

Macraes Phase 4 - Fast-track

Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

for: Oceana Gold (New Zealand) Limited



Document Approval and Revision History

Document title	Macraes Phase 4 - Fast-track
	Ecological Impact Assessment for Terrestrial and Wetland Ecology Values
Prepared for	Oceana Gold (New Zealand) Limited
Version	Final
Date	3 September 2026
Filename	E7_MP4Fast_Ecia_REV 0 020926

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Rev. no.	Date	Author(s)
Final	3 September 2026	CW, DvW, LD, MA

Reference: Bioresearches (2026). Ecological Impact Assessment for Terrestrial and Wetland Ecology Values. Report for OceanaGold New Zealand Limited. 265 p.

Cover Illustration: Golden Bar pit, Macraes, Otago.

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List of Abbreviations and Terminology

List of abbreviations.

Abbreviation	Full term
AEE	Assessment of Environmental Effects
AMP	Avifauna Management Plan
BOAM	Biodiversity Offset Accounting Model
BRWRS	Back Road Waste Rock Stack
CMA	Central Mining Area
CN	Coronation Mining Area
DOC	Department of Conservation
DVT	Direct Vegetation Transfer
ED	Ecological District
EclA	Ecological Impact Assessment
EclAG	Ecological Impact Assessment Guidelines
EIANZ	Environment Institute of Australia and New Zealand
FTAA	Fast-track Approvals Act 2024
FTSF	Frasers Tailings Storage Facility
GB	Golden Bar
GBHR	Golden Bar Haul Road
GPUG	Golden Point Underground / Golden Point Underground Extension
ha	hectares
LMMP	Lizard Management Plan
MEEA	Murphys Ecological Enhancement Area
MP3	Macraes Phase III Project
MP4	Macraes Phase Four Project
NES-F	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NPS-FM	National Policy Statement for Freshwater Management
NPS-IB	National Policy Statement for Indigenous Biodiversity
ORC	Otago Regional Council
ORPS	Otago Regional Policy Statement
OGL	OceanaGold
OGLNZL	Oceana Gold (New Zealand) Limited

pORPS	Proposed Otago Regional Policy Statement
RMA	Resource Management Act 1991
REMP	Residual Effects Management Plan
REA	Residual Effects Analysis
REAR-TE	Residual Effects Analysis Report: Terrestrial Ecology
REAR-WE	Residual Effects Analysis Report: Wetland Ecology
SCD	Seepage Capture Drains
TAR	Threatened and At Risk
TSF	Tailings Storage Facility
VDT	Vegetation Direct Transfer
WDC	Waitaki District Council
WRS	Waste Rock Stack
ZOI	Zone of Influence

List of key terminology.

Term	Meaning in this report
20 m buffer	A precautionary buffer was applied around parts of the direct impact footprint to account for potential edge effects or uncertainty in the extent of disturbance. For Threatened plant assessment, plants within the footprint or 20 m buffer are treated as unable to be avoided unless otherwise confirmed.
80 m buffer	A wider ecological records buffer is used in parts of the vegetation assessment to identify nearby Threatened, At Risk, Data Deficient or locally uncommon plant records that may be relevant to indirect effects or management planning.
100 m wetland assessment area	The area used in the wetland assessment to consider potential indirect effects on natural inland wetlands, including drainage, dewatering, altered runoff or other hydrological effects.
Avoidance	Measures that prevent an adverse effect from occurring, such as removing BRWRS from the MP4 development footprint or avoiding retained habitats through final set-out and no-go areas.
Back Road Waste Rock Stack avoidance	The removal of BRWRS from the MP4 development footprint, avoiding direct vegetation clearance, earthworks, waste rock placement and associated habitat loss in that area.
Biodiversity compensation	A conservation outcome that meets the requirements in Appendix 4 of the NPS-IB and results from actions that are intended to compensate for any more than minor residual adverse effects on indigenous biodiversity after all appropriate avoidance, minimisation, remediation, and biodiversity offsetting measures have been sequentially applied.
Biodiversity offset	A measurable conservation outcome that meets the requirements in Appendix 3 of the NPS-IB and results from actions that are intended to redress any more than minor residual adverse effects on indigenous biodiversity after all appropriate avoidance, minimisation, and remediation measures have been sequentially applied; and achieve a net gain in type, amount, and condition of indigenous biodiversity compared to that lost.
Direct effects	Effects that occur through direct physical disturbance, including vegetation clearance, wetland reclamation, earthworks, pit development, waste rock placement, road construction or habitat removal.
Direct loss area	The mapped area of proposed works where vegetation clearance, earthworks, reclamation, landform modification or other direct physical disturbance may occur.
Ecological value	The importance assigned to an ecological receptor, using the EIANZ framework and considering representativeness, rarity/distinctiveness, diversity, pattern, and ecological context.
Impact area	The direct loss area plus any precautionary contingency applied for assessment purposes, unless otherwise stated. In this EclA, several terrestrial vegetation and fauna effect calculations include the direct loss area plus a 20 m precautionary contingency.
Indirect effects	Effects that occur outside the direct disturbance footprint or through secondary pathways, including dust deposition, weed invasion, altered hydrology, sedimentation, edge effects, noise, vibration, lighting or accidental encroachment.
Level of effect	The overall effect rating is derived by combining ecological value and magnitude of effect using the EIANZ EclA matrix.
Magnitude of effect	The scale or degree of ecological change expected as a result of the Project, considering factors such as extent, duration, intensity, reversibility and proportion of the receptor affected.

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Minimisation	Measures that reduce the extent, duration or severity of an adverse effect, including staged clearance, construction controls, dust suppression, erosion and sediment controls, weed hygiene and ecological supervision.
Natural inland wetland	A natural inland wetland as defined under the NPS-FM and relevant wetland delineation protocols.
No-go area	An area identified for protection during works, usually demarcated by fencing, flagging or other physical controls to prevent accidental disturbance.
Project	The Macraes Phase Four Project, comprising the proposed mining, infrastructure, waste rock storage, tailings storage, road realignment, underground mining and associated ecological management works, was assessed in this EclA.
Project Footprint	Includes all areas within which MP4 works is proposed to occur, including consented and unconsented areas such as pits, waste rock stacks, haul roads, road realignments, tailings storage, backfill areas and associated infrastructure.
Remediation	Measures that repair or reinstate affected areas within the Project Footprint, including rehabilitation of disturbed landforms, replacement of growth media and revegetation.
Residual effects	Adverse ecological effects that remain after measures to avoid, minimise, and remedy effects have been applied.
Threatened and At Risk plants	Plant species with a recognised national or regional conservation status, including Regionally Threatened, Regionally At Risk, Data Deficient and locally uncommon species, where assessed in the vegetation values report.
Vegetation Direct Transfer	The transfer of intact vegetation, associated soil, seedbank and substrate from an impact area to a recipient site, where practicable, to retain ecological material and assist restoration or threatened plant management.
Zone of Influence	The areas/resources/values that may be affected by the biophysical changes caused by the proposed Project and associated activities within a defined wider area, both within and beyond the Project Footprint. This may include areas affected by dust, noise, vibration, lighting, hydrological change, sedimentation, edge effects or other disturbance pathways.

1 Executive summary

1.1 Purpose and scope

This Ecological Impact Assessment (EclA) assesses the effects of the Macraes Phase 4 Project (MP4, the Project) on terrestrial and wetland ecological values within the Macraes' Ecological District (ED). It is the principal terrestrial and wetland ecology assessment supporting the Project's application under the Fast-track Approvals Act 2024 and integrates the findings of the supporting vegetation, flora, invertebrate, lizard, avifauna, bat and wetland assessments and management plans.

The assessment applies the EIANZ Ecological Impact Assessment Guidelines (2018) and the effects management hierarchies established by the National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB) and the National Policy Statement for Freshwater Management 2020 (NPS-FM). This report:

- Identifies the ecological values present, including terrestrial vegetation, flora, invertebrates, lizards, birds, bats and wetlands;
- Assesses direct and indirect effects arising from construction and operation; and
- Determines the residual level of effect after avoidance, minimisation and remediation.

Biodiversity offset and compensation outcomes, including whether net positive or net loss is predicted, are assessed separately in the Terrestrial and Wetland Residual Effects Analysis reports (Bioresearches, 2026l; Bioresearches, 2026m). This EclA identifies the values for which Moderate or higher residual levels of effect remain, and residual effects management is required.

1.2 Project overview

MP4 would extend mining at the Macraes Operation to approximately 2039. The Project includes open pit extensions, underground mining, waste rock storage, tailings storage, pit backfilling, road and haul road works, and associated infrastructure.

The principal surface work areas assessed are Coronation Mining Area, the Central Mining Area, the Golden Bar Haul Road and the Golden Bar Mining Area. The Golden Point Underground Extension is predominantly subterranean and is not expected to require substantial surface vegetation clearance. The Back Road Waste Rock Stack has been removed from the MP4 development footprint and is therefore treated as an avoided direct impact area.

The assessed non-consented impact area, comprising the direct impact footprint and a precautionary 20 m buffer, is approximately 325 ha. Approximately 220 ha comprises modified land cover, including exotic grassland, mine-disturbed land, roads, pine and rehabilitated mine surfaces. Within the direct impact footprint, the principal indigenous terrestrial habitat losses include approximately 75.42 ha of Snow tussock grassland (hereby referred to as snow tussock grassland), 2.22 ha of dry shrubland and 0.16 ha of rock habitat. When the 20 m buffer is included, the corresponding assessed extents are 90.01 ha, 3.06 ha and 0.26 ha.

1.3 Approach to the assessment

Ecological values were assigned using the EIANZ value scale of Negligible, Low, Moderate, High and Very High. Species values were based conservatively on the higher of the applicable national or regional threat classification. The magnitude of each effect was then assessed and combined with ecological value to determine the level of effect. A precautionary approach was applied where survey coverage, detection probability, ecological response or management outcomes were uncertain.

Direct habitat loss was quantified from the direct impact footprint. Indirect effects, including dust, weeds, sedimentation, altered runoff, hydrological change and edge effects, were assessed beyond that footprint according to the relevant effect pathway. The Impact area provides an additional 20 m precautionary edge allowance for residual effects analyses on immediately adjoining habitat, with additional areas considered where particular indirect effects may extend further.

