & Hare, 2016) and this technique offered a relatively effective and time efficient method for determining species presence and relative abundance in the PCs.

- Many of the PCs were neither visited nor searched by the Project herpetologist. This was the result of a prioritisation process that was largely driven by the areal extent of the PCs, the amount and diversity of potential lizard habitat present, and time constraints during the April survey period. For example, some PCs (e.g., CN BF, IM9, Frasers BF/WRS, GP BB) were almost entirely operational mine workings, a 'habitat type' that was not considered to support lizards. Therefore, these PCs were deprioritised over PCs with the highest values and where the largest impacts on lizards were anticipated. For completeness, all unvisited PCs were investigated through a desktop assessment involving a review of recent (2022) high-definition aerial drone photographs and ground-based photographs where available, which allowed key habitat features to be identified and mapped. However, it is acknowledged that the presence of lizards could not be determined using this method.

To address many of the survey limitations, a comprehensive lizard baseline (pre-impact) monitoring programme will be implemented in April 2024. The monitoring programme is designed to collect additional information on the lizard species diversity and population numbers within some of the MP4 impact and buffer areas. This information will improve the understanding of lizard populations potentially affected by the MP4 project. The baseline monitoring programme is described in detail in the MP4 Stage 3 Lizard Management Plan (Bioresearches, 2024b).

4 ASSESSMENT OF HERPETOFAUNA VALUES AND EFFECTS

4.1 ASSESSMENT METHODOLOGY

This section focuses on assessing project-related effects on the herpetological values identified during the survey. Herpetofauna values and project-related effects (both on herpetofauna communities and their habitats) were identified and assessed using:

1) The Environment Institute of Australia and New Zealand ("EIANZ") guidelines for Ecological Impact Assessment ("EcIAG") (Roper-Lindsay *et al.*, 2018), which were adapted based on expert opinion.
    a. **Step 1:** Ecological values ranging from 'Negligible' to 'Very High' were assigned to each of the PCs based on the NZTCS threat status of lizards occurring in the zone of impact ("ZOI"). For PCs that were not visited or surveyed for lizards, a conservative approach was taken by predicting the likely presence of lizard species in the ZOI, based on habitat availability and quality, and assigning the relevant ecological value score based on threat status. Since the EcIAGs (Roper-Lindsay *et al.,* 2018) do not include criteria to determine habitat suitability values for a given species, habitat values were considered only during the magnitude of effects assessment stage (Step 2).

    b. **Step 2:** Magnitude of effect was assessed in accordance with Table 8 of the guidelines and accounted for level of confidence in understanding the expected effect in terms of spatial scale ('local' scale = OGL Macraes landholdings, ~13,063 ha; 'landscape' scale = Macraes Ecological District, ~113,818 ha; and were relevant, 'National' scale), duration and timescale, relative permanence, and timing of the effect in respect of key ecological factors. Habitat suitability criteria outlined by Baber *et al.,* (2021) (Appendix III) were used to assist with informing the magnitude of effects assignments.

    c. **Step 3:** The overall level of effects was determined using a matrix approach (Table 10 in the EIANZ framework; Appendix II) that combines the ecological values with the magnitude of effects resulting from the activity. The matrix describes an overall level of effect on a scale of 'Negligible' to 'Very High'. Positive effects are also accounted for within the matrix. The overall level of effects on each value was assessed before recommendations to avoid, remedy, or mitigate effects were applied.

2) National Policy Statement for Indigenous Biodiversity 2023 ("NPSIB"). Appendix 1 of the NPSIB sets out criteria for assessing Significant Natural Areas (i.e., areas of significant indigenous vegetation and significant habitats of indigenous fauna). Table 4.2 of this report provides a summary of the assessment against the NPSIB significance criteria.

3) The Partially Operative Otago Regional Policy Statement 2019 ("POORPS"). Criteria for identifying areas with significant indigenous vegetation or significant habitats of indigenous fauna are set out in in Schedule 4 of the POORPS 2019. Consideration was also given to the

criteria listed in the Proposed ORPS 2021 (*APP 2 – Significance criteria for indigenous biodiversity*), which are essentially the same as those in the POORPS 2019. Table 4.3 of this report provides a summary of the assessment against the POORPS criteria.

4) The Waitaki District Plan 2010 ("WDP"), under *16.9.3 Policies - Policy 3 "…criteria to identify areas with significant indigenous vegetation or significant habitats of indigenous fauna…"*. Consideration was also given to the criteria listed in the Draft WDP 2022 (*APP3 Criteria for evaluating the significance of indigenous vegetation and habitats of indigenous fauna*), though this document has no statutory effect. Table 4.4 of this report provides a summary of the assessment against the WDP criteria.

The assessment of ecological values as they pertain to native herpetofauna was determined by considering all assessment frameworks (EIANZ guidelines, NPSIB, POORPS, and WDP) (see Table 4.1).

The level of effect would then be used to guide the extent and nature of avoidance measures, and any ecological management response required, which may include remediation, mitigation, offsetting, or compensation. An assessment of the overall level of effects after recommendations to avoid, remedy, or mitigate effects is not covered in this report but rather are provided in the separate, accompanying Impact Management Plan (Ahikā Consulting, 2024b).

4.2 HERPETOFAUNA ECOLOGICAL VALUES

The herpetological values assessment for each of the PCs is provided in Table 4.1.

The primary criteria for assigning herpetofauna ecological value to each of the PCs is the presence and conservation threat status of lizard species occurring in the ZOI (Roper-Lindsay *et al.,* 2018). However, a variety of other ecological features of the local herpetofauna that may be considered as part of the value score assignments are discussed more broadly in the sections that follow Table 4.1.

Table 4.1. Herpetological values assessment for each of the PCs.

Site	Herpetofauna values	Value score
Coronation Stage 6 Pit	• Two 'At Risk' and one 'Not Threatened' lizard species present in the impact and/ or buffer areas. • Qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under the POORPS/ PORP and WDP.	High
Coronation North Backfill	• One 'Not Threatened' lizard species may be present in the impact area.	Low
Northern Gully WRS	• One 'Not Threatened' lizard species may be present in the impact area.	Low
Golden Bar Stage 2 Pit	• One 'Not Threatened' lizard species known to be present, and at least one 'At Risk' species likely to present, in the impact and/ or buffer areas. • Qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under the POORPS/ PORP and WDP.	High
Golden Bar WRS	• Two 'At Risk' and one 'Not Threatened' lizard species present in the impact and/ or buffer areas. • Qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under the POORPS/ PORP and WDP.	High
Innes Mills Stage 9 Pit	• One 'Not Threatened' and/ or one 'At Risk' lizard species may to be present in the impact and/ or buffer area.	High
Innes Mills Stage 10 Pit	• One 'Not Threatened' and/ or one 'At Risk' lizard species may to be present in the impact and/ or buffer area.	High
Frasers Backfill	• No native lizards expected to occur in the impact area because no habitat is available. • One species, McCann's skink ('Not Threatened') may occur on the periphery of the buffer area.	Negligible
Golden Bar Road Realignment	• One 'Not Threatened' and one 'At Risk' lizard species likely to be present in the impact and/ or buffer area.	High
Golden Point Backfill Buttress	• One 'Not Threatened' and two 'At Risk' lizard species may to be present in the impact and/ or buffer area.	High

4.2.1 Threatened or 'At Risk' species

Of the three lizard taxa confirmed in the ZOI, two (korero gecko and tussock skink) are listed as 'At Risk—Declining' under the New Zealand threat classification system (Townsend *et al.* 2008; Hitchmough *et al*., 2021) and one, McCann's skink, is listed as 'Not Threatened'.

The 'At Risk' taxa were widely distributed across the ZOI (but did not occur in all PCs) and populations were present at moderate to high relative abundance.

4.2.2 Herpetofauna communities

Three taxa of native lizard were recorded in the ZOI, McCann's skink, tussock skink, and korero gecko. Differences in the species diversity and relative abundance across the nine PCs were observed, with the highest diversity and abundance of lizards recorded at Golden Bar WRS (n = 44; relative abundance 11.9 lizards/ person hour; three taxa).

All three lizard taxa were recorded in two (Coronation 6 Pit and Golden Bar WRS) of the nine PCs and only McCann's skink was recorded at Golden Bar2 Pit.

Syntopic[11] McCann's and tussock skinks were observed in riparian vegetation at Golden Bar WRS. Syntopic McCann's skink and korero gecko were found on rock tors at Coronation 6 Pit and Golden Bar WRS.

McCann's skink was the most encountered species at all sites, and it was typically associated with a wide range of habitat types, including rock tors/ tor complexes, shrubland, tussockland, riparian vegetation, and exotic grassland. McCann's skinks were particularly common in dryer habitats where rock features (tors or rock piles) were present. This species exists at high population abundance across the PCs and the entirety of its South Island range.

Tussock skinks were less commonly encountered but were moderately abundant in some areas supporting dense grasses and sedges (e.g., in the riparian vegetation area of Golden Bar WRS). In general, tussock skinks typically prefer grassy habitats, either native tussock grasslands or unkept exotic grasses, but they are adaptable and will occupy a variety of other habitat types such as areas with rocky or woody cover, wetland herbfields, and shrublands. In semi-arid lowland areas, this species is often confined to damper gullies (Jewell, 2022a). Considering the complexity of the habitats preferred by tussock skinks and the visual search methods (cf. pitfall traps or G-minnow funnel traps) employed during the survey, it is likely that the detection rates are an underestimate of the true abundance of this species in the ZOI.

Korero gecko was the least encountered lizard taxon in the ZOI. The geckos were strongly associated with rock features such as rock tors/ rock tor complexes, as well as more isolated rock piles scattered throughout tussockland. Despite the number of rock tors searched, only a small proportion supported

[11] *Syntopic*: individuals of different species that occur side-by-side in nature, utilising the same habitat(s), versus *Sympatric*: occurring together in the same geographic area (overlapping ranges) (Jørgensen & Fath, 2008).

korero geckos. It is unclear whether this is a genuine result or the result of inadequate detection (i.e., individuals were missed because of the complexity and depth of the crevices in some tors) due to environmental variables (e.g., time of year and temperatures), or survey methods (i.e., diurnal vs. nocturnal searches). Nonetheless, the availability of high-quality rock tor and rock pile habitats within the ZOI suggests that korero geckos may be more abundant than what was revealed during this survey.

Five other lizard taxa (herbfield skink, Otago skink, grand skink, Otago green skink, and jewelled gecko) are known to occur in the surrounding landscape (i.e., within 20 km radius) but were not recorded during the survey, despite search efforts in the kinds of habitats occupied by these taxa. Populations of all these lizards are in decline in the Macraes ED, and it is likely that jewelled gecko is functionally, if not locally, extinct in the Macraes ED.

The herbfield skink is becoming increasingly rare across large parts of its range due in part to degradation of habitat. Within the Macraes ED, this species is typically found in association with tussock grassland supporting dense woody subshrubs, or wetter areas (e.g., seepages, flushes, wetlands, and the grassland surrounding such areas). It is less reliant on stable retreats such as rocks, and therefore, is particularly sensitive to habitat modification of grassland and low woody shrubs by grazing, drainage, or weed incursion (Jewell, 2020b). Habitats favoured by herbfield skinks were seemingly not well represented in the ZOI; however, it is possible that small, isolated areas of woody subshrubs or seepages were missed. The most recent record of a herbfield skink on OceanaGold landholdings was from an area of rocks along Horse Flat Road (Deepdell North III ZOI; between Coronation 6 Pit and Round Hill Innes Mills SPIM), reported in 2018 (Bovill, 2018). This record was subsequently considered dubious, and it was reported by Thorsen (2019) that the habitat was anomalous for this species and the possibility existed that this was a misidentification of a subadult skink of another species. Overall, the status of herbfield skinks within the wider Project area remains uncertain, but if this species is present populations are likely to be very small.

Otago green skinks were recorded on OceanaGold landholdings in the 1960s (Whitaker, 1986) but since then, herpetofauna surveys carried out as part of mining consents have largely been unsuccessful in detecting this taxon. In 2015, a dedicated attempt was made to locate this taxon over the extent of the landholdings. After ten days of searching, which included searches of valleys to the north and west of the Golden Bar2 Pit PC, no Otago green skinks were found (Ecogecko, 2015). With no sightings of Otago green skinks on OceanaGold landholdings for over half a century there was a growing concern that the taxon may be locally extinct on the landholdings. However, in January 2023, a tracking tunnel print believed to be from an Otago green skink was recorded in the base of a valley in Deepdell Station Ecology Covenant, approximately 5.6 km due west of the Coronation 6 Pit PC (M. Tocher, unpub. data). This record was later verified by the observation of a live Otago green skink close to the location of the tracking tunnel that recorded the print (M. Tocher, pers. comm. 31/01/2024). Interestingly, Otago green skink was only detected in the covenant site after approximately three years of mammalian pest control over the site. These recent records provide evidence that Otago green skink can persist at very low (less than detectable) abundance in the local landscape and may potentially occur within the MP4 ZOI.

Otago and grand skinks are rare in the surrounding landscape, most likely because they are large-bodied and heavily impacted by exotic mammalian predators. There are several relatively recent

records (within the last five years) of grand skinks from the DOC grand and Otago skink ("GAOS") management areas to the south of OceanaGold landholdings. More recently (in December 2023) two grand skinks (a juvenile and an adult) were observed on rock tors in the proposed Redbank Ecological Covenant on OceanaGold landholdings, approximately 6.5 km west of GB WRS and 4.5 km southwest of IM9 Pit (L. Sherwood, Ahikā Consulting; pers. obs., 01/12/2023). Grand skinks were known to occur historically in the Deepdell catchment, in rock tors 1.5 km northwest of the BRWRS (Whitaker, 1996). In addition, there are a couple of records of grand skinks from 1996, located 3–7 km southwest of the landholdings (DOC Herpetofauna database), and the remains of grand skinks were found in rock tors dismantled as part of the Deepdell North Stage III project in February 2021 (LizardExpertNZ, 2021). Otago skinks were recorded approximately 2.5 km south of the Frasers Pit PC in 2003 (DOC Herpetofauna database) and more recently in 2014, when two individuals were found in a valley system to the immediate west of Golden Bar, on OceanaGold landholdings (Ecogecko, 2015).

The relatively recent sightings of Otago green skink, grand skink, and Otago skink in the landscape surrounding the MP4 Project area suggests the possibility that remnant populations may occur in some areas of some PCs (e.g., the large tor complexes or deep gullies of Golden Bar WRS). However, considering the relatively low quality of rock tor habitats (i.e., smaller, less complex rock tors), largely degraded gully vegetation, and no mammalian pest control in any of the impact areas, there is reasonable certainty that they do not occur in the areas subject to direct impacts.

4.2.3 Ecological function

New Zealand lizards, including the three species recorded in the Project area, play important roles in the ecosystem as predators, prey, seed dispersers, and pollinators (Hare *et al*., 2016).

Many New Zealand lizards appear to be omnivorous, feeding primarily on arthropods but also taking fruits, flowers, nectar, and honeydew (Hare *et al.* 2016). Other organisms are also often consumed, including smaller lizards (of the same or different species) and carrion of larger vertebrates. Lizards are a key component in the diet of many predatory species, including a variety of native birds and some invertebrates (Hare *et al.,* 2016).

McCann's and tussock skinks, and *Woodworthia* geckos are known to supplement their diet with fruits (e.g., berries) when available in the environment. Inadvertent dispersal of seeds by lizards after fruit consumption has been shown to benefit native shrubs by allowing seeds to escape parent plants and reach safe establishment sites. Indeed, li1zards can be important seed dispersers even at reduced densities on the mainland and in shrublands lacking a diversity of frugivorous birds, lizards may be especially important dispersers of seeds (Wotton *et al.,* 2016). Geckos, including *Woodworthia* taxa, are also known to be efficient and effective pollinators of flowers (Whitaker, 1987; Smith, 2009) and have even been regarded as ecologically significant pollinators (Smith, 2009).

4.2.4 Species diversity

Seven lizard taxa are known to occur in the Macraes ED and up to five (certainly three[12]) taxa have been recorded on OceanaGold landholdings in the recent past. The three taxa confirmed from in the ZOI during this survey are two species of skink (McCann's skink and tussock skink) and one gecko (korero gecko). Together the diversity within the ZOI represents 42.9% of the total lizard diversity within the Macraes ED.

4.2.4.1 Tussock skink, *Oligosoma chionochloescens*

The tussock skink is listed as 'At Risk – Declining' under the NZTCS (Hitchmough *et al*., 2021). The listing is based on criterion C(2), which reflects a very large population (total area of occupancy >10 000 ha [100 km^2]) and low to high (10–70%; "Data Poor Trend" qualifier) ongoing or predicted decline.

Agents of decline include habitat loss, particularly conversion of shrubland, tussockland, and wetland to production farmland, as well as ongoing impacts of mammalian predators. Tussock skinks occur at sites that are free of mammalian predators (GOAS fenced areas), at sites free of all mammals except mice (Orokonui Sanctuary, Mokomoko Dryland Sanctuary), and sites under intensive pest management (GAOS non-fenced areas).

It is a relatively short-lived species, reaching sexual maturity in 2–3 years, and has a generation time of approximately 5–7.5 years.

Within the ZOI, this species appears to exist in scattered but moderately abundant populations where suitable habitat is available (e.g., dense grassland, areas with rocky or woody cover, shrublands, and damper gullies). Within the wider Macraes ED, this species is common and can be very abundant in good quality habitat, even in the presence of mammalian predators. Tussock skink populations in predator managed sites elsewhere within their distributional range are likely to be benefiting.

4.2.4.2 Korero gecko (*Woodworthia* "Otago/Southland large")

The korero gecko is currently listed as 'At Risk – Declining'. The listing is based on criterion C(1), which reflects a very large population (>100 000 mature individuals) and low to high (10–70%; "Partial Decline" qualifier) ongoing or predicted decline (Hitchmough *et al*., 2021).

Agents of decline include ongoing impacts of mammalian predators and probably some level of habitat loss. Korero geckos in the Macraes ED are habitat restricted; they rely on rock tors and rocky features in the landscape to persist. In other parts of their range (e.g., Southland), korero geckos have been recorded in rimu trees deep within dense podocarp forest (T. Jewell & C. Knox unpublished data). Korero geckos occur at sites that are free of mammalian predators (GOAS fenced areas), at sites free of all mammals except mice (Orokonui Sanctuary), and sites under intensive pest management (GAOS non-fenced areas). Korero gecko populations at these sites are likely to be benefiting from mammalian predator management.

[12] Recognising that the herbfield skink record from 2018 is considered dubious.

It is a long-lived species, is slow to reach sexual maturity (~8 years at higher latitudes) and has a generation time of approximately 15 years meaning population recovery time is slow.

Within the ZOI, korero geckos occur at moderate (in some areas possibly high) abundance in very localised rock tor, rocky outcrop, and rock pile habitats. Similarly, within the wider Macraes ED this species occupies the abundant rocky outcrops and populations can reach considerable abundances.

4.2.4.3 Other lizard taxa

The herbfield, Otago green skink, Otago skink, and grand skink have been included here because their presence in the ZOI cannot be confidently discounted.

4.2.4.3.1 Herbfield skink, Oligosoma murihiku

The herbfield skink is currently classified as 'At Risk – Declining', based on criterion B(2); a large population (total area of occupancy ≤10 000 ha [100 km^2]) and low to moderate (10–50%) ongoing or predicted decline (Hitchmough *et al*., 2021).

Agents of decline are like those affecting tussock skink such as habitat loss, particularly conversion of shrubland, tussockland, and wetland to production farmland, as well as ongoing impacts of mammalian predators. Herbfield skinks occur at sites that are free of mammalian predators (GOAS fenced areas) and sites under intensive pest management (GAOS non-fenced areas). Populations in these areas are likely to be benefiting.

Within the wider Macraes area this species is infrequently encountered and prefers low herbaceous vegetation in stream gullies, wetlands and grassy shrublands. It also uses loose rocks and logs for cover if available, and readily climbs vegetation to bask and forage (van Winkel *et al*., 2018; Jewell, 2019; Jewell, 2022b).

It is a relatively short-lived species, reaching sexual maturity in 2–3 years, and has a generation time of approximately 6–7 years.

4.2.4.3.2 Otago green skink (Oligosoma aff. chloronoton "Eastern Otago")

The Otago green skink is classified as 'At Risk – Declining', based on criterion B(2); a large population (total area of occupancy ≤10 000 ha [100 km2]) and low to moderate (10–50%) ongoing or predicted decline (Hitchmough *et al*., 2021).

It has declined drastically in recent years with the most abundant populations occurring at higher altitude sites and in mammal-controlled sanctuaries. It has largely disappeared from lowland areas of Otago (Purdie, 2022). Until very recently (2023), this taxon had not been recorded on or near OGL Landholdings since the 1960s. It occupies a range of habitats (e.g., tussockland, rocky screes, and riparian margins) and is an avid sunbasker ((van Winkel *et al*., 2018; Purdie, 2022). This lizard appears to be particularly susceptible to the impacts of mammalian predators.

Little is known of its reproductive biology.

4.2.4.3.3 Otago skink (Oligosoma otagense) and grand skink (Oligosoma grande)

Both the Otago and grand skink are currently classified as 'Nationally Endangered' based on criterion B(1); 250–1000 mature individuals, stable population. They are Range Restricted and Conservation Dependent. The Otago skink is thought to occupy less than 8% of its historical range (Purdie, 2022).

Agents of decline include habitat loss, particularly conversion of shrubland, tussockland, and wetland to production farmland, as well as ongoing impacts of mammalian predators. Both Otago and grand skinks occur at sites that are free of mammalian predators (GOAS fenced areas) and sites under intensive pest management (GAOS non-fenced areas). Populations in these areas are likely to be benefiting.

Within the wider Macraes ED both species are infrequently encountered, except in areas where mammalian predators are managed. They prefer rocky outcrops and tors, especially those occurring in steep-sided valleys (van Winkel *et al.,* 2018).

Both species are relatively long-lived (20+ years), reaching sexual maturity in 4–6 years, and have a generation time of approximately 10–15 years.

4.2.5 Species of biogeographic interest

Of the lizard taxa recorded in the ZOI, none occur at their distribution limits—though Macraes is close to the northern distributional boundary for tussock skink—and none are of biogeographic interest.

4.2.6 Genetically or morphologically distinct forms

Genetically distinct forms of two lizard species (McCann's skink and korero gecko) are present in the ZOI.

4.2.6.1 McCann's skink (*Oligosoma maccanni*)

McCann's skink populations from eastern Otago and eastern Southland are grouped under Clade 4 by O'Neill *et al.* (2008). The Clade 4 group represents members that are genetically distinct from the six other recognised Clades. The Clade 4 group broadly occurs south of the Waitaki River, from the Ida Range south to the Hokonui Hills in northern Southland, and west to Alexandra.

The Clade 4 group is widely distributed across the ZOI and is widely distributed and abundant throughout the Macraes ED.

4.2.6.2 Korero gecko (*Woodworthia* "Otago/Southland large")

The gecko *Woodworthia* "Otago/Southland large" is an undescribed taxon within the *Woodworthia* genus that contains several other unnamed entities previously classified as *Woodworthia maculatus* (Hitchmough, 1997; Nielsen *et al*. 2011).

Ongoing research has indicated that three subclades within *Woodworthia* "Otago/Southland large" merit recognition as full species. The subclades include *W.* "Otago/Southland large", *W.* "south-

western", and *W.* "Raggedy" (van Winkel *et al.*, 2018; Hitchmough *et al.*, 2021). The Macraes population is part of the *W.* "Otago/Southland large" subclade, which occurs in eastern Otago (excluding Raggedy Range) and eastern and central Southland.

Woodworthia "Otago/Southland large" is widely distributed across the ZOI and is widely distributed and abundant throughout the Macraes ED.

Of scientific interest, is the potential presence of two distinct races of *W*. "Otago/Southland large" on OceanaGold landholdings. In 2020, an unusual Korero gecko was recorded during the Stage 1 lizard salvage as part Deepdell North Stage III Project (LizardExpertNZ, 2021). The gecko was later identified a 'black-spotted gecko'[13] and it was inferred that a 'genetic' contact zone exists over and round where the gecko was located. Since this gecko was found south of the Coronation 6 Pit PC, there is a possibility that a genetic contact zone falls within or across one of the MP4 Project PCs.

4.2.7 Lizard habitats

Ten broad habitat types were identified in the ZOI and of these, seven were considered to provide habitat value for lizards. These included rock tors/ tor complexes, shrubland, tussockland, riparian vegetation, exotic grassland (including rank and grazed pasture), ephemeral wetlands, and exotic treeland (e.g., pine plantation, shelterbelts). Native lizards were recorded using all suitable habitat types except for ephemeral wetlands and exotic treeland though, it is likely that these habitats are used by some species of lizard (e.g., McCann's skink, tussock skink).