Rehabilitation refers to ecological repair within the Project footprint. Conservation actions undertaken outside directly affected areas are treated as biodiversity offsetting or compensation, except where actions adjacent to works directly repair an identified indirect effect.

1.4 Ecological values and significance

The Project is located within a modified pastoral and mining landscape. Exotic grassland, mine-disturbed land, roads, pine and rehabilitated mine surfaces comprise much of the affected area and generally have Low or Negligible ecological value. Some modified habitats nevertheless provide habitat for indigenous lizards and open-country birds.

Higher ecological values are concentrated within Snow tussock grassland, rock habitat, natural inland wetlands, riparian vegetation and habitat supporting Threatened and At-Risk (TAR) plants. Ephemeral wetlands have Very High ecological value because they represent a long-inundation subtype of a Naturally Uncommon and Critically Endangered ecosystem. 51 TAR plant species have been recorded within the MP4 Zone of Influence, including two Not Threatened but locally uncommon species (kowhai and fuchsia).

The Project area is assessed as ecologically significant overall under the NPS-IB and applicable regional policy criteria. Indigenous snow tussock grassland, dry shrubland, rock habitat, wetlands and riparian communities each meet one or more ecological significance criteria. Modified land covers, particularly exotic grassland, mine-disturbed land and roads, generally do not.

Coronation Mining Area has Very High overall ecological value because it contains Very High value ephemeral wetlands and rock habitat, High value snow tussock grassland, and most of the Regionally TAR plant records identified within the Project footprint. Golden Bar has High overall value, the Central Mining Area has Moderate value, and the Golden Bar Haul Road has Low value at the corridor scale, although it contains localised High value wetlands and At-Risk plant records. The known surface values within the Golden Point Underground Extension area have High overall value.

Lizard values range from Low to High, with McCann's skink, southern grass skink and kōrero gecko recorded. Avifauna values range from Low to Very High at the species scale and include kārearea, banded dotterel and South Island pied oystercatcher. The indigenous invertebrate assemblage has High overall value, with the highest functional values associated with tussock, shrubland, wetlands,

riparian vegetation and rocky habitats. Targeted surveys did not detect bats, and bats are not assessed as an affected receptor.

1.5 Summary of effects

The Project would result in permanent and temporary effects through vegetation clearance, wetland reclamation, earthworks, road construction, pit expansion, waste rock placement, tailings storage and associated infrastructure. Direct effects include habitat loss, displacement, injury and mortality. Indirect effects include dust, weed invasion, sedimentation, accidental encroachment, altered runoff, hydrological change, noise, lighting, vibration and increased vehicle or stock access.

The principal terrestrial vegetation effects relate to the loss and modification of snow tussock grassland, rock habitat, natural inland wetlands, riparian vegetation and TAR plant habitat. The assessed loss of snow tussock grassland represents a low proportion (approximately 4.5 %) of the area mapped within OGNZL landholdings. Corresponding losses of rock habitat and dry shrubland represent approximately 0.8 percent and 0.4 percent, respectively. Proportional losses are lower at the Macraes' ED scale.

TAR plants may be affected where individuals or supporting habitats occur within the footprint or adjoining buffer. Where avoidance is not practicable, affected plant material will require salvage, propagation, translocation or other management under the relevant vegetation and flora management plans.

Approximately 238.7 ha of suitable lizard habitat, estimated to support 155,564 lizards, and approximately 325 ha of suitable invertebrate habitat occur within the footprint and 20 m buffer. Lizards and invertebrates are vulnerable to injury and mortality during vegetation clearance, soil stripping and disturbance of rock or dense vegetation refugia. Birds are generally able to move away from active works, although nests, eggs and chicks may be affected where clearance or earthworks occur during the breeding season.

Natural inland wetlands would be affected by reclamation, drainage, dewatering and other hydrological changes. Affected wetland types include ephemeral wetland, freshwater herbaceous wetland, sedgeland, seepage wetland and wetland shrubland. The highest effects relate to the loss of Very High value ephemeral wetlands and High value freshwater herbaceous wetlands.

1.6 Effects management

The effects management hierarchy has informed Project design and the proposed construction and operational controls. Principal avoidance measures include the use of a predominantly underground design for the Golden Point Underground Extension, refinement of works boundaries, and establishment of no-go areas around retained ecological values where practicable. Further, currently held consents for Back Road Waste Rock Stack, which supports very high ecological values, will be surrendered.

Other management measures include works-footprint demarcation, staged clearance, ecological supervision, erosion and sediment control, dust suppression, runoff management, weed hygiene and protection of retained vegetation.

TAR plants and associated invertebrates will be managed through vegetation direct transfer, seed collection, propagation, salvage and translocation.

Lizard management will include pre-clearance checks, salvage and relocation, careful removal of refugia, and preparation of suitable receiving habitat.

Avifauna management will include pre-works surveys, seasonal controls where practicable, and protection or management of identified nests.

Temporary disturbance areas, completed landforms, batters, margins and access tracks will be rehabilitated through landform stabilisation, replacement of growth media, revegetation and weed control.

Vegetation direct transfer will retain vegetation, soil, seedbank and associated ecological material where practicable and provide propagules for rehabilitation. These measures will reduce effects but will not fully replace all mature indigenous vegetation, rock habitat, wetlands or rare plant values removed from the footprint.

1.7 Residual effects

Residual adverse effects remain after avoidance, minimisation and remediation. At the habitat level, the residual effect is Very High for indigenous snow tussock grassland, High for freshwater herbaceous wetland, Moderate for rock habitat and wetland sedgeland, and Low or Very Low for dry shrubland. Residual effects also remain on ephemeral wetlands and associated flora.

The residual effect on the terrestrial invertebrate assemblage and several At Risk invertebrates, including *Orocrambus sophistes*, is High, with Moderate effects remaining for a number of other notable invertebrates. For lizards, residual effects range from Moderate for McCann's skink to Very High for southern grass skink and kōrero gecko.

Although salvage and propagation will be undertaken for affected TAR plants, outcomes remain uncertain for some species. Twelve plant species are assessed as having High or Very High residual effects, eight have Moderate residual effects, and nine have Low, Very Low or Negligible residual effects.

Residual effects management is therefore required for all receptors with a Moderate or higher residual level of effect, including snow tussock grassland, rock habitat, natural inland wetlands, a subset of TAR plants, the indigenous invertebrate assemblage and notable invertebrates, and indigenous lizards.

1.8 Offsetting, compensation and predicted outcomes

The terrestrial and wetland Residual Effects Analysis reports identify the conservation actions proposed to address Moderate or higher residual effects and assess those actions against the relevant NPS-IB and NPS-FM principles.

The terrestrial package includes pest-exclusion fencing, landscape-scale pest control, stock exclusion, protection and enhancement of existing tussock and shrubland, tussock and shrubland revegetation, and removal of recently established exotic conifers at Mt Highlay Station to avert further loss of indigenous habitat. The wetland package includes wetland restoration and enhancement, buffering,

stock exclusion, weed control, plant salvage and propagation, and trials to create or restore wetland values, including copper tussock wetland, where ecologically appropriate.

These actions have been scaled to the residual effects they are intended to address. Restoration and pest management are also expected to benefit indigenous species not directly affected by the Project, including Otago skink, grand skink and several indigenous bird species.

Predicted outcomes for individual biodiversity values, including whether net gain, net positive, uncertainty or net loss is expected, are reported in the separate Residual Effects Analysis reports. Net loss cannot be excluded for a small number of TAR plant species because the success of salvage, propagation and establishment remains uncertain.

1.9 Overall conclusion

Most of the MP4 impact area comprises modified land cover of Low or Negligible ecological value. However, the Project would also affect discrete High and Very High value ecological receptors, particularly at Coronation Mining Area and Golden Bar, within a landscape assessed as ecologically significant overall.

The principal effects relate to the loss or modification of snow tussock grassland, natural inland wetlands, rock habitat, rare plant habitat and habitat used by indigenous invertebrates, lizards and open-country birds. These effects have been reduced through Project design, removal of the Back Road Waste Rock Stack, the underground Golden Point Underground Extension, footprint refinement, construction controls and species-specific management.

Moderate or higher residual effects remain for a defined range of habitats and species. These effects require implementation of the terrestrial and wetland residual effects management packages, together with monitoring, performance targets, adaptive management and reporting.

Subject to finalisation and effective implementation of the ecological management plans and residual effects management measures, the effects of MP4 can be addressed through the applicable effects management hierarchies. The predicted biodiversity outcomes and remaining areas of uncertainty are set out in the terrestrial and wetland Residual Effects Analysis reports.

Summaries of Ecological values, magnitudes and residual levels of effect are presented below in Table 1-1 and Table 1-2.

Table 1-1. Ecological value, areal extent of impact, magnitude of effect and residual level of effect for vegetation and habitat types affected by MP4.

Vegetation/habitat type	Ecological value	Areal extent of impact (ha) ¹	Magnitude of effect ²	Residual level of effect ³
Terrestrial habitats				
Snow tussock grassland	Very High	90.01	High	Very High
Dry shrubland (grey scrub)	Moderate	3.06	Low	Low
Rock outcrops	Very High	0.26	Low	Moderate
Wetland and riparian habitats				
Ephemeral wetland	Very High	1.14	High	Very High
Freshwater herbaceous wetland (FWH) ⁴	High	4.82	Moderate	High
Wetland sedgeland ⁴	Moderate	1.74	Low	Moderate
Wetland seepage	High	0.02	High	High
Wetland shrubland	Moderate	0.03	High	Moderate
Copper tussock wetland	High to Very High	0.21	High	Very High
Induced wetland	Negligible to Low	3.58	Low	Low

¹ Areal extent of impact is the direct loss plus a 20 m precautionary buffer. ² Magnitude of effect is prior to mitigation. ³ The residual level of effect is after avoidance, minimisation and remediation, and does not include biodiversity offsetting or compensation. ⁴ Includes wetland extent reclaimed at Camp Creek and Coal Creek

Table 1-2. Ecological value, magnitude of effect and residual level of effect for all assessed species. Scientific names are shown in italics.

Species	National threat status	Regional threat status	Ecological value	Magnitude of effect	Residual level of effect
Plant species					
Dwarf broom (<i>Carmichaelia corrugata</i>)	Threatened – Nationally Vulnerable	Threatened – Regionally Critical	Very High	Very High	Very High
Indigenous St John's wort (<i>Hypericum rubicundulum</i>)	Threatened – Nationally Endangered	Threatened – Regionally Critical	Very High	Very High	Very High
Wetland daisy (<i>Lagenophora barkeri</i>)	At Risk – Declining	Threatened – Regionally Endangered	Very High	Low	Moderate
<i>Lobelia ionantha</i>	At Risk - Declining	Threatened – Regionally Endangered	Very High	Very High	Very High
Creeping button daisy (<i>Leptinella pusilla</i>)	At Risk – Declining	Threatened – Regionally Endangered	Very High	Moderate	High
<i>Rytidosperma thomsonii</i>	At Risk – Declining	Threatened – Regionally Endangered	Very High	Very High	High

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Species	National threat status	Regional threat status	Ecological value	Magnitude of effect	Residual level of effect
<i>Sonchus aff. novae-zelandiae</i>	Threatened – Nationally Endangered	Threatened – Regionally Endangered	Very High	Very High	Very High
<i>Bidibidi (Acaena buehananii)</i>	At Risk – Declining	Threatened – Regionally Vulnerable	Very High	High	High
Narrow-leaved speargrass (<i>Aciphylla subflabellata</i>)	At Risk – Declining	Threatened – Regionally Vulnerable	Very High	Low	Moderate
Tufted hair grass (<i>Deschampsia cespitosa</i>)	At Risk – Declining	Threatened – Regionally Vulnerable	Very High	Very High	Very High
<i>Epilobium insulare</i>	At Risk – Declining	Threatened – Regionally Vulnerable	Very High	Low	Low
<i>Euchiton polylepis</i>	At Risk – Declining	Threatened – Regionally Vulnerable	Very High	High	Very High
<i>Juncus pusillus</i>	At Risk – Naturally Uncommon	Threatened – Regionally Vulnerable	Very High	Low	Moderate
<i>Lobelia perpusilla</i>	Not Threatened	Threatened – Regionally Vulnerable	Very High	Moderate	High
Dwarf greenhood orchid (<i>Pterostylis tristis</i>)	At Risk – Declining	Threatened – Regionally Vulnerable	Very High	Moderate	High
Delicate bluegrass (<i>Anthosachne falcis</i>)	At Risk – Declining	At Risk – Regionally Declining	High	Low	Very Low
Desert broom (<i>Carmichaelia petriei</i>)	At Risk – Declining	At Risk – Regionally Declining	High	Low	Low
<i>Colobanthus strictus</i>	Not Threatened	At Risk - Declining	High	Moderate	High
<i>Juncus distegus</i>	Not Threatened	At Risk – Regionally Declining	High	Low	Very Low
New Zealand mint / hīoi (<i>Mentha cunninghamii</i>)	At Risk – Declining	At Risk – Regionally Declining	High	Low	Very Low
<i>Rytidosperma buehananii</i>	At Risk – Declining	At Risk – Regionally Declining	High	Moderate	Moderate
Wetland grass (<i>Agrostis pallescens</i>)	At Risk – Naturally Uncommon	At Risk – Regionally Naturally Uncommon	Moderate	High	Moderate
<i>Brachyscome longiscapa</i>	At Risk – Naturally Uncommon	At Risk – Regionally Naturally Uncommon	Moderate	Negligible	Low
Hooker's mountain daisy (<i>Celmisia hookeri</i>)	At Risk – Naturally Uncommon	At Risk – Regionally Naturally Uncommon	Moderate	Negligible	Negligible
<i>Lagenophora pinnatifida</i>	Not Threatened	At Risk – Naturally Uncommon	Moderate	Moderate	Moderate
<i>Poa pusilla</i>	Not Threatened	At Risk – Regionally Naturally Uncommon	Moderate	Moderate	Moderate
<i>Olearia bullata</i>	Not Threatened	At Risk – Regionally Naturally Uncommon	Moderate	Low	Low
<i>Oxalis rubens</i>	Not Threatened	Regionally Data Deficient	Moderate	Low	Very Low

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Species	National threat status	Regional threat status	Ecological value	Magnitude of effect	Residual level of effect
Porcupine shrub (<i>Melicytus aff. alpinus</i> (c) (CHR 541568; Otago))	Data Deficient	Regionally Data Deficient	Moderate	High	Moderate
Invertebrate species					
Invertebrate assemblage (Project-wide)	–	–	High	High	High
<i>Orocrambus sophistes</i>	Threatened – Nationally Vulnerable	–	Very High	Moderate	High
<i>Agrotis admirationis</i>	At Risk – Declining	–	High	Moderate	High
<i>Asaphodes recta</i>	At Risk – Declining	–	High	Moderate	High
<i>Dasyuris partheniata</i>	At Risk – Declining	–	High	Moderate	High
<i>Nyctemera annulata</i>	At Risk – Declining	–	High	Low	Low
New Zealand praying mantis (<i>Orthodera novaezealandiae</i>)	At Risk – Declining	–	High	Low	Low
<i>Pasiphila</i> sp. A (NZAC 04285480)	At Risk – Declining	–	High	Low	Low
<i>Patagoniodes farinaria</i>	At Risk – Declining	–	High	Low	Low
<i>Samana acutata</i>	At Risk – Declining	–	High	Moderate	High
<i>Theoxena scissaria</i>	At Risk – Declining	–	High	Moderate	High
<i>Bityla sericea</i>	At Risk – Naturally Uncommon	–	Moderate	Moderate	Moderate
<i>Wiseana fuliginea</i>	Data Deficient	–	Moderate	Moderate	Moderate
<i>Wiseana mimica</i>	Data Deficient	–	Moderate	Moderate	Low
<i>Zelandobius uniramus</i>	Data Deficient	–	Moderate	Moderate	Moderate
Otago ground wētā (<i>Hemiandrus maia</i>)	Not Threatened	–	Low	Moderate	Low
<i>Mecodema</i> sp. “Oamaru”	Not listed	–	Moderate	Moderate	Moderate
<i>Orocrambus cf. cyclopicus</i>	Not listed	–	Moderate	Moderate	Moderate
Lizard species					
McCann’s skink (<i>Oligosoma maccanni</i>)	Not Threatened	Regionally Not Threatened	Low	High	Moderate
Southern grass skink (<i>Oligosoma chionocholescens</i>)	At Risk – Declining	At Risk – Regionally Declining	High	High	Very High
Kōrero gecko (<i>Woodworthia “Otago/Southland”</i>)	At Risk – Declining	At Risk – Regionally Declining	High	High	Very High
Bird species					
Kārearea / eastern falcon (<i>Falco novaeseelandiae</i>)	Threatened – Nationally Vulnerable	Regionally Vulnerable	Very High	Low	Moderate
Banded dotterel / pohowera (<i>Charadrius bicinctus bicinctus</i>)	At Risk – Declining	Regionally Vulnerable	Very High	Low	Moderate
South Island pied oystercatcher / tōrea (<i>Haematopus finschi</i>)	At Risk – Declining	Regionally Vulnerable	Very High	Low	Moderate

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Species	National threat status	Regional threat status	Ecological value	Magnitude of effect	Residual level of effect
Black shag / kōau (<i>Phalacrocorax carbo</i>)	At Risk – Relict	Regionally Endangered	Very High	Negligible	Low
New Zealand pipit / pīhoihoi (<i>Anthus novaeseelandiae</i>)	At Risk – Declining	Regionally Not Threatened	High	Low	Low
Silvereye / tauhou (<i>Zosterops lateralis</i>)	Not Threatened	Regionally Declining	High	Negligible	Very Low
Fernbird / mātātā (<i>Poodytes punctatus</i>)	At Risk – Declining	Regionally Declining	High	Negligible	Very Low
Australasian shoveler / kuruwhegu (<i>Spatula rhynchotis</i>)	Not Threatened	Regionally Not Threatened	Low	Low	Very Low
Grey teal / tētē-moroiti (<i>Anas gracilis</i>)	Not Threatened	Regionally Not Threatened	Low	Low	Very Low
Grey warbler / riroriro (<i>Gerygone igata</i>)	Not Threatened	Regionally Not Threatened	Low	Negligible	Very Low
Kererū / New Zealand pigeon (<i>Hemiphaga novaeseelandiae</i>)	Not Threatened	Regionally Not Threatened	Low	Negligible	Very Low
New Zealand scaup / pāpango (<i>Aythya novaeseelandiae</i>)	Not Threatened	Regionally Not Threatened	Low	Negligible	Very Low
Paradise shelduck / pūtangitangi (<i>Tadorna variegata</i>)	Not Threatened	Regionally Not Threatened	Low	Low	Very Low
Pied stilt / poaka (<i>Himantopus leucocephalus</i>)	Not Threatened	Regionally Not Threatened	Low	Low	Very Low
Pūkeko	Not Threatened	Regionally Not Threatened	Low	Low	Very Low
Sacred kingfisher / kōtare (<i>Todiramphus sanctus</i>)	Not Threatened	Regionally Not Threatened	Low	Low	Very Low
South Island fantail / pīwakawaka (<i>Rhipidura fuliginosa</i>)	Not Threatened	Regionally Not Threatened	Low	Negligible	Very Low
Southern black-backed gull / karoro (<i>Larus dominicanus</i>)	Not Threatened	Regionally Not Threatened	Low	High	Low
Spur-winged plover	Not Threatened	Regionally Not Threatened	Low	Low	Very Low
Swamp harrier / kāhu (<i>Circus approximans</i>)	Not Threatened	Regionally Not Threatened	Low	Low	Very Low
Tūī (<i>Prosthemadera novaeseelandiae</i>)	Not Threatened	Regionally Not Threatened	Low	Negligible	Very Low
Welcome swallow / warou (<i>Hirundo neoxena</i>)	Not Threatened	Regionally Not Threatened	Low	Low	Very Low
White-faced heron / matuku moana (<i>Egretta novaehollandiae</i>)	Not Threatened	Regionally Not Threatened	Low	Low	Very Low

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

2 Introduction

2.1 Macraes Phase 4 Project Description

OceanaGold (New Zealand) Limited (“**OGNZL**”) currently undertakes open pit and underground gold mining operations at the Macraes Operation located at Golden Point Road, Macraes Flat, East Otago. As part of their ongoing operations, OGNZL continually review the remaining life of the Macraes Operation in light of updated knowledge of the gold resource and the economics of mining.