None of the identified lizard habitat types were exclusive to the ZOI (i.e., all are represented throughout the wider landscape). Rock tors, shrubland, and tussockland, which were considered the highest value habitats for native lizards, occur in abundance throughout surrounding local landscape (i.e., OGL Macraes landholdings) and throughout the Macraes ED.

4.2.8 Significance criteria under the policy framework

Assessing the herpetofauna values for each PC against the significance criteria provided in the NPSIB indicated that six of the ten PCs (Coronation 6 Pit, Golden Bar2 Pit, Golden Bar WRS, IM9 Pit, Golden Bar Road realignment, and Golden Point Backfill Buttress) qualified as areas with significant indigenous vegetation or significant habitats of indigenous fauna (Table 4.2). Assessment against the significance criteria provided in the POORPS/ PORPS and WDP indicated only four PCs (Coronation 6 Pit, Golden Bar2 Pit, Golden Bar WRS, and Golden Bar Road realignment) qualified as significant (Tables 4.3 & 4.4).

[13] The black-spotted gecko is considered a distinctive race (with morphological and genetic differences) of the korero gecko.

Table 4.2. Assessment of lizard values in each PC against the National Policy Statement for Indigenous Biodiversity 2023 ("NPSIB") significance criteria. Project Components: 1 = Coronation 6 Pit; 2 = Coronation North Backfill; 3 = Northern Gully Waste Rock Stack; 4 = Golden Bar2 Pit; 5 = Golden Bar WRS; 6 = IM9 Pit; 7 = IM10 Pit; 8 = Frasers Backfill; 9 = Golden Bar Road realignment; and 10 = Golden Point Backfill Buttress."?" denotes uncertainty as PCs were not ground-truthed.

		Project Component									
NPSIB	**Macraes MP4 significance assessment**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Representativeness	The habitats for lizards are typical or characteristic of the indigenous diversity of the ecological district, though some habitats are degraded examples of their type (e.g., tussockland, shrubland). Indigenous vegetation and habitats are representative of the full range and extent of ecological diversity across all environmental gradients in an ecological district. The fauna habitat supports a typical suite of indigenous lizards that would occur in the present-day environment.	Yes	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?
Diversity and pattern	The area supports an expected range of diversity and pattern of indigenous lizards and/ or lizard habitats, similar to the diversity at the level of the Ecological District.	No	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?
Rarity and distinctiveness	The area supports species, or habitats used by species, that are 'At Risk' (e.g., tussock skink, korero gecko) and/ or potentially threatened (e.g., grand skink). Lizard species in the area occur at their distribution limits, are endemic to the Otago region, or are of biogeographic interest. Grand and Otago skinks have not been considered here because if either or both were to occur in any of the PCs, they would occur only within the buffer areas where potentially suitable habitat exists, and not in areas directly impacted by the project (see *4.1 Desktop Assessment*). Genetically distinct forms of two lizard species (McCann's skink and korero gecko) are present in the PCs, though these distinct forms are not currently managed as separate taxonomic units.	Yes	No?	No?	Yes	Yes	Yes?	Yes?	No?	Yes?	Yes?
Ecological context	The terrestrial ecological features in the area, as they pertain to indigenous lizards, provide some connectivity between the site and adjoining sites, and provide resources (e.g., food, refuge, breeding sites) for lizards.	Yes	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?

Table 4.3. Assessment of <u>lizard values</u> in each PC against the Partially Operative and Proposed Otago Regional Policy Statements (POORPS & PORPS, respectively) significance criteria. Project Components: 1 = Coronation 6 Pit; 2 = Coronation North Backfill; 3 = Northern Gully Waste Rock Stack; 4 = Golden Bar2 Pit; 5 = Golden Bar WRS; 6 = IM9 Pit; 7 = IM10 Pit; 8 = Frasers Backfill; 9 = Golden Bar Road realignment; and 10 = Golden Point Backfill Buttress."?" denotes uncertainty as PCs were not ground-truthed.

		Project Component									
POPORPS/PORPS	**Macraes MP4 significance assessment**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Representativeness	The habitats for lizards are typical or characteristic of the natural diversity of the ecological district, though some habitats are degraded examples of their type (e.g., tussockland, shrubland).	No	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?
Rarity	The area supports species, and habitats that support species, that are 'At Risk' (e.g., tussock skink, korero gecko) and/ or potentially threatened (e.g., grand skink).	Yes	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?
Diversity	The area supports a diversity of indigenous lizards and/ or lizard habitats, similar to the diversity found within the immediately surrounding landscape and at the level of the Ecological District.	No	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?
Distinctiveness	Lizard species in the area occur at their distribution limits, are endemic to the Otago region, or are of biogeographic interest. Grand and Otago skinks have not been considered here because if either or both were to occur in any of the PCs, they would occur only within the buffer areas where potentially suitable habitat exists, and not in areas directly impacted by the project (see *4.1 Desktop Assessment*). Genetically distinct forms of two lizard species (McCann's skink and korero gecko) are present in the PCs, though these distinct forms are not currently managed as separate taxonomic units.	No	No?	No?	No	No	No?	No?	No?	No?	No?
Ecological Context	The terrestrial ecological features in the area, as they pertain to indigenous lizards, provide some connectivity between the site and adjoining sites, and provide resources (e.g., food, refuge, breeding sites) for lizards.	Yes	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?
Coastal Environment	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 4.4. Assessment of lizard values in each PC against the Waitaki District Plan significance criteria. Project Components: 1 = Coronation 6 Pit; 2 = Coronation North Backfill; 3 = Northern Gully Waste Rock Stack; 4 = Golden Bar2 Pit; 5 = Golden Bar WRS; 6 = IM9 Pit; 7 = IM10 Pit; 8 = Frasers Backfill; 9 = Golden Bar Road realignment; and 10 = Golden Point Backfill Buttress."?" denotes uncertainty as PCs were not ground-truthed.

		Project Component									
Waitaki District Plan	**Macraes MP4 significance assessment**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Representativeness	The area supports habitats and ecological processes (e.g., lizard community contributions to the environment) that are typical of the ecological district relative to the pre-European baseline and contributes to maintaining an appropriate proportional representation of these features.	No	No?	No?	Yes	Yes	No	No	No	Yes?	No?
Rarity and Distinctiveness	The area supports 'At Risk – Declining' lizard species and lizard habitats (e.g., rock tors) that are important in the lifecycle of protected or threatened indigenous lizards.	Yes	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?
Diversity and Pattern	The area supports a relatively diverse lizard fauna (at least three taxa), a diversity of habitats for indigenous lizards, and ecological processes (e.g., lizard seed dispersal, lizard plant pollination, lizards as prey for other fauna and as predators of invertebrates, etc.). These features are typical of the immediate surrounding landscape and at the level of the Ecological District.	No	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?
Ecological Context, Size and Shape	Lizard habitats within the area share ecological connections with adjoining habitats allowing dispersal of lizards through the landscape and provides regular resources (e.g., food, refuge, breeding sites) for lizards.	Yes	No?	No?	Yes	Yes	No?	No?	No?	Yes?	No?

4.3 MAGNITUDE OF EFFECT ON HERPETOFAUNA VALUES

Potential adverse effects of the proposed project on local herpetofauna extend to two 'At Risk' (korero gecko and tussock skink) and one 'Not threatened' (McCann's skink) taxon confirmed to be present in the ZOI. In addition, there are historical records of a further five threatened or 'At Risk' lizard species from the surrounding landscape (see Section 3.2.1). Therefore, it is possible that impacts may extent to additional threatened or 'At Risk' species if they are later found to be present in any of the PCs.

The mining activities proposed within the ~124 ha unconsented impact area (approximately 72% of which supports lizard habitat) would result in range of direct impacts on native lizards and their habitats during the construction stages of the project, through excavation for mining pits, formation or realignment of new haulage and public roads, and construction of a new waste rock stacks areas. A range of potential indirect effects are also expected in the wider buffer zone areas of the ZOI (~105 ha, of which 75% supports lizard habitat) during construction and operational activities.

Potential impacts are expected to be highest in areas supporting suitable habitat for native lizards within the PC footprints, with lesser impact expected in the surrounding buffer zones. Table 4.5 provides a breakdown of the areal extent (ha) of lizard habitat types within each PC directly (i.e., within the footprint) and indirectly (i.e., within the 100 m buffer) impacted by the project (i.e., all PCs, excluding overlap in PCs). Table 4.6 provides a similar breakdown of impacted habitats but on the scale of the ZOI (i.e., the PC footprints and buffer areas).

Table 4.7 provides a detailed assessment of the magnitude and level of unmitigated effects on herpetofauna for each of the PCs. Potential direct and indirect impacts on herpetofauna ecological values are discussed more generally in the sections that follow.

4.3.1 Potential direct effects

Potential direct effects on approximately 124 ha of land, including approximately 90 ha that supports suitable lizard habitat (the remaining 34 ha represents unsuitable mine workings and open water), within the ZOI impact footprint are anticipated (Table 4.6).

Potential direct effects on herpetofauna and herpetofauna habitats expected as a result of the MP4 Project include:

- Injury to or mortality of native lizards, including 'At Risk' taxa;
- Direct and permanent loss of lizard habitat and associated resources;
- Displacement of resident native lizards into adjacent habitat that may already be at population carrying capacity or may be of lower habitat quality;

4.3.1.1 Effect of construction of waste rock stack

Deposition of WRS material will destroy some known habitat of lizard species and cause the mortality of an unknown quantity of individuals representing 'At Risk' and 'Not Threatened' taxa.

4.3.1.2 Effect of removing rock material when excavating pit

Excavating the pit and associated processes will destroy some known habitat of lizard species and cause the mortality of an unknown quantity of individuals representing 'At Risk' and 'Not Threatened' taxa.

4.3.1.3 Effects of displacement of resident animals

Displacement of individuals is only likely to occur along the fringes of the PCs. Individuals within the footprints of the ZOI are likely to be directly killed as a result of earth-moving activities. Displaced individuals would be pushed into habitats that are assumed to be at population carrying capacity or may be of lower habitat quality, resulting in increased intra- and inter-specific competition and possibly mortality over the short- to medium-term if the habitat is unable to support an influx of individuals.

4.3.1.4 Scale of habitat loss

On a wider landscape scale, it is anticipated that the direct loss of lizard habitat from the surrounding local landscape (i.e., within OceanaGold Macraes landholdings) and from the Macraes ED, would be in the order of < 1% and < 0.5%, respectively.

4.3.2 Potential indirect effects

Potential indirect effects on approximately 105 ha of land, including approximately 79 ha that supports suitable lizard habitat (the remaining 26 ha represents unsuitable mine workings and open water), within the buffer zone are anticipated (Table 4.6). However, there is a moderate level of uncertainty around the magnitude of these impacts as adequately quantifying them is inherently difficult.

Potential indirect effects on herpetofauna and herpetofauna habitats expected as a result of the MP4 Project include:

- Increase in habitat edge effects and habitat fragmentation;
- Reduction in ecological connectivity/ corridors due to fragmentation;
- Disturbances within the buffer zone of the ZOI due to increased noise, vibrations, sediment run-off, dust creation, and artificial lighting;
- Loss of areas available for restoration and improvement of ecological corridors across the landscape.

4.3.2.1 Effects of noise & vibration

The influence of noise and vibration (from heavy machinery and blasting) on the lizard populations is largely unknown but the effects are likely to be low, if not negligible, since lizard populations currently persist in very close proximity to existing mining activities.

4.3.2.2 Effects of dust

Effects of dust are likely to be negligible as excess dust is controlled as part of the existing mining programme and the risk of dust-fall rapidly decreases with distance from work areas.

4.3.2.3 Effects of light

The effects of artificial lighting are likely to be low, if not negligible, since lizard populations currently persist in very close proximity to existing mining activities, where lighting is used. The taxon that is most likely to be affected by lighting is the korero gecko because of its nocturnal behaviour. There is a possibility that artificial lighting, especially flood lighting, may cause disruption to gecko behaviour or to their prey (particularly nocturnal moths). Potential effects are difficult to assess as the impact of artificial lighting on New Zealand lizards has not been investigated.

4.3.2.4 Effect of sediment run-off

Considered a negligible effect as sediment control measures to limit or prevent sediment run-off is part of the existing mining programme.

4.3.2.5 Effect of changes in weed populations

The importation of weed species, either directly through seed contamination of equipment or material or indirectly by creating favourable establishment sites, may present a risk to lizard habitat quality. Competitive weed species in particular, could rapidly transform natural lizard habitat into areas less suitable or unsuitable for lizard taxa.

4.3.2.6 Effects of accidental fire

Fires accidentally ignited by mining machinery or activities presents a low to high risk to native lizard communities, depending on the timing and habitat type(s) subjected to fire. Lizards will perish as a result of fires though, there is some evidence to demonstrate that lizards can survive, and populations may recover following grassland fires.

4.3.2.7 Changed hydrological regimes

Changes in hydrological regimes as a result of mining activities may have potential adverse effects on the long-term persistence or quality of habitats utilised by lizards that prefer damper environments (e.g., tussock skink).

Table 4.5. Areal extent (ha) of lizard habitat types directly impacted (i.e., within the footprint) in each Project Component (PC). Red shaded squares indicate where the highest impacts (based on loss of areal extent of habitat or number of rock tors) are anticipated. "Mine workings" and "Open water (ponds)" habitat categories not included because they do not provide suitable habitat for lizards. Note: total values exclude PC/ habitat overlap.

		Project Component										
	Habitat type	CO6 Pit	CN BF	NGWRS	GB2 Pit	GB WRS	IM9 Pit	IM10 Pit	Frasers BF/WRS	GB RR	GP BB	Total (Footprint)
Decreasing lizard habitat quality ↓	No. rock tors/ tor complexes	1	0	0	6	5	0	0	0	0	0	**12**
	Rock tors	0.002	0	0	0.01	0.03	0	0	0	0	0	**0.04**
	Shrubland	0	0	0	0	0.04	0	0	0	0	0	**0.04**
	Tussockland	2.9	0	0	4.9	23.5	0	0.2	0	0.06	0	**31.6**
	Riparian vegetation	0.02	0	0	0.03	0.3	0	0.1	0	0	0	**0.42**
	Exotic grasses/pasture	0	0.02	17.6[14]	8.8	24.0	0.5	3.6	0	0.9	0.6	**38.37**
	Ephemeral wetlands	0.02	0	0	0	0	0	0	0	0	0	**0.02**
	Felled pine	2.6	0	0	0	0	0	0	0	0	0	**2.60**
	Exotic treeland (incl. pine)	0	0	0	0	0	0	0	0	0	0	**0**
	Mine workings	0	0.03	3.6	9.0	0	5.1	2	0	0.26	13.6	**30.0**
	Open water (ponds)	0	0	0	0.05	0.1	0	0	0	0	0	**0.15**
Total (all suitable lizard habitat)		**5.5**	**0.02**	**21.2**	**13.7**	**48.0**	**0.5**	**3.9**	**0**	**0.9**	**0.6**	**90.7**
Total (all habitat types)		**5.5**	**0.05**	**17.6**	**22.8**	**48.0**	**5.6**	**5.9**	**0**	**1.2**	**14.2**	**124.4**

[14] The NGWRS habitat types are referred to as "Rehabilitated mine workings" in Ahikā Consulting (2024a).

Table 4.6. Areal extent (ha) of lizard habitat types directly (i.e., within the footprint) and indirectly (i.e., within the buffer) impacted in the Zone of Impact (ZOI). Showing areal extents for all PCs combined, excluding PC and habitat overlap.

	Habitat type	ZOI Footprint	ZOI Buffer
Decreasing lizard habitat quality ↓	**No. rock tors/ tor complexes**	12	71
	Rock tors	0.04	0.02
	Shrubland	0.04	0.50
	Tussockland	31.6	37.08
	Riparian vegetation	0.42	0.92
	Exotic grasses/pasture[15]	55.97	36.24
	Ephemeral wetlands	0.02	0.86
	Felled pine	2.60	2.20
	Exotic treeland (incl. pine)	0	1.10
	Mine workings	33.6	26.26
	Open water (ponds)	0.15	0.05
	Total (all suitable lizard habitat)	**90.7**	**78.92**
	Total (all habitat types)	**124.4**	**105.23**

4.3.3 Cumulative effects

The staged implementation approach to OceanaGold's Macraes mine has to date impacted over 2,000 ha of land, an unknown portion of which previously supported indigenous vegetation and habitat for lizards. For each stage of the MP4 project, impact management has been undertaken to address project stage effects. However, cumulative environmental impacts[16] resulting from many different, often individually insignificant, or unaccounted for, effects or because of failures in previously implemented effects management can accumulate over time to produce an overall effect greater than envisioned at each project stage. In addition, non-project related effects potentially resulting from surrounding land use practices such as pastoral farming activities (e.g., conversion of tussock to grazing pastures) can act in conjunction with project effects to generate unforeseen ecological impacts over the longer term.

[15] The Exotic grass/ pasture habitat type within the NGWRS PC is referred to as "Rehabilitated mine workings" in Ahikā Consulting (2024a).

[16] Cumulative effects include the effects that would result if the activity for which consent is sought is approved, in combination with the effects of other existing activities and/ or effects which are likely to arise over time (Milne, 2008)

Cumulative effects are usually neither measured nor accounted for because they are difficult to discern. Yet it is important to consider the impacts of the proposed activity, in conjunction with the effects of existing activities and over time (after avoiding, remedying, and mitigating), to understand a project's overall level of impact. The assessment of cumulative effects requires the consideration of appropriate temporal and spatial boundaries for the assessment, and consideration of the interactions of the ecological effects of the project along with past and future activities. One type of cumulative effect is incremental habitat loss (permanent or effective) or degradation or fragmentation, which can be difficult to assess on a project-by-project basis.

For the MP4 project, in the context of cumulative effects on native lizards, an appropriate temporal scale would be the date prior to the establishment of the mine in 1990 through to 2030 (the current proposed LOM). An appropriate spatial scale for consideration of cumulative effects is the Macraes ED. With respect to potential future effects, further staged implementation of the mine, ongoing agricultural pressures in the surrounding landscape, and general habitat degradation through spread of pests, weeds, and diseases are expected to cause potential disturbance to or reduce available habitat for lizards and/ or maintain declining population trends.

At least three (possibly four) species of lizard (Otago, grand and Otago green skink) previously reported on OceanaGold's Macraes landholdings have seemingly declined to extinction or near-extinction in recent decades and all except one species found in the ZOI are in a state of population decline. Furthermore, extensive areas of high-quality lizard habitat (e.g., complex rock tor features, native tussockland, and riparian habitats) have been cleared or converted over the decades to accommodate mining and agricultural practices. The cumulative impact of these historical effects, in conjunction with those anticipated from the MP4 Stage 3 project, could have long-term consequences for native lizard populations and their habitats if impacts are not appropriately mitigated. While no dedicated attempts have been made to quantify cumulative impacts, due to the complexity and uncertainty surrounding cumulative impact analysis, historical impacts have been considered in assigning magnitude of effect (see Table 4.7).

4.3.4 Consideration of climate change impacts on lizards

Human-mediated climate change is expected to be a major driver of species and population extirpations in future (Jarvie *et al*., 2022). Ectothermic species such as lizards are particularly sensitive to climate (Angilletta *et al.,* 2004) and environmental variables such as temperature, rainfall, and relative humidity regulate their metabolism and physiology, which in turn affects the demographic performance of populations through controls on their development, growth, reproduction, overwinter survival, microhabitat use, and behaviour (Bellis *et al.,* 2020).

Comparatively little is known about how climate change will impact lizard distributions in temperate regions such as New Zealand. However, vulnerability to climate change is expected to vary among New Zealand lizard species and with rising temperatures and more frequent rainfall, climate change in New Zealand is expected to result in a reduction in the amount of climatically suitable area for some lizards (Jarvie *et al*., 2022).

A recent study on weather-dependent effects and life-history traits on microhabitat use by korero geckos at Macraes suggested that future climate warming may provide some initial benefits to these cold-tolerant geckos (e.g., creating a warmer environment where activity levels may increase). However, over the longer-term, outcomes are likely dependent on the magnitude of warming and the availability of suitably cool refugia to ensure body temperatures do not surpass thermal maxima, which would lead to mortality (Chukwuka, 2020). Subsequent predictive modelling has demonstrated that the amount of climatically suitable area for New Zealand lizards in general increased for a minority of species under climate change, but decreased for the majority, and disappeared entirely under the business-as-usual scenario for three species of native lizard; one of which is the korero gecko (Jarvie *et al*., 2022).

While it is not possible to quantify, with any certainty, the potential impacts of climate change on lizards, it is important to identify species likely to be vulnerable to climate change, understand the climate requirements of focal species, and consider current and future climate suitability when selecting mitigation sites to minimise future biodiversity loss (IUCN, 2013; Pecl *et al*., 2017; Bellis *et al.,* 2020; Jarvie *et al*., 2022).

Furthermore, considering the permanent loss of key habitat features as a result of development and how this may accelerate climate change impacts is important. For example, the loss of rock tors as part of MP4 may have implications for the ability of saxicolous (i.e., 'tor-reliant') lizards (e.g., korero gecko) to persist in the face of climate change. Korero geckos are reliant on rock tors for critical life history needs (e.g., protection from predators, thermoregulation, refuge from high and low temperatures, social interactions) and where complex tors are lost and cannot to be replaced during site remediation then geckos may become predisposed to climate change associated effects (e.g., warmer temperatures, higher rainfall, predatory mammal habitat expansion). Of the lizards known to occur in the ZOI, those with life-history traits such as larger body size, lower reproductive output, and later maturity (e.g., korero gecko) are expected to be the most vulnerable to climate change effects.

Finally, consideration of potential climate change effects on species or taxonomic groups that threaten native lizards (e.g., introduced predatory mammals) and on vegetation that provides habitat for lizards is equally important when designing management packages to address adverse effects of development on native lizards.

Climate change impacts in relation to the MP4 Project have been addressed in Table 4.7.

4.4 LEVEL OF EFFECT ON HERPETOFAUNA

Based on the current assessment, the project would result in the direct mortality of an undetermined number (likely high 1,000s) of native lizards, including the loss of individuals of 'At Risk' taxa, within the PC footprints. The proposed project would also result in the permanent loss of approximately 73 ha of identified lizard habitat, much of it occupied by native lizards (including 'At Risk' and 'Not Threatened' taxa). At least 12 irreplaceable rock tors/ rock tor complexes would be lost. In addition, potential indirect, temporal, and unquantified impacts may affect up to 79 ha of suitable or potentially suitable lizard habitat, including 71 high quality rock tors, in the buffer zone.

On a landscape scale, the impacted areas are relatively small compared to the availability of habitat for native lizard taxa within the local (< 1% of land within OGL Macraes landholdings) and Macraes ED (< 0.5%) landscapes. However, considering the potential additive or cumulative effects of historical and future land conversion and habitat clearance, the scale of the impact on local lizards is likely to be higher.

The level of effects on native lizard populations and their habitats within the PCs, prior to measures to avoid, remedy, or mitigate, range from **Very low** to **High** (Table 4.7).

A level of effect that corresponds to Moderate, High or Very High is generally accepted by ecologists to constitute a 'significant ecological effect' under the RMA and it is usual for a 'Very High' level of effect to trigger re-design or avoidance. A Low or Very Low level of effect is usually considered to correspond to a 'minor ecological effect' or 'less than minor ecological effect', respectively under the RMA. A level of effect of Moderate or higher generally requires mitigation measures to reduce the level of effect.

Table 4.7. Assessment of magnitude of effects and level of <u>unmitigated</u> effects on herpetofauna and herpetofauna habitats as a result of the proposed MP4 Project activities.