Reflecting recent exploration success and optimisation work, together with higher gold prices, the Macraes Phase Four Project (“**MP4**” or “**the Project**”) seeks to extend the life of mining at the Macraes Operation until at least 2039. The Project, which will enable ongoing gold production at a rate of approximately 130,000 ounces per annum, is identified as a Listed Project in Schedule 2 of the Fast-track Approvals Act 2024 (“**FTAA**”) as a project providing significant national or regional benefits.

To support the development of the substantive application for the Project, OGNZL has engaged Bioresearches to provide an assessment of the Project’s effects on Ecology and, to the extent required, identify any necessary management and operation measures to address any such effects.

2.1.1 Site Location and Description

OGNZL owns and operates the Macraes Operation at Macraes, approximately 30 km northwest of Palmerston in the Otago Region. The Macraes Operation is the largest gold mine in New Zealand and, since commissioning in 1990, has produced more than 6 million ounces of gold.

Macraes Flat is situated on an elevated plateau at approximately 500 m above sea level. The plateau is flanked by the Taieri Ridge to the northwest, Shag Valley and Horse Range to the east, and the coastal hills and extinct volcanic cones of Palmerston and Waikouaiti to the southeast. Macraes Road provides access to Macraes Flat and the Macraes Operation, connecting to State Highway 85 to the east and State Highway 87 (SH87, the Middlemarch–Hyde Road) to the west.

The environment within and surrounding the Macraes Operation has been shaped by historic and current mining activities. Figure 2.1 shows the arrangement of the major mine features at the Macraes Operation. In summary, the current components of the Macraes Operation include:

- Numerous open pits (both operational and non-operational);
- Two underground mines (Fraser’s, now closed, and Golden Point, which is actively mined);
- Waste rock stacks at various stages of operation and rehabilitation;
- A network of haul roads and general mine service tracks;
- A Processing Plant;
- Five tailings storage facilities (three inactive, one active but nearing capacity, and one under construction and currently receiving tailings);
- An extensive network of water management infrastructure, including diversion drains, silt ponds, sumps, pit lakes, and freshwater storage reservoirs;
- Two consented but not yet constructed water storage reservoirs (Camp Creek Dam and Coal Creek Dam); and
- Associated infrastructure supporting ongoing operations, including district roads, powerlines, workshops, offices, and associated water and amenity facilities.

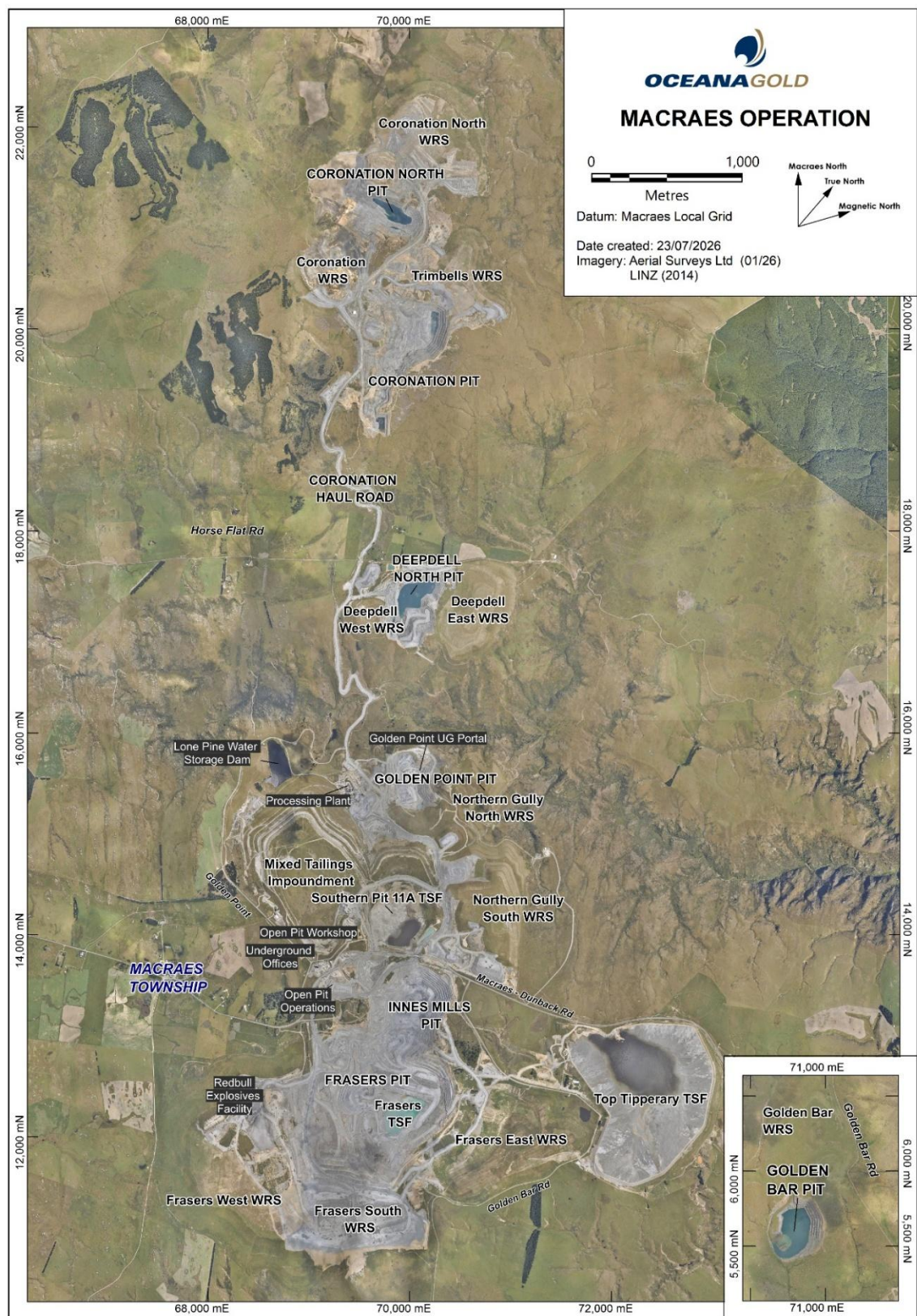


Figure 2.1: Existing site layout at the Macraes Operation (as of July 2026)

2.1.2 Project Overview

The Project is made up of the following proposed key activities:

- **Open pit extensions** at Coronation, Coronation North, Innes Mills, and Golden Bar.
- **Underground mine expansion** through further development of the Golden Point Underground mine (“**GPUG**”).
- **Tailings management**, including:
 - Construction of the Frasers Tailings Storage Facility (“**FTSF**”) Stage 3 to accommodate a total tailings storage of up to 153 Mt; and
 - Hydraulic mining and relocation of tailings from the Mixed Tailings Impoundment (“**MTI**”), Southern Pit Option 10 TSF (“**SP10**”), and Southern Pit Option 11A TSF (“**SP11**”) to FTSF.
- **Waste rock disposal**, including increased storage capacity within open pits and at existing waste rock stacks at Coronation, Coronation North, Innes Mills, Golden Bar, Golden Point, and Frasers.
- **Water management infrastructure and operations**, including:
 - Construction of Camp Creek and Coal Creek water storage dams for flow and water quality management;
 - Construction, operation and maintenance of a Water Treatment Plant; and
 - Ongoing operation and maintenance of the Mine Water Management System (“**MWMS**”).
- **Infrastructure and roading works**, including:
 - Realignment of Macraes Road in two stages; and
 - Relocation of the Open Pit Mining Workshop.
- **Ecological enhancements**, including establishment of:
 - Murphys Ecological Enhancement Area (“**MEEA**”) near Murphys Creek, including predator fencing, access tracks, and site facilities;
 - Mt Highlay restoration area;
 - Cranky Jims Link shrubland enhancement area;
 - Murphys Link tussock protection area; and
 - Additional compensation measures for residual ecological impacts.
- **Mine closure and rehabilitation activities**, including rehabilitation of mining landforms, creation of pit lakes, dry capping of tailings storage facilities, and revegetation in accordance with closure objectives.

An overview of the proposed activities which make up the Project is shown in Figure 2.2 below.

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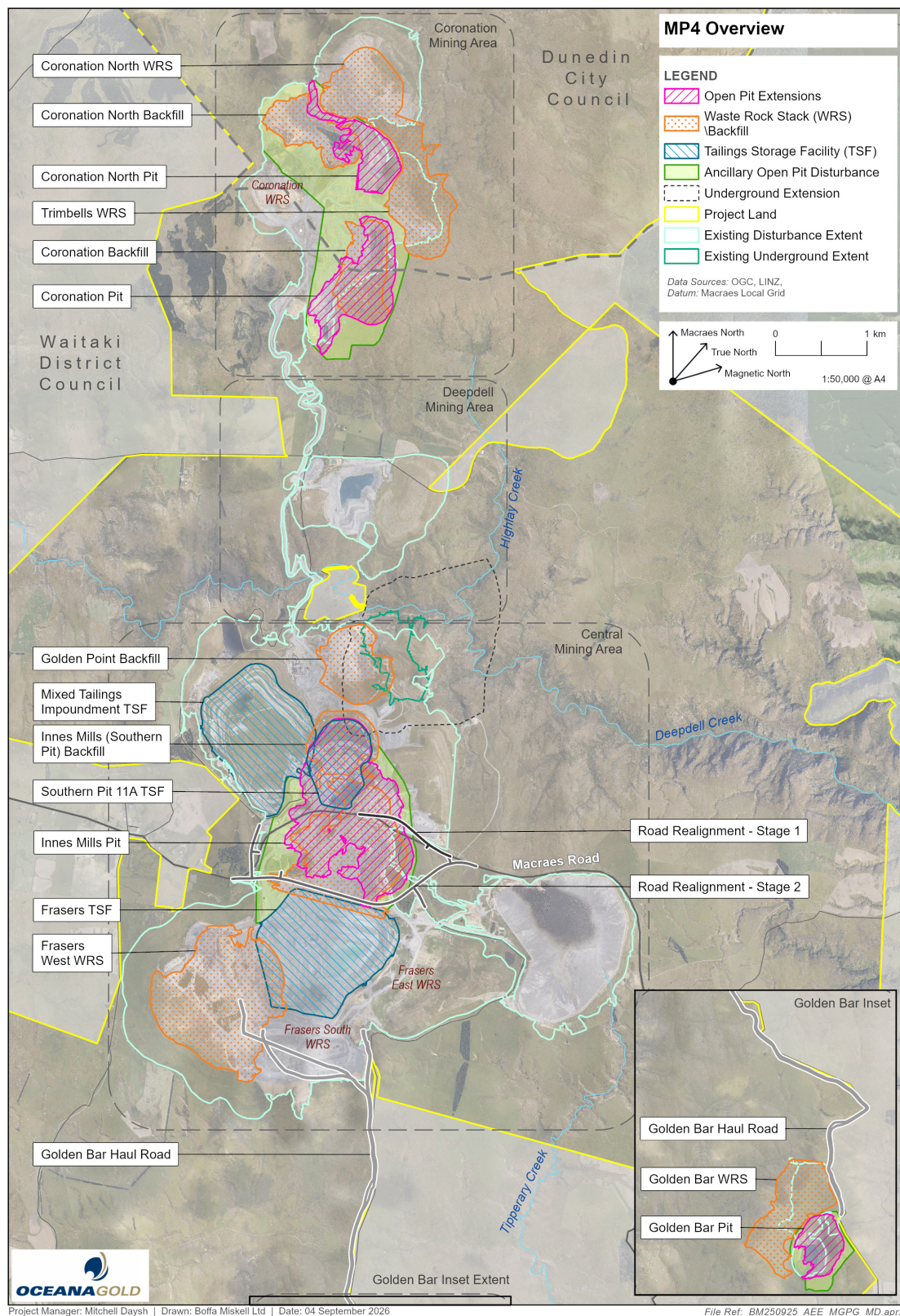