Site	Herpetofauna value score	Direct adverse effect	Indirect effects	Magnitude of effect (Table 8 EIANZ)	Level of unmitigated effects (Table 10 EIANZ)
CO6 Pit	High	Permanent loss of: • Native lizards (both 'Not Threatened' and 'At Risk' species), though it is anticipated that only a relatively small proportion of the lizard population within the local landscape (OGL Macraes landholdings) and Macraes ED (estimated at < 5% and < 1%, respectively) would be affected. On a national scale, the impact on lizards is considered Negligible. • 5.54 ha of lizard habitat, including loss of 1 rock tor (0.002 ha), representing a relatively small proportion of the available habitat in the local landscape (OGL Macraes landholdings) (estimated at < 1%) and Macraes ED (estimated at < 0.5%) would be affected. On a national scale, the impact on lizard habitat is considered Negligible. Habitat suitability score of Moderate (Baber *et al.* 2021). Qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under one or all the NPSIB, POORPS/ PORP and WDP. Cumulative effect: loss of lizards and lizard habitat will contribute to the historical and future loss of these features from the local landscape and Macraes ED. Permanent loss of rock tors may predispose 'At Risk' species to climate change impacts. Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR having a minor effect on the known population or range of the element/feature.	Lizard populations and habitats in the buffer zone (specifically the ~5 ha of tussockland) immediately adjacent to the project footprint may be subject to edge effects, vibration, noise, and dust disturbance.	Low	Low
CN BF	Low	Permanent loss of: • Native lizards ('Not Threatened' species), though it is anticipated that a very small proportion of the lizard population within the local landscape (OGL Macraes landholdings) and Macraes ED (estimated at < 1% and < 0.5%, respectively) would be affected. On a national scale, the impact on lizards is considered Negligible. • 0.02 ha of lizard habitat, representing a tiny proportion of the available habitat in the local landscape (OGL Macraes landholdings) (estimated at < 0.05%) and Macraes ED (estimated at < 0.05%) would be affected. On a national scale, the impact on lizard habitat is considered Negligible. Habitat suitability score of Low/ Moderate (Baber *et al.* 2021). Does not qualify as an area with significant indigenous vegetation or significant habitats of indigenous fauna under one or all the NPSIB, POORPS/ PORP and WDP.	Unlikely to be any indirect effects given the buffer zone is comprised of existing mine working (i.e., no lizard values)	Negligible	Very low

		Cumulative effect: loss of lizards and lizard habitat will contribute to the historical and future loss of these features from the local landscape and Macraes ED. Permanent loss of rock tors may predispose 'At Risk' species to climate change impacts. Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR having a minor effect on the known population or range of the element/feature.			
NGWRS	Low	Permanent loss of: • Native lizards ('Not Threatened' species) that may be present in the footprint. It is anticipated that a very small proportion of the lizard population within the local landscape (OGL Macraes landholdings) and Macraes ED (estimated at < 1% and < 0.5%, respectively) would be affected. On a national scale, the impact on lizards is considered Negligible. • 17.6 ha of low-quality lizard habitat (exotic grass growing over waste rock), representing a tiny proportion of the available habitat in the local landscape (OGL Macraes landholdings) (estimated at < 0.05%) and Macraes ED (estimated at < 0.05%) would be affected. On a national scale, the impact on lizard habitat is considered Negligible. Habitat suitability score of Low/ Moderate (Baber *et al.* 2021). Does not qualify as an area with significant indigenous vegetation or significant habitats of indigenous fauna under one or all the NPSIB, POORPS/ PORP and WDP. Cumulative effect: loss of lizards and lizard habitat will contribute to the historical and future loss of these features from the local landscape and Macraes ED. It is acknowledged that the NGWRS area has been previously worked over. Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR having a minor effect on the known population or range of the element/feature.	Indirect effects considered unlikely due to the area having been worked historically and much of the footprint is currently surrounded by active mine workings.	Low	Very Low

GB2 Pit	High	Permanent loss of: • Native lizards (both 'Not Threatened' and 'At Risk' species), though only a relatively small proportion of the lizard population within the local landscape (OGL Macraes landholdings) and Macraes ED (estimated at < 5% and < 1%, respectively) would be affected. On a national scale, the impact on lizards is considered Negligible. • ~5 ha of higher quality lizard habitat, including loss of 6 rock tors (0.01 ha) and in addition, loss of ~ 9 ha of lower quality exotic pastureland that supports lizards. Relatively small proportion of the available habitat in the local landscape (OGL Macraes landholdings) (estimated at < 1%) and Macraes ED (estimated at < 0.5%) would be affected. On a national scale, the impact on lizard habitat is considered Negligible. Cumulative effect: loss of lizards and lizard habitat will contribute to the historical and future loss of these features from the local landscape and Macraes ED. Habitat suitability score of High (Baber *et al.* 2021). Qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under one or all the NPSIB, POORPS/ PORP and WDP. Permanent loss of rock tors may predispose 'At Risk' species to climate change impacts. Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.	Lizard populations and habitats immediately adjacent to the project footprint may be subject to edge effects, vibration, noise, and dust disturbance. Lizard habitat occurring in the 100 m buffer zone is of moderate quality for lizards (i.e., mostly comprised of grazed tussockland and riparian vegetation, with few complex rock tors.	Moderate	High
GB WRS	High	Permanent loss of: • Native lizards (both 'Not Threatened' and 'At Risk' species), representing a relatively small proportion of the lizard population within the local landscape (OGL Macraes landholdings) and Macraes ED (estimated at < 5% and < 1%, respectively) would be affected. On a national scale, the impact on lizards is considered Negligible. • ~48 ha of higher quality lizard habitat, including loss of 5 rock tors (0.03 ha) and 23.5 ha of tussockland. In addition, loss of ~ 24 ha of lower quality exotic pastureland that supports lizards. Representing a relatively small proportion of the available habitat in the local landscape (OGL Macraes landholdings) (estimated at < 1%) and Macraes ED (estimated at < 0.5%) would be affected. On a national scale, the impact on lizard habitat is considered Negligible. Habitat suitability score of High (Baber *et al.* 2021). Qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under one or all the NPSIB, POORPS/ PORP and WDP. Cumulative effect: loss of lizards and lizard habitat will contribute to the historical and future loss of these features from the local landscape and Macraes ED. Permanent loss of rock tors may predispose 'At Risk' species to climate change impacts.	Lizard populations and habitats immediately adjacent to the project footprint may be subject to edge effects, vibration, noise, and dust disturbance. Lizard habitat occurring in the 100 m buffer zone is of high quality for lizards (i.e., tussockland and large complex rock tor complexes, and riparian vegetation)	Moderate	High

		Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR Loss of a moderate proportion of the known population or range of the element/feature.			
IM 9 Pit	High	Permanent loss of: • Small numbers of 'Not Threatened' and if present, 'At Risk' lizards. • A small area (~0.46 ha) of lower value native lizard habitat. Cumulative effect: loss of lizards and lizard habitat will contribute to the historical and future loss of these features from the local landscape and Macraes ED. Habitat suitability score of Very low (Baber *et al.* 2021). If At Risk lizards are confirmed, it qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under NPSIB. Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR having negligible effect on the known population or range of the element/feature.	Lizard populations and habitats immediately adjacent to the project footprint may be subject to edge effects, vibration, noise, and dust disturbance.	Low	Low
IM 10 Pit	High	Permanent loss of: • Small numbers of 'Not Threatened' and if present, 'At Risk' lizards. • A small area (~3.9 ha) of lower value native lizard habitat. Cumulative effect: loss of lizards and lizard habitat will contribute to the historical and future loss of these features from the local landscape and Macraes ED. Habitat suitability score of Very low (Baber *et al.* 2021). If At Risk lizards are confirmed, it qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under NPSIB. Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR having negligible effect on the known population or range of the element/feature.	Lizard populations and habitats immediately adjacent to the project footprint may be subject to edge effects, vibration, noise, and dust disturbance.	Low	Low

Frasers BF/WRS	Negligible	• No impacts on lizards anticipated inside the footprint as there is no existing lizard habitat present. Habitat suitability score of Negligible. Does not qualify as an area with significant indigenous vegetation or significant habitats of indigenous fauna under the NPSIB, POORPS/ PORP and WDP. No change from the existing baseline condition AND/OR having negligible effect on the known population or range of the element/feature.	No or very minor anticipated indirect effects considering the land surrounding the impact area has been previously disturbed/ worked and is of poor quality for native lizards.	Negligible	Very low
GB RR	High	If lizards are present, there would be permanent loss of: • Native lizards (both 'Not Threatened' and 'At Risk' species), representing a relatively small proportion of the lizard population within the local landscape (OGL Macraes landholdings) and Macraes ED (estimated at < 5% and < 1%, respectively) would be affected. On a national scale, the impact on lizards is considered Negligible. • Lower value native lizard habitat (~ 0.06 ha of tussockland and 0.87 ha of exotic grass), representing a relatively small proportion of the available habitat in the local landscape (OGL Macraes landholdings) (estimated at < 1%) and Macraes ED (estimated at < 0.5%) would be affected. On a national scale, the impact on lizard habitat is considered Negligible. Cumulative effect: loss of lizards and lizard habitat will contribute to the historical and future loss of these features from the local landscape and Macraes ED. Habitat suitability score of Low (Baber *et al.* 2021). Qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under one or all the NPSIB, POORPS/ PORP and WDP. Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR having negligible effect on the known population or range of the element/feature.	Minor anticipated indirect effects considering the land surrounding the impact area has either been previously disturbed/ worked or is already subject to edge effects, vibration, noise, and dust disturbance. Habitat in the buffer area is generally of lower quality for native lizards.	Low	Low
GP BB	High	If lizards are present, there would be permanent loss of: • Native lizards (both 'Not Threatened' and 'At Risk' species), representing a relatively small proportion of the lizard population within the local landscape (OGL Macraes landholdings) and Macraes ED (estimated at < 1% and < 0.5%, respectively) would be affected. On a national scale, the impact on lizards is considered Negligible. • Lower value native lizard habitat (~ 0.6 ha of exotic grass), representing a very small proportion of the available habitat in the local landscape (OGL Macraes landholdings) (estimated at < 1%) and Macraes ED (estimated at < 0.5%) would be affected. On a national scale, the impact on lizard habitat is considered Negligible. Cumulative effect: loss of lizards and lizard habitat will contribute to the historical and future loss of these features from the local landscape and Macraes ED.	Minor anticipated indirect effects considering the land surrounding the impact area has either been previously disturbed/ worked or is already subject to edge effects, vibration, noise, and dust disturbance. Habitat in the buffer area is generally of poor quality for native lizards.	Low	Low

		Habitat suitability score of Low (Baber *et al.* 2021). Qualifies as an area with significant indigenous vegetation or significant habitats of indigenous fauna under one or all the NPSIB, POORPS/ PORP and WDP. Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR having negligible effect on the known population or range of the element/feature.			

5 RECOMMENDATIONS TO ADDRESS POTENTIAL ADVERSE EFFECTS

Efforts to address potential adverse effects are considered necessary for all habitats and species that are expected to incur 'Moderate' or 'High' 'Level of Effects' as a result of the project (Table 4.7) (Roper-Lindsay *et al.,* 2018).

While adverse effects are not addressed in this report, two key documents have been prepared as part of the MP4 Project to identify how OGL will avoid, mitigate, remedy, offset, and/ or compensate for adverse effects on ecological (including herpetofauna) values resulting from the Project. These documents are the Lizard Management Plan (Bioresearches, 2024b) and the Impact Management Plan (Ahikā Consulting, 2024b). Together these management plans address:

- Efforts to avoid or minimise the potential for adverse ecological effects through optioneering and concept design phases of the project and include refining the configuration of the project, where possible, to avoid high ecological value areas.
- Lizard mitigation options such as salvage and relocation of native lizards into suitable and secure habitat outside of the project footprint, where long term site protection is guaranteed.
- Opportunities for remediation such as the restoration of native lizard habitats on capped waste rock stacks or reversion of pastural land to native vegetation on OceanaGold landholdings to replenish lizard habitat within the surrounding landscape.
- Offsetting and compensation measures to address remaining (residual) adverse effects. Offset or compensatory measures will involve land covenanting, revegetation, pest control (i.e., weeds and introduced predatory mammals), and potentially out of kind (like-for-like or trade-up) contributions.