Figure 2.2: MP4 Overview Plan

2.1.3 Sequencing of Activities and Proposed Work Dates

The project is not being progressed in stages. Rather, all activities that comprise the MP4 project are included in this substantive application. Those activities are anticipated to occur across a period of 13 years, with OGNZL proposing to commence the MP4 project as soon as the necessary approvals are obtained.

The activities described herein are expected to be generally sequenced as follows:

- The continuation of Innes Mills Pit mining from Year 1 to Year 12;
- The continuation of Coronation Pit mining from Year 2 to Year 6;
- Relocation of tailings from Southern Pit TSF and MTI from Year 2 to Year 12 to facilitate mining of Innes Mills Stage 13 (IM13);
- The continuation of Golden Bar Pit mining mostly in Year 3 and in Year 7;
- The continuation of GPUG mining from Year 1 to Year 10;
- The continuation of Coronation North mining from Year 1 to Year 2 and then from Year 7 to Year 10;
- Associated replenishment of stockpiles throughout the MP4 mine life; and
- Full site rehabilitation to commence in Year 11 and be completed by approximately end of Year 13.

Mine planning is fluid at complex multi-pit operations such as the Macraes Operation. Precise timing of activities depends on a range of factors and operational requirements may facilitate changes to the sequencing of some activities.

Table 2-1 shows the anticipated sequencing of the proposed MP4 activities across the life of the project.

Table 2-1: Anticipated sequencing of MP4 activities

Pit	Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
Innes Mills	IM8													
	IM9													
	IM10													
	IM11													
	IM12													
	IM13													
Coronation North	CN5													
	CN6													
Coronation	CO6													
	CO7													
	CO8													
Golden Bar	GB2													
	GB3													
Underground	GPUG													
Stockpiles														

2.2 Purpose and Scope

The purpose of this report is to detail the analyses and results of the Macraes Phase 4 (MP4) Project's effects on terrestrial and wetland ecological values, present measures to avoid and minimise those effects, and identify any residual adverse effects that are more than minor remaining.

To this end, the report:

- a) Summarises ecological values as reported in targeted assessments (Bioresearches 2026a,b,c,d; Whirika 2026) within the Project Impact Area and its surrounds.
- b) Describes ecological effects on these values that are expected to result from construction and operation, and residual impacts (after measures to avoid, minimise, or remedy impacts are undertaken).
- c) Provides recommendations to avoid, minimise or remedy adverse effects on ecological values and recommendations to offset or compensate residual impacts where possible and appropriate.
- d) Presents an overall conclusion on the level of actual and potential ecological effects of the Project, after all recommended effects management measures (including residual effects management) have been undertaken.

The terrestrial and wetland ecological values are identified and described in greater detail in other documents, identified as E2-E5 in Table 2-2 below. This document (E7) sits within a series of ecology-focused documents relating to the MP4 Project.

This Ecological Impact Assessment (EcIA) report should be read alongside the Substantive Application, which contains further details on the context of the project, and in conjunction with the terrestrial, wetland and freshwater management and offset plans.

Table 2-2. Ecology Documents prepared for the proposed Macraes Phase 4 Project. Current document highlighted.

Document #	Document name	Aspects covered	Author
E1	Terrestrial and Wetland Ecology Summary		Bioresearches (2026a)
Ecological Assessments			
E2	Assessment of Vegetation and Wetland Values	Terrestrial vegetation and wetlands	Whirika (2026)
E3	Assessment of Invertebrate Values		Bioresearches (2026b)
E4	Assessment of Lizard Values		Bioresearches (2026c)
E5	Assessment of Avifauna Values		Bioresearches (2026d)
E6	Assessment of Bat Values		Bioresearches (2026e)
E7	Ecological Impact Assessment	Terrestrial and wetland ecosystems and fauna	Bioresearches (2026f)
Ecological Management			
E8	Vegetation and TAR Flora Management Plan	Indigenous vegetation and threatened plants (wetland and terrestrial)	Bioresearches (2026g)
E9	Wetland Management Plan	Management and monitoring of Wetlands and TAR wetland plants	Bioresearches (2026h)
E10	Invertebrate Management & Monitoring Plan	Effects management and monitoring for invertebrates	Bioresearches (2026i)
E11	Lizard Management & Monitoring Plan	Effects management and monitoring for lizards	Bioresearches (2026j)
E12	Avifauna Management & Monitoring Plan	Effects management and monitoring for birds	Bioresearches (2026k)
Residual Effects Analysis and Management			
E13	Residual Effects Analysis: Terrestrial Ecology	Residual effects analyses for vegetation and fauna	Bioresearches (2026l)
E14	Residual Effects Analysis: Wetlands	Residual effects analyses for wetlands	Bioresearches (2026m)
E15	Residual Effects Terrestrial Restoration Plan	Compensation planting and vegetation restoration	Bioresearches (2026n)
E16	Residual Effects Wetland Management Plan	Planting and restoration for wetlands	Bioresearches (2026o)
E17	Ecological Impact Assessment: Pest-proof Fence Construction	Terrestrial and wetland ecosystems and fauna	Bioresearches (2026p)
E18	Pest Control and Elimination Plan	Animal pest management	Alliance Ecology (2026)

2.3 Study Area

Ecological Investigations were undertaken within the project's zone of influence (ZOI) (see section 2.3.1, below) and also extended into the surrounding landscape. This wider area encompassed approximately 13,000 ha of OGNZL landholdings in the Macraes area, providing context for the assessments, including evaluation of local-scale proportional effects (e.g. Section 5.2.) and identification of opportunities for ecological restoration and enhancement.

2.3.1 Zone of Influence

The ZOI of the Project relates to an area occupied by habitats and species that are adjacent to and may extend beyond the physical footprint of the project as well. It is defined in the EIANZ Guidelines as "the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities."

The extent of the ZOI and the nature of project effects may vary between species and habitat types. Throughout this report, the ZOI is used to inform desktop assessments and to identify and describe the actual and potential effects of the Project during both the construction and operational phases on adjacent terrestrial and wetland habitats, and the indigenous species they support.

The ZOI may extend beyond the immediate Project footprint where ecological values are influenced by wider landscape-scale processes. For MP4, the following ZOI applied:

All wetlands: Up to 100 m from the direct footprint (NESF).

Terrestrial vegetation and habitats: Generally, this is species or environment dependant, but a 20 m 'edge effect' zone was applied to effects assessments. While there does not appear to be a universally accepted minimum edge effect for similar grassland habitats in New Zealand, vegetation plots and lizard surveys indicated that these environments remained relatively intact within 20 m of existing infrastructure¹, and therefore 20 m was adopted as an edge effect zone as for MP4.

Bird species: Species specific zones of influence were applied up to 200 m (e.g. nesting falcon) and are addressed in separate management plans. Some species, such as NZ Pipit were regularly observed foraging on and around mining infrastructure and vehicle parking areas.

This approach ensures that ecological effects are assessed at spatial scales appropriate to the species, habitats, and ecological processes potentially affected by the Project.

2.3.2 Impact Assessment Areas

For the purposes of this assessment, the wider MP4 Project area has been divided into a series of smaller, discrete assessment areas (see Table 2-3) to enable values and effects to be assessed at a more localised and ecologically meaningful scale. This approach recognises that habitat composition, landscape context, degree of modification, and habitat utilisation vary across the broader Macraes operational landscape. Defining smaller assessment areas allows ecological values, habitat function,

¹ Plot data- note that Waste Rock Stack and Pit edge plots at Coronation Mining Area support some of the highest indigenous species' richness and canopy cover for Snow tussock grassland.

and potential effects to be assigned more accurately in relation to the specific habitats and ecological characteristics present within each area.

The assessment areas comprise:

2.3.2.1 Coronation Mining Area

The Coronation and Coronation Mining Area pits have been mined as separate pits between 2013 and 2019. The Coronation Mining Area component of MP4 involves the continuation and extension of open-pit mining (Stage 6), together with associated backfilling and waste rock management. Mining will recover additional ore from deeper and laterally extended portions of the existing pit footprint; with waste rock placed within approved backfill areas and raised waste rock stacks where required. Activities will utilise existing mining infrastructure and haul road networks and will occur in a sequenced manner consistent with the broader MP4 mining schedule (approximately 2033–2035 for this area). No substantial new standalone infrastructure is proposed, as Coronation Mining Area operates within an established mining envelope.