6 REFERENCES

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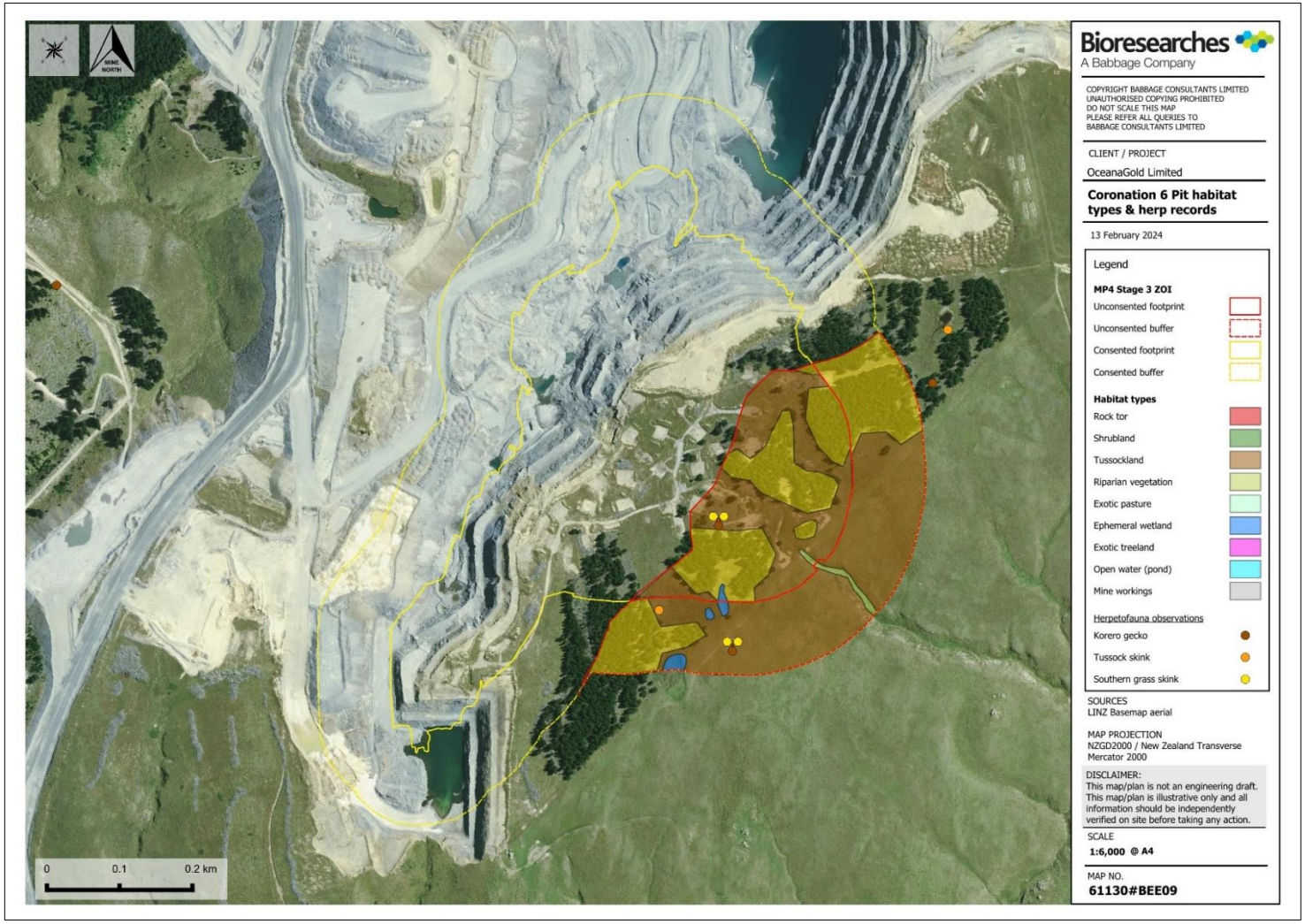
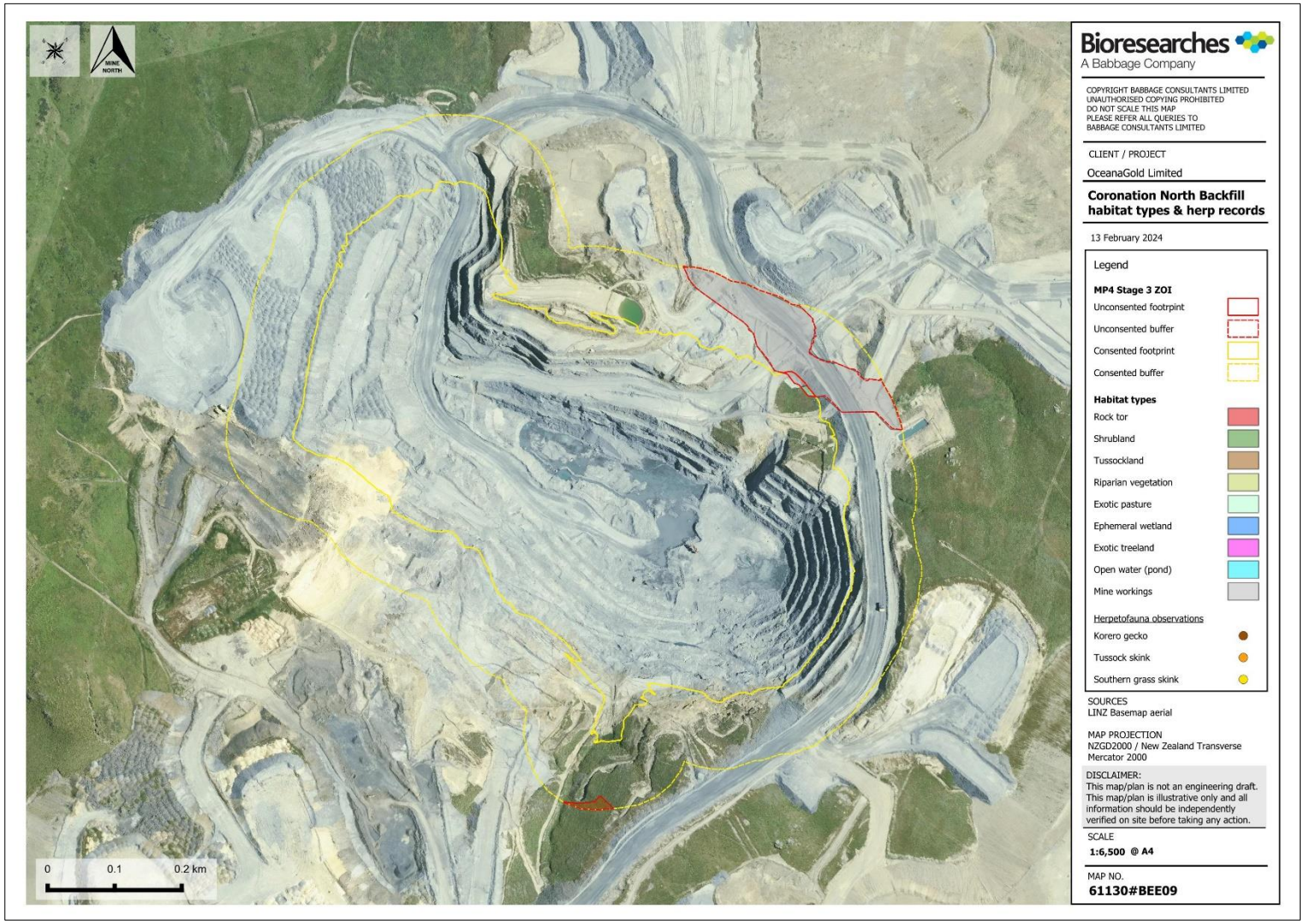
7 APPENDICES

APPENDIX I. HERPETOFAUNA SURVEY RECORDS AND MAPPED HERPETOFAUNA HABITAT TYPES FOR EACH MP4 PROJECT COMPONENT (PC)