2.3.2.2 Central Mining Area

The Central Mining area (CMA) comprises extensions to the Innes Mills open pit (Stages 11–13) and the development of Frasers Tailings Storage Facility (FTSF) Stage 3 within the mined-out Frasers Pit. The Innes Mills pit will be expanded primarily to the east and northwest, largely over previously disturbed haul roads and pasture, with mining undertaken sequentially to enable efficient cut-and-fill balancing across adjacent pits. FTSF Stage 3 will provide substantial additional tailings storage capacity within the Frasers Pit void, including relocated tailings from other facilities. Waste rock will be disposed of in existing and expanded backfill areas and waste rock stacks. Mining will utilise established haul routes and processing infrastructure and will continue through approximately 2035 under the indicative schedule.

2.3.2.3 Golden Bar Mining Area

The Golden Bar component comprises Stage 2–3 extensions to the existing open pit, involving an approximate lateral expansion (primarily to the east and northeast) to access additional ore. Much of the expansion footprint occurs over rehabilitated land from earlier mining phases, although some new disturbance will occur over snow tussock grassland. The pit extension necessitates expansion of the existing Golden Bar Waste Rock Stack (GBWRS), including placement of additional material over the current stack and extension of its footprint to increase storage capacity. Ore will be stockpiled adjacent to the GBWRS and transported to the Processing Plant via established private haul roads. Temporary ancillary infrastructure (e.g., fuel storage, ablutions, operator facilities) will be established as required. Progressive rehabilitation, contouring, and revegetation will occur during and following operations.

2.3.2.4 Golden Bar Haul Road

The Golden Bar component includes realignment of sections of Golden Bar Road (and associated connections to Macraes Road) to accommodate pit expansion and ongoing mining activities. The realignment will involve construction of a new road corridor across previously disturbed and rehabilitated mining landforms, with earthworks including cuts and fills, installation of culverts for

stormwater management, and formation of a new road platform. The works are designed to maintain safe public access while enabling continued mining at Golden Bar and Innes Mills. Vegetation clearance and earthworks will be required within the designated corridor.

2.3.2.5 Golden Point Underground (GPUG);

The Golden Point Underground Extension (GPUG) involves the continuation and expansion of the existing underground mining operation. Unlike the open-pit and waste rock stack components of the Project, GPUG is predominantly subterranean and is not expected to require substantial new surface disturbance. Surface activities are largely confined to existing access points, ventilation infrastructure, haul roads, and operational support areas. The surface assessment area covers approximately 52.58 ha.

2.3.2.6 Back Road Waste Rock Stack (BRWRS)

The Back Road Waste Rock Stack (BRWRS) was previously consented under the Macraes Phase III Project (MP3) for expansion east of the Round Hill/Southern Pit area. Under MP4, OceanaGold proposes to surrender the existing consents relating to further BRWRS construction, meaning the expanded BRWRS will not form part of the MP4 development footprint. The surrender of these consents may contribute to the overall environmental effects balance of the project by avoiding the ecological disturbance that is currently authorised to occur within that area. For the purposes of this assessment, any actual benefits of this approach have not been captured and would be in addition to effects conclusions for MP4.

2.3.2.7 Seepage Capture Drains

The Seepage Capture Drains (SCD) are proposed on the toe of existing WRS at Coronation North and Frasers West. The construction of the SCD will be engineered seepage collection systems, designed to intercept seepage from the WRS's prior to it entering streams and wetlands. This captured seepage will be discharged into the site's mine water management system or treated prior to discharge back into the receiving environment. The SCD are a crucial component in the reduction of contaminant loading, carried by the seepage, into the receiving environment.

2.3.2.8 Direct Loss Areas

For the purpose of these assessments, Impact area assessments only include new impact areas and exclude previously consented mining activities that may be incorporated into the MP4 project. For example, several proposed pit and waste rock stack areas are mostly within previously consented areas. As such, only new, unconsented impacts are considered for impact assessment areas.

Figure 2.3. (Over page) Macraes Phase 4 project areas and non-consented impact areas.



**Murphys Ecological
Enhancement Area**

**Central
Mining Area**

Camp Creek Dam

**Coronation
Mining Area**

Coal Creek Dam

Golden Bar

Golden Bar Haul Road

**Cranky
Jims Link**

Back Road WRS

Golden Point Underground

Mt Highlay

MP4 Project Areas

Date: 03/07/2026

Drawn By: CG

Client: OceanaGold New Zealand Ltd

Scale: 1:110,000

Legend

 OGL Landholdings

Mining Areas

 MP4 Project Components

 Camp and Coal Creek Dams

 Back Road Waste Rock Stack

Offset/Compensation Sites

 Sites of Protection/Restoration for Compensation Package

 Existing Ecology Covenants

 Predator Proof Fence

 Predator Proof Fence Buffer

SOURCES

LINZ Basemap aerial

MAP PROJECTION

NZGD2000 / New Zealand Transverse
Mercator 2000

Bioresearches 
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0 2,000 4,000 m

Macraes Phase 4 - Fast-track

Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Table 2-3. The MP4 Project components used for ecological assessments, and the specific MP4 elements each one contains.

Assessment Area	Project Component	Component Purpose
Coronation Mining Area	Coronation Mining Area Pit Extension (Stage 6) (CN6)	Open pit extension
	Coronation Pit Extension (Stages 6–8) (CO6–8)	Open pit extension
	Trimbells Waste Rock Stack Height Raise and Extension (TRWRS)	Waste rock storage
	Coronation Mining Area Waste Rock Stack Height Raise (CNWRS)	Waste rock storage
	Coronation Waste Rock Stack (COWRS)	Waste rock storage
	Coronation Pit Backfill (COBF)	Pit backfill/waste rock disposal
	Coronation Mining Area Pit Backfill (CNBF)	Pit backfill/waste rock disposal
Central Mining Area	Innes Mills Pit Extension (Stages 11–13) (IM11–13)	Open-pit extension
	Frasers Tailings Storage Facility Stage 3 (FTSF3)	Tailings storage facility
	Macraes Road Realignment Stage 1 (MRR1)	Road realignment/roading infrastructure
	Macraes Road Realignment Stage 2 (MRR2)	Road realignment/roading infrastructure
	Frasers West Waste Rock Stack Height Raise (FWWRS)	Waste rock storage
	Innes Mills Backfill (IMBF)	Pit backfill/waste rock disposal
	Southern Pit Backfill (SPBF)	Pit backfill/waste rock disposal
	Golden Point Backfill (GPBF)	Pit backfill/waste rock disposal
	Mixed Tailings Impoundment (MTI)	Tailings storage/tailings management
	SP10 and SP11 Tailings Storage Facilities (SP10 and SP11)	Tailings storage facilities
	Back Road Waste Rock Stack (BRWRS)	Waste rock storage (now avoided / consent surrender proposed)
	Top Tipper Tailings Storage Facility (TTTSF)	Tailings storage facility
Golden Bar Mining Area	Golden Bar Pit Extension (Stages 2–3) (GB2–3)	Open-pit extension
	Golden Bar Waste Rock Stack Extension (GBWRS)	Waste rock storage
Golden Bar Haul Road	Golden Bar Haul Road / Golden Bar Road Realignment	Haul road and public road realignment infrastructure
Golden Point Underground Area	Golden Point Underground Expansion (GPUG)	Underground mining extension. No direct loss. Potential indirect effects assessed in this report relate to vibration and hydrological change
Back Road Waste Rock Stack	Back Road Waste Rock Stack	A potential mining area that was identified as of important ecological value is now an avoided area
Project-wide Infrastructure	Mine Water Management System (MWMS)	Water management infrastructure
Seepage Catchment Drains	Coronation North and Frasers West Waste Rock Stacks	Construction of capture drains

2.4 Statutory Context

This section summarises the legislation, policy, plans and strategies relevant to the protection, conservation and enhancement of nature conservation interests associated with MP4. The ecological effects described in this report are assessed as they relate to the ecological values described in the ecological values assessments (Table 2-2) as well as they relate to planning, policy and statutory framework as addressed in the sections below.

The statutory and planning documents that provide the framework for this ecological assessment are detailed in the substantive application report (Mitchell Daysh 2025). Of particular relevance to this assessment are The Fast-track Approvals Act 2024 ('FTAA') and the relevant legislation referred to therein, including:

- The relevant parts of the RMA including Parts 2 and 6
- The purpose of the Wildlife Act 1953
- National Policy Statement for Renewable Electricity Generation (updated December 2025)
- Otago Regional Policy Statement 2019 (operative March 2024)
- Proposed Otago Regional Policy Statement 2021 (Decisions version)
- Clutha District Plan.

2.4.1 Fast-track Approvals Act 2024 (FTAA)

The purpose of the FTAA is to facilitate the delivery of infrastructure and development projects with significant regional or national benefits. The system is intended to be a 'one-stop-shop' for resource consents under the Resource Management Act 1991 and includes approvals required (for this Project) under the Wildlife Act (1953).

2.4.2 Resource Management Act 1991 (RMA)

The purpose of the Resource Management Act 1991 (RMA) is to achieve sustainable management of natural resources. Important elements of this are the maintenance of indigenous biodiversity and the protection of significant indigenous vegetation and habitats. The RMA requires that any adverse effects of development be avoided, remedied, or mitigated (note that the *effects management hierarchy* is defined in the NPS-IB, 2023 and identified below).

2.4.3 Wildlife Act (1953) (WA)

The WA provides legal protection to listed species classed as wildlife. It controls how people interact with wildlife, including all native birds, bats, frogs, lizards, and some invertebrates. Note, it does not cover plants or freshwater fish. A recent Amendment Bill (2025) has key provisions that aim to balance the practicalities of lawful activities that may incidentally harm or kill wildlife. It should be noted, therefore, that the amendments enable the Department of Conservation to impose conditions on authorizations to mitigate adverse effects of wildlife - if the overall effect of granting the authority will be protective of wildlife.

2.4.4 National Policy Statement for Indigenous Biodiversity (NPS-IB, 2023)

The NPS-IB provides direction to councils to protect, maintain and restore indigenous biodiversity in the terrestrial environment, requiring at least no further reduction nationally. It is relevant to the proposal because the Project is within the terrestrial environment, and it contains indigenous biodiversity as defined in Section 1.6 (Interpretation) of the NPS-IB.

The NPS-IB requires that indigenous biodiversity that is not protected by an SNA:

- a. Is managed by applying the effects management hierarchy (avoid, minimise, remedy, offset, compensate), where those effects are more than minor.
- b. is managed to give effect to its Objective and Policies, where those effects are not more than minor (Section 3.16 (2)).

2.4.4.1 Tangata whenua

The NPSIB recognises tangata whenua as kaitiaki of, and partners, in the management of indigenous biodiversity (NPSIB, Policy 2). Schedule 97 of the Ngai Tahu Claims Settlement Act 1998 lists 52 taoka Manu (bird) species and 39 taoka plant species. While no Kārara (lizards) are listed in Schedule 97, the April 2026 Statement of Evidence of Jade Watkin (Ecology and Kāi Tahu) affirms the cultural value of Kārara / lizards (including tussock skink and McCann's skink) as "*spiritual guardians of wāhi tapu and urupā, are respected kaitiaki, and are part of the whakapapa of Kāi Tahu*". Taoka species identified within the EclA are listed in Appendix B.

2.4.5 National Policy Statement for Freshwater Management (NPS-FM, 2020)

The NPS-FM provides direction under the RMA to local authorities for managing activities that affect the health of freshwater ecosystems. It establishes protections for freshwater bodies, including natural inland wetlands, and includes provisions for monitoring and reporting on freshwater quality and quantity. The NPS-FM also addresses the impacts of land use activities on freshwater resources, ensuring that these are sustainably managed.

The effects management hierarchy is an approach to managing the adverse effects of an activity on wetlands that requires that (NPS-FM, 3.21):

- a) adverse effects are avoided where practicable; then
- b) where adverse effects cannot be avoided, they are minimised where practicable; then
- c) where adverse effects cannot be minimised, they are remedied where practicable; then
- d) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, biodiversity offsetting is provided where possible; then
- e) where biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided; then
- e) if biodiversity compensation is not appropriate, the activity itself is avoided.

2.4.6 National Environmental Standards for Freshwater (NES-F, 2020)

The National Environmental Standards for Freshwater 2020 (NES-F) set requirements and regulations for carrying out certain activities that pose risks to freshwater and freshwater ecosystems. Loss of wetland extent is a Discretionary Activity under Subpart 45D of the NES-F ('Extraction of minerals and

ancillary activities'), provided that there is a functional need for the wetland loss in that location; and the effects management hierarchy is applied.

2.4.7 Regional Plans and Policies

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.

2.4.7.1 Otago Regional Policy Statement 2021 (Operative 9 July 2026)

The Otago Regional Policy Statement (ORPS) is a new RPS that implements the National Planning Standards and respond to a range of new national directions 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 ORPS, the following objectives, policies, and appendices would apply to the MP4 Project:

Objectives:

- ECO-01 – 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 – *Kaitiaki* 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 specified new activities: Maintain Otago's indigenous biodiversity by following the sequential steps in the effects management hierarchy set out in ECO-P6;
- ECO-P5A – Managing adverse effects of established activities on significant natural areas.
- ECO-P6 – Maintaining indigenous biodiversity: manage Otago's indigenous biodiversity by applying the effects management hierarchy (in relation to indigenous biodiversity) to manage more than minor adverse effects on indigenous biodiversity and recognising and providing for the protection of significant indigenous biodiversity values identified under ECO-M2(4), requiring the maintenance of indigenous biodiversity for all other adverse effects of any activity, and when significant indigenous biodiversity values are identified under ECO-M2(4), protecting those values in district plans.
- ECO-P8 – Restoration and enhancement: The extent, occupancy and condition of Otago's indigenous biodiversity is increased.

- ECO-P11 – Resilience to climate change: Promote the resilience of indigenous biodiversity to climate change.

Appendices

- APP2 – Criteria for identifying areas that qualify as significant natural areas (SNAs),
- APP3 – Criteria for *biodiversity* offsetting, and
- APP4 – Criteria for *biodiversity* compensation.

2.4.7.2 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 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 Project area. Thus, it has no relevance to the current assessment other than acknowledging its presence and purpose.

3 Ecological Context

3.1 Lammerlaw Ecological Region and Macraes Ecological District

The Lammerlaw Ecological Region is situated within inland Otago and is bounded by the Otago Coast Ecological Region to the East, the Central Otago Ecological Region to the west, the Kakanui Ecological Region to the North and the Waikaia and Gore Ecological Regions to the South. The Lammerlaw Ecological Region covers approximately 434,000 ha and consists of four ED, including Tapanui, Lawrence, Waipori and Macraes. The Macraes ED is the northern-most ED within the Lammerlaw Ecological Region, with an area of approximately 114,000 ha, and falls between the Central Otago, Otago Coast and Kakanui Ecological Regions, with the Waipori ED to the south.

The Macraes ED is characterised by a dry continental climate, rolling uplands, and extensive snow tussock grasslands (McEwen, 1987). Situated between the Taieri and Shag River catchments, the district comprises an upland plateau and hill-country landscape ranging from approximately 300–900 m above sea level. Compared with coastal Otago, the climate is relatively dry, with cold winters, warm summers, and frequent frosts that strongly influence vegetation patterns and ecosystem composition.

The Macraes ED was once characterised by extensive dryland forest and shrubland communities, interspersed with montane short tussockland transitioning into subalpine tall tussockland (Bibby 1997). Areas of mixed hardwood and podocarp forest, kānuka woodland, and *Coprosma*–flax scrub were also historically widespread across the district. However, much of this original vegetation cover has been profoundly altered over the past c. 750 years, primarily through repeated anthropogenic burning associated with human land use practices (McGlone *et al.* 1995; Whitaker 1996). Following European settlement in the 1850s, large areas were further modified through repeated burning, cultivation, oversowing, and fertiliser application, resulting in the widespread establishment of exotic pasture systems (Thompson 1949; Whitaker 1996).

Today, the Macraes ED represents a highly modified landscape, with approximately 75% of the district dominated by exotic vegetation types, particularly improved pasture. The remaining indigenous vegetation is fragmented and largely confined to snow tussock grassland, copper tussock wetlands, and dry shrubland communities, with only very small and isolated remnants of original forest ecosystems persisting across the district (Bibby 1997).

Tussock grasslands

The current ecosystem extent data (Otago Regional Council, Spatial data Portal; Table 3-1) indicate that snow tussock grassland remains the dominant ecosystem type in the Macraes ED, covering approximately 11,777 ha within the ED. This ecosystem forms the characteristic vegetation of the upland landscape and reflects the district's cool, dry climatic conditions and historically low forest cover.

Shrublands

Shrublands are also a significant component of the landscape, with approximately 3,532 ha of matagouri, *Coprosma propinqua*, and kōwhai scrub or forest mapped. These communities typically occur along drainage lines and gullies, often forming transitional vegetation between grassland and forest ecosystems. Smaller areas of kānuka, mānuka, and broadleaved scrub and forest are also present.

Wetlands

Wetlands occur as scattered features in valley bottoms, seepage zones, and poorly drained depressions. These include approximately 222 ha of red tussock and *Schoenus pauciflorus* wetlands, 136 ha of ephemeral herbfield wetlands, and smaller areas of sedgeland and herbfield-mossfield communities. Although limited in extent, these habitats contribute disproportionately to biodiversity by supporting specialised flora and wetland-associated fauna.

Indigenous forest

Indigenous forest is rare within the district, with less than 10 ha of kahikatea, tōtara, mataī, and other native forest types mapped. This reflects both the naturally dry climate and the extensive historical clearance of inland Otago landscapes (Department of Conservation, 1997).

Overall, the Macraes ED is characterised by a tussock-dominated upland landscape with scattered shrubland and wetland habitats. Remaining indigenous vegetation is concentrated in less accessible hill country, drainage systems, and wetlands, where grazing and cultivation pressures have been lower.

Table 3-1. Current ecosystem types and extent within the Macraes ED. Ecosystem extents are based on those mapped by the Otago Regional Council.

Ecosystem Type	Area (Ha)
AL1: Narrow-leaved and slim snow tussock tussockland/shrubland	2,504.8
CLF4.2: Kahikatea, totara, matai forest	8.3
Gravel or Rock	8.2
Indigenous Forest	1.0
Kanuka scrub/forest	227.6
Lake or Pond	37.9
Makahikatoa scrub and shrubland	130.8
Manuka scrub/forest	4.2
River	13.2
Snow Tussock Grassland	11,777.0
VS5: Broadleaved species scrub/forest	45.4
VS6: Matagouri, <i>Coprosma propinqua</i> , kowhai scrub (grey scrub)	3,531.5
WL14: Herbfield (ephemeral wetland)	135.9
WL16: Red tussock, <i>Schoenus pauciflorus</i> tussockland	222.1
WL17: <i>Schoenus pauciflorus</i> sedgeland (alpine seepages/flushes)	9.8
WL22: Carex, Schoenus pauciflorus sedgeland	32.0
WL8: Herbfield/mossfield/sedgeland	15.2
Unmapped ecosystem	95,139.1
Total	18,704.9

3.2 Local context (OGNZL context)

The Macraes Ecological District provides the appropriate broad landscape context for understanding the distribution, representativeness and significance of ecological values associated with MP4. However, available habitat mapping at the Ecological District scale is necessarily generalised and is not sufficiently precise to support reliable calculation of proportional habitat loss. Broad-scale datasets may not accurately distinguish fragmented vegetation communities, small wetlands, rock outcrops or differences in habitat condition. They are therefore useful for establishing ecological context, but less suitable as the principal denominator for quantifying the magnitude of effects arising from a spatially defined project.

Reliance solely on the Ecological District scale could also dilute the apparent proportional effect by comparing a localised habitat loss against a much larger and less accurately mapped area. Such an approach risks understating the importance of the loss within the surrounding landscape. For this reason, proportional effects are instead assessed at the smallest landscape scale for which sufficiently comprehensive and reliable mapping is available.

The approximately 13,000 ha of surrounding OGNZL landholdings provide this local landscape context. Habitat mapping across the landholdings has been refined using aerial imagery, existing ecological information and field verification (Figure 3.1). It therefore provides a more accurate basis for comparing the Project impact area with the extent of comparable habitats in the surrounding landscape. The use of this local scale is also precautionary because it generally results in higher proportional loss estimates than assessment against the full Macraes Ecological District.

An exception applies to TAR flora. Available information on the occurrence and distribution of individual plant species across the surrounding OGNZL landholdings is incomplete and does not provide a sufficiently reliable basis for local-scale proportional assessment. Pre-management effects on these species have therefore been assessed at the Macraes Ecological District scale. This difference reflects a limitation in the available local distribution data and does not imply that the Ecological District scale provides a more accurate representation of effects on local plant populations.