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Coronation North Backfill habitat types & herp records
13 February 2024
Legend
MP4 Stage 3 ZOI
Unconsented footprint
Unconsented buffer
Consented footprint
Consented buffer
Habitat types
Rock tor
Shrubland
Tussockland
Riparian vegetation
Exotic pasture
Ephemeral wetland
Exotic treeland
Open water (pond)
Mine workings
Herpetofauna observations
Korero gecko
Tussock skink
Southern grass skink
SOURCES
LINZ Basemap aerial
MAP PROJECTION
NZGD2000 / New Zealand Transverse Mercator 2000
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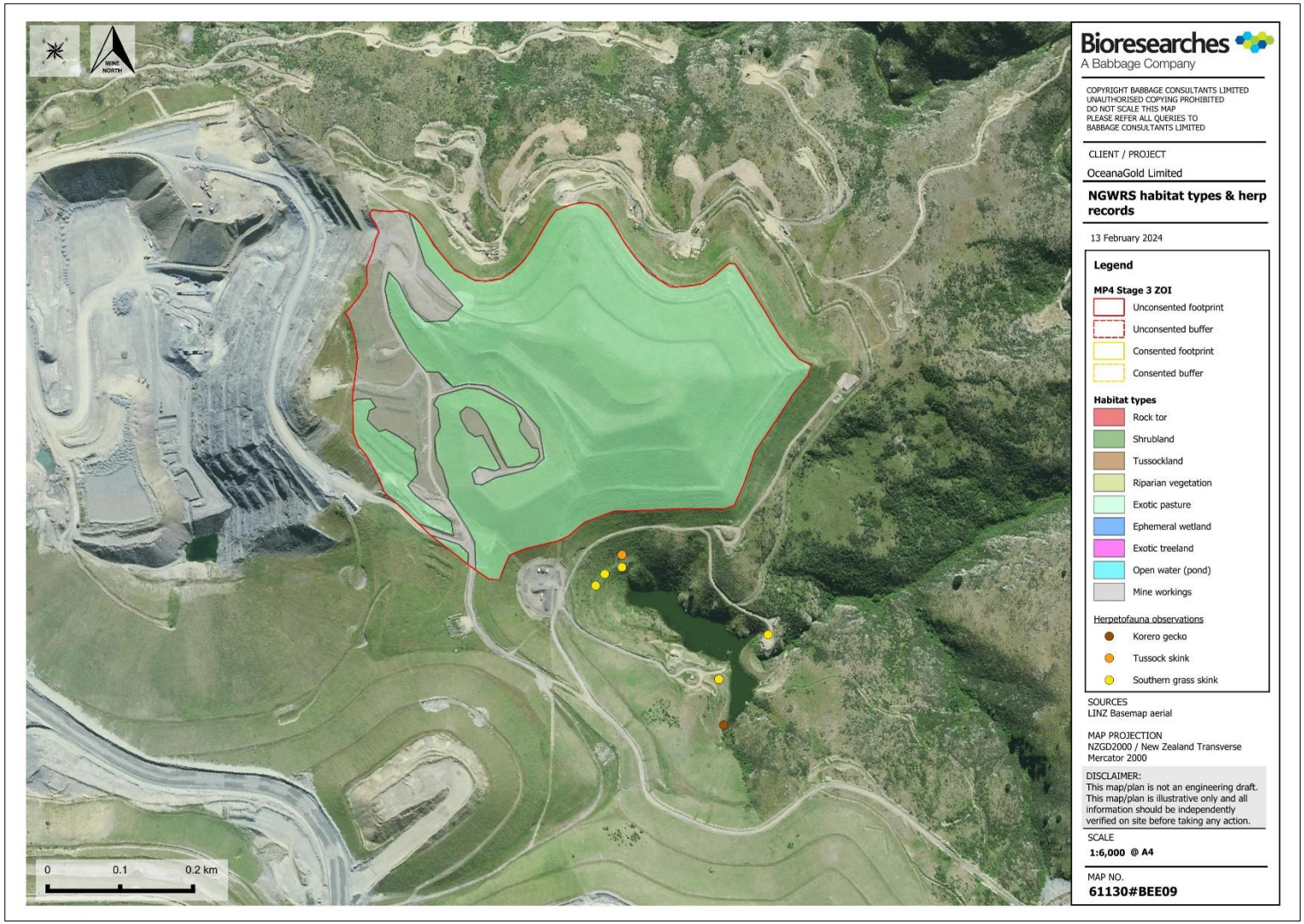
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Herpetofauna observations
Korero gecko
Tussock skink
Southern grass skink
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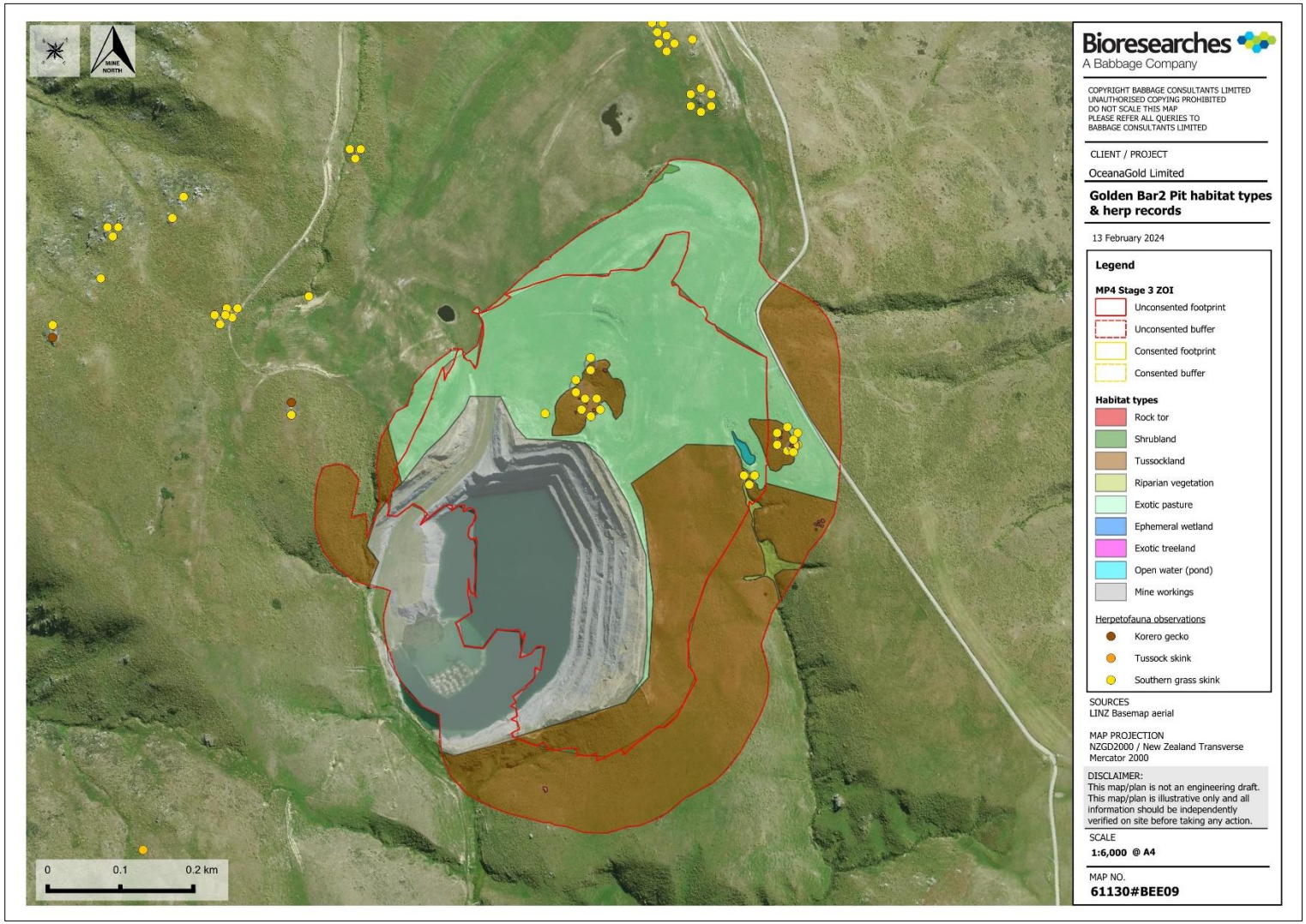
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Golden Bar2 Pit habitat types & herp records
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Exotic pasture
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Mine workings
Herpetofauna observations
Korero gecko
Tussock skink
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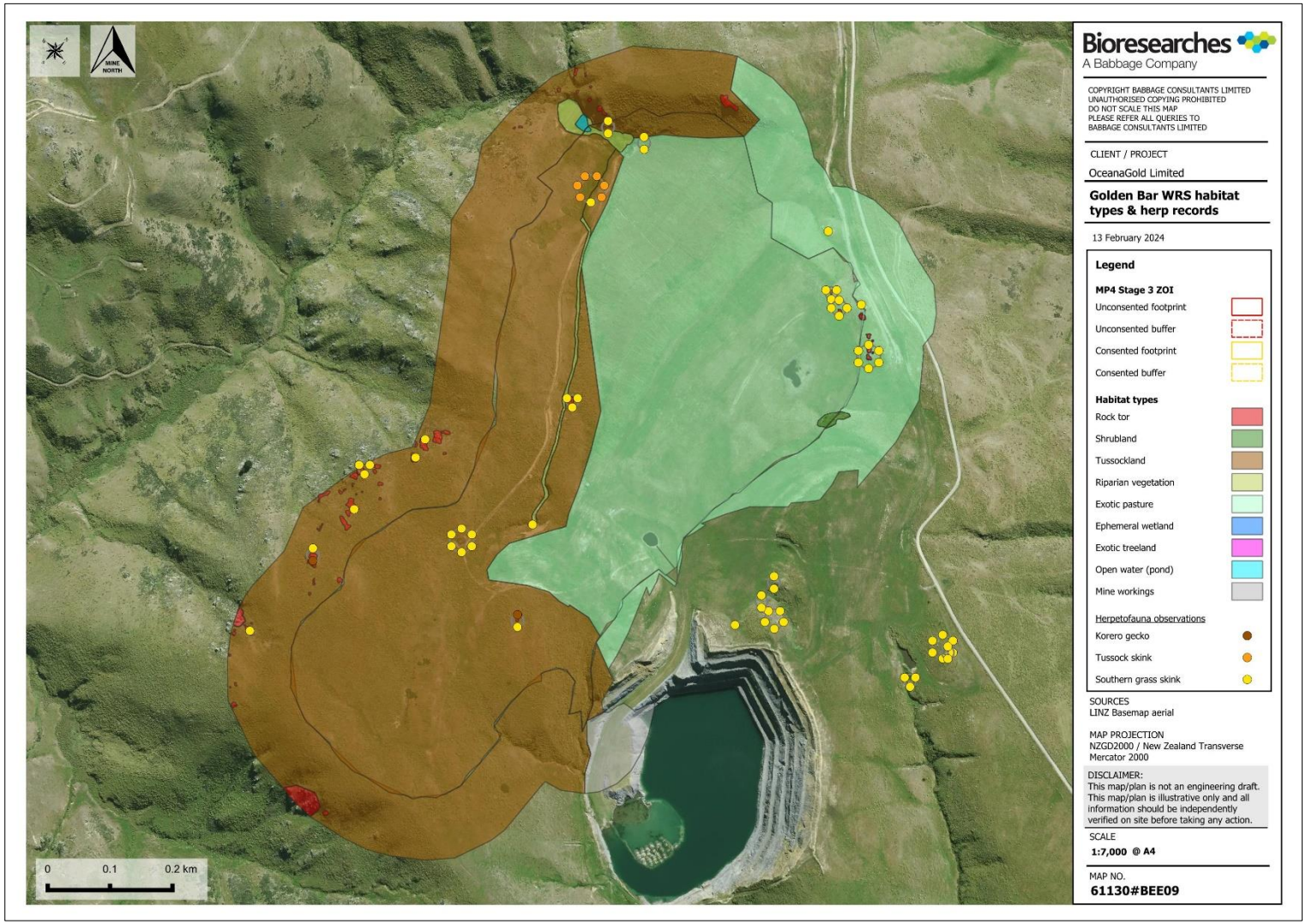
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Golden Bar WRS habitat types & herp records
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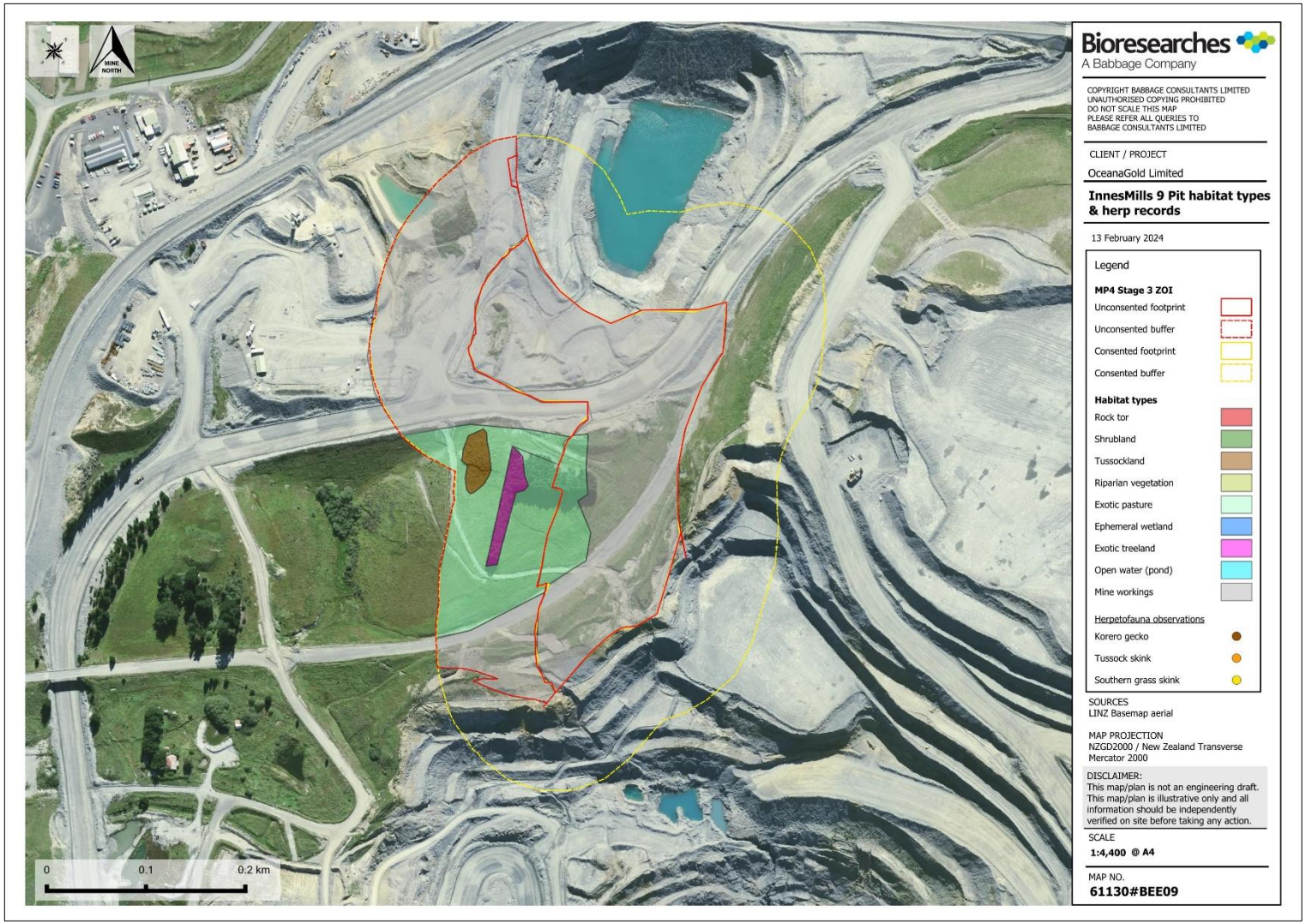
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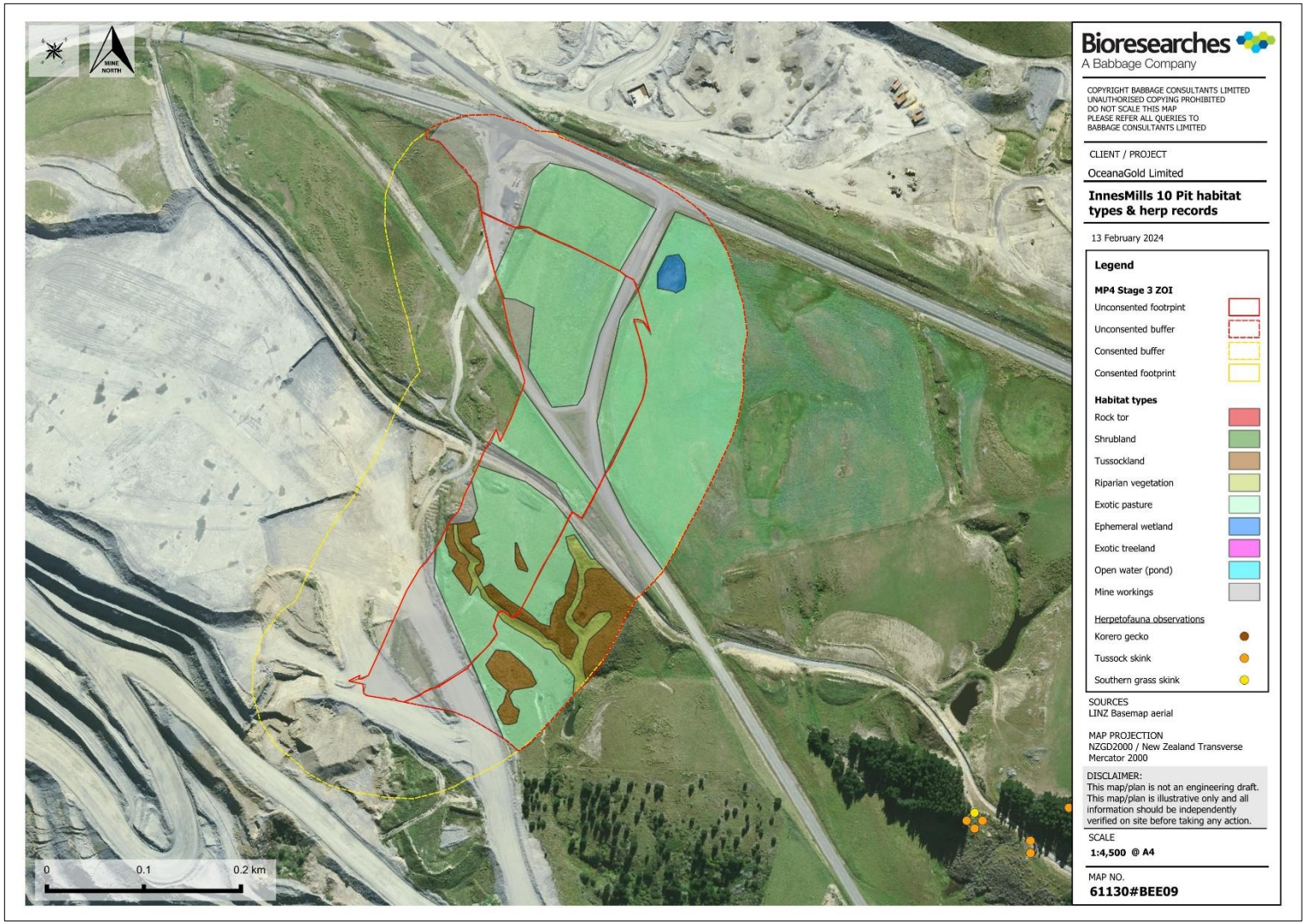
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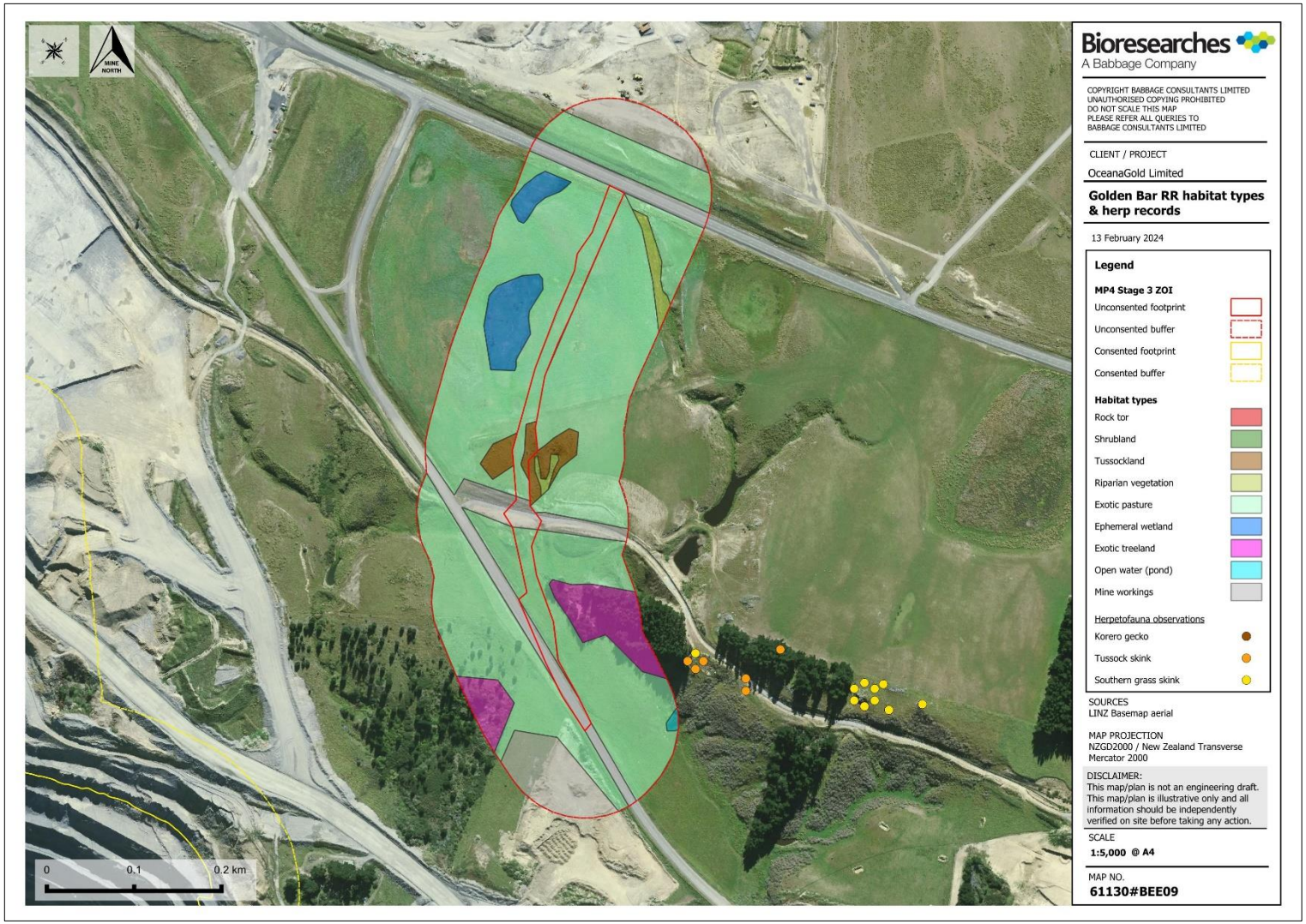
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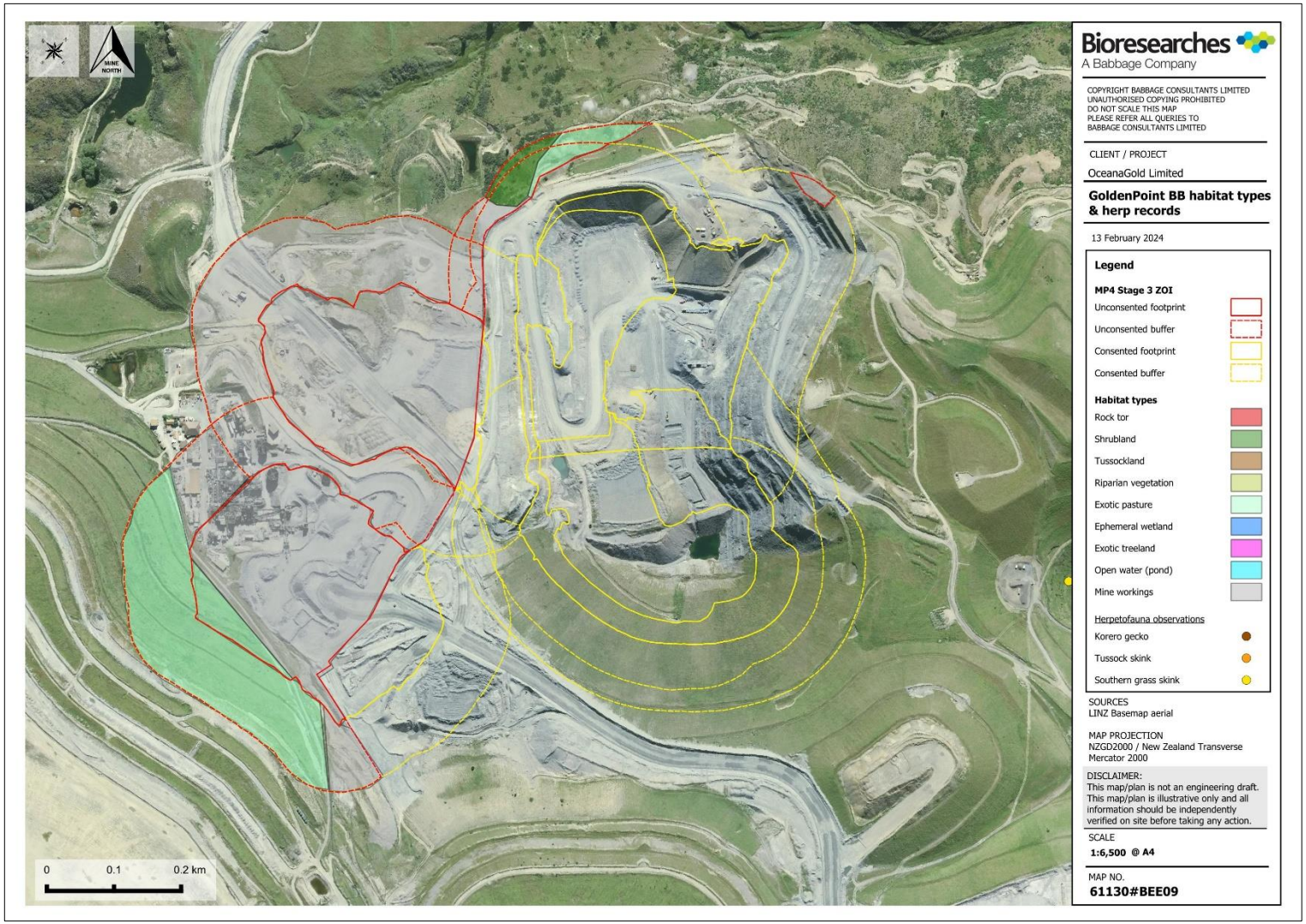
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APPENDIX II. EIANZ KEY TABLES FOR ASSESSING LEVEL OF EFFECT.

Table 5 Factors to consider in assigning value to terrestrial species for EcIA

Determining factors	
Nationally Threatened species, found in the ZOI either permanently or seasonally	Very High
Species listed as At Risk – Declining, found in the ZOI, either permanently or seasonally	High
Species listed as any other category of At Risk, found in the ZOI either permanently or seasonally	Moderate
Locally (ED) uncommon or distinctive species	Moderate
Nationally and locally common indigenous species	Low
Exotic species, including pests, species having recreational value	Negligible

Table 6. Scoring for sites or areas combining values for four matters in Table 4.

Value	Description
Very High	Area rates High for 3 or all of the four assessment matters listed in **Table 4**. Likely to be nationally important and recognised as such.
High	Area rates High for 2 of the assessment matters, Moderate and Low for the remainder, or Area rates High for 1 of the assessment maters, Moderate for the remainder. Likely to be regionally important and recognised as such.
Moderate	Area rates High for one matter, Moderate and Low for the remainder, or Area rates Moderate for 2 or more assessment matters Low or Very Low for the remainder Likely to be important at the level of the Ecological District.
Low	Area rates Low or Very Low for majority of assessment matters and Moderate for one. Limited ecological value other than as local habitat for tolerant native species.
Negligible	Area rates Very Low for 3 matters and Moderate, Low or Very Low for remainder.

Table 8. Criteria for describing magnitude of effect (Adapted from Regini (2000) and Boffa Miskell (2011))

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

Table 10. Criteria for describing level of effects (Adapted from Regini (2000) and Boffa Miskell (2011))

Ecological Value ▸ Magnitude ▾	Very high	High	Moderate	Low	Negligible
Very high	Very high	Very high	High	Moderate	Low
High	Very high	Very high	Moderate	Low	Very low
Moderate	High	High	Moderate	Low	Very low
Low	Moderate	Low	Low	Very low	Very low
Negligible	Low	Very Low	Very low	Very low	Very low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

APPENDIX III. PROPOSED SET OF CRITERIA FOR ASSESSING HABITAT SUITABILITY OF A SPECIES (BABER *ET AL.*, 2021).

Habitat suitability value score	Description
Negligible	Habitat not suitable.
Very low	Marginal habitat that may be used but is not important for any part of the species or species assemblage life cycle(s).
Low	Habitat that provides some, but not all, of a species or species assemblages life-history requirements and/or the habitat is of low quality and the relative abundance within the habitat is low compared to other habitat types.
Moderate	Habitat that provides for most, if not all, of a species or species assemblage's life-history requirements and/or the habitat quality is of moderate quality and the relative abundance within the habitat is moderate compared to other habitat types.
High	Habitat that would typically provide for all species or species assemblage life-history requirements and/or provides a critical resource or resource(s) for life-history requirements. The habitat quality is high and the relative abundance within the habitat is, or is likely to be, high compared to other habitat types.
Very high	Habitat that provides for all species or species assemblage life-history requirements and/or provides a critical resource or resource(s) needed for life-history requirements. The habitat quality is very high and the relative abundance within the habitat is or is likely to be very high compared to other habitat types. Likely to be a local or regional hotspot for that species assemblage or benchmark with the species or species assemblage at carrying capacity.