This approach is consistent with the wider MP4 reporting, which uses the surrounding OGNZL landholdings to evaluate local-scale proportional effects and recognises the landholdings as a mapped mosaic of mining areas, rehabilitated landforms, pastoral land, indigenous vegetation, wetlands and other habitats.

3.3.1 Maps of ecosystem extents within the MP4 impact footprint

Ecosystem types (following pages)

Figure 3.1. Extent of mapped tussock, shrubland and wetland within OGNZL landholdings

Figure 3.2. Non-consented impact areas and associated ecosystem types, within the proposed MP4 works of Coronation Mining Area.

Figure 3.3. Non-consented impact areas and associated ecosystem types, within the proposed MP4 works of Golden Point Underground mining area

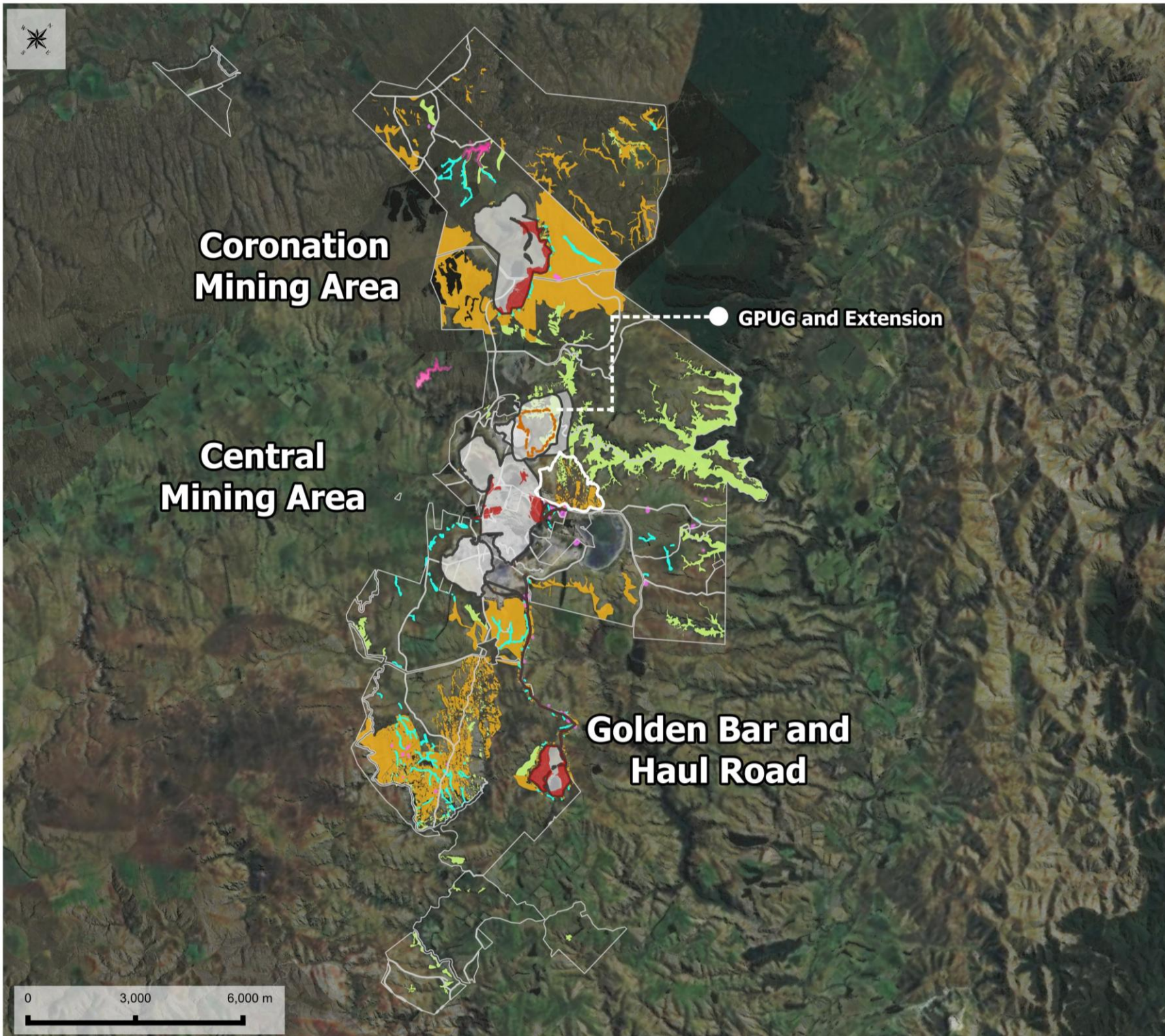
Figure 3.4. Non-consented impact areas and associated ecosystem types, within the proposed MP4 works of Central Macraes mining area

Figure 3.5. Non-consented impact areas and associated ecosystem types, within the proposed MP4 works of the Golden Bar Haul Road areas. Note that the northern end of the road is in the left image, the southern end on the right.

Figure 3.6. Non-consented impact areas and associated ecosystem types, within the proposed MP4 works of Golden Bar area.

Figure 3.7. Non-consented impact areas and associated ecosystem types, within the proposed MP4 works of Back Road Waste Rock Stack.

Figure 3.8. Non-consented impact areas and associated ecosystem types, within the proposed MP4 works at Frasers West French Drain.



Ecosystem Extents OGL Landholdings

Date: 07/08/2026
Drawn By: MS
Client: OceanaGold New Zealand Ltd
Scale: 1:142,857

Legend

- OGL Landholdings: 15,018.44 ha
- Camp and Coal Creek
- Back Road Waste Rock Stack
- MP4 Impact Areas
- GPUG Consented Boundary
- Areas of habitat/vegetation loss within the MP4 Project

Indicative Ecosystem Types within OGL Landholdings

- Tussock Grassland: 1,913.46 ha
- Dry Shrubland: 1,294.38 ha

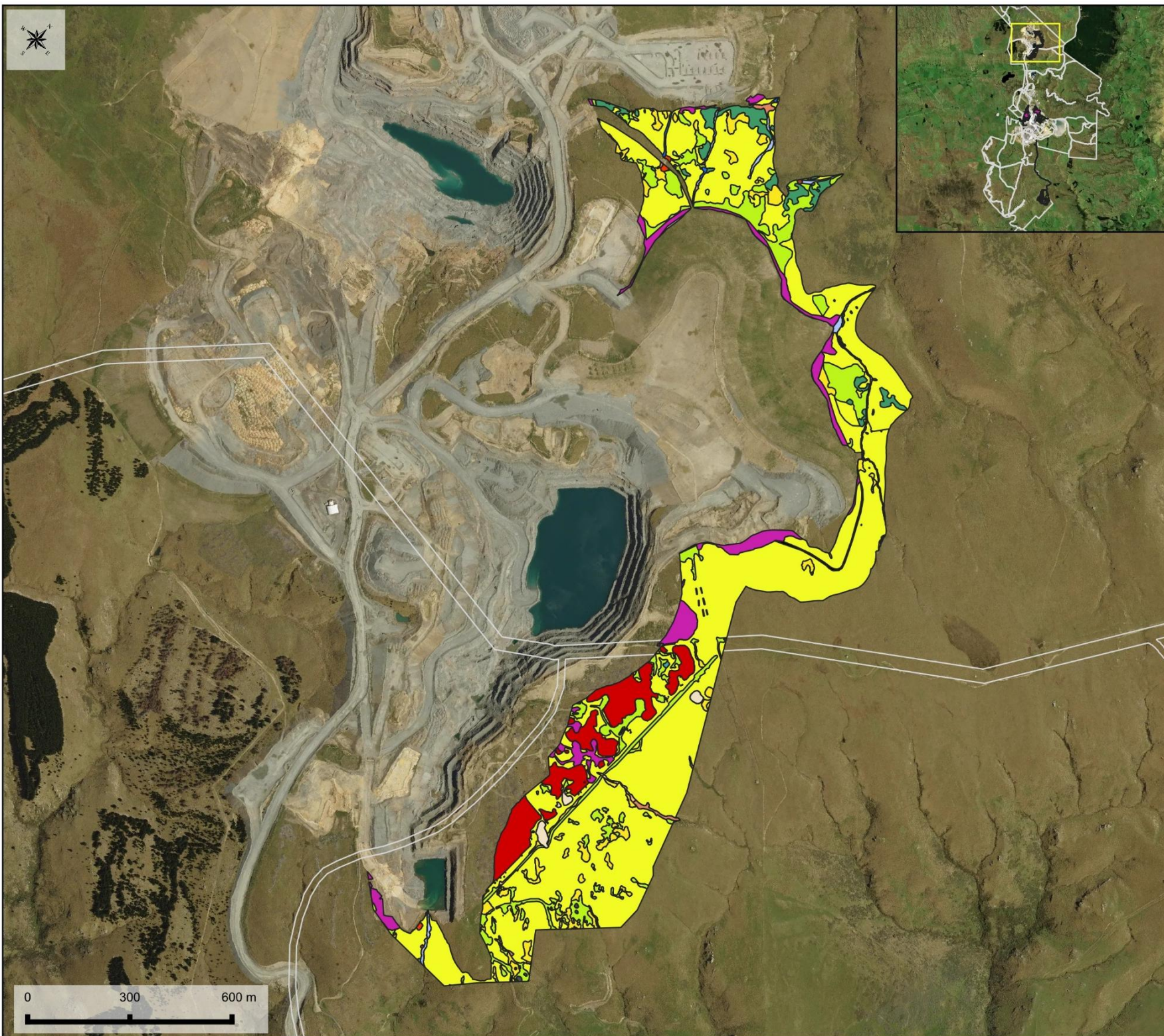
Wetlands

- Gully: 45.66 ha
- Ephemeral: 9.70 ha

Vegetation boundaries and classifications were interpreted from LINZ aerial imagery and validated where possible through selected ground-truthing and desktop aerial analysis. Vegetation types and boundaries should be regarded as indicative.

SOURCES
LINZ Basemap aerial

MAP PROJECTION
NZGD2000 / New Zealand Transverse
Mercator 2000



Coronation Mining Area ecosystem extents (impact area only)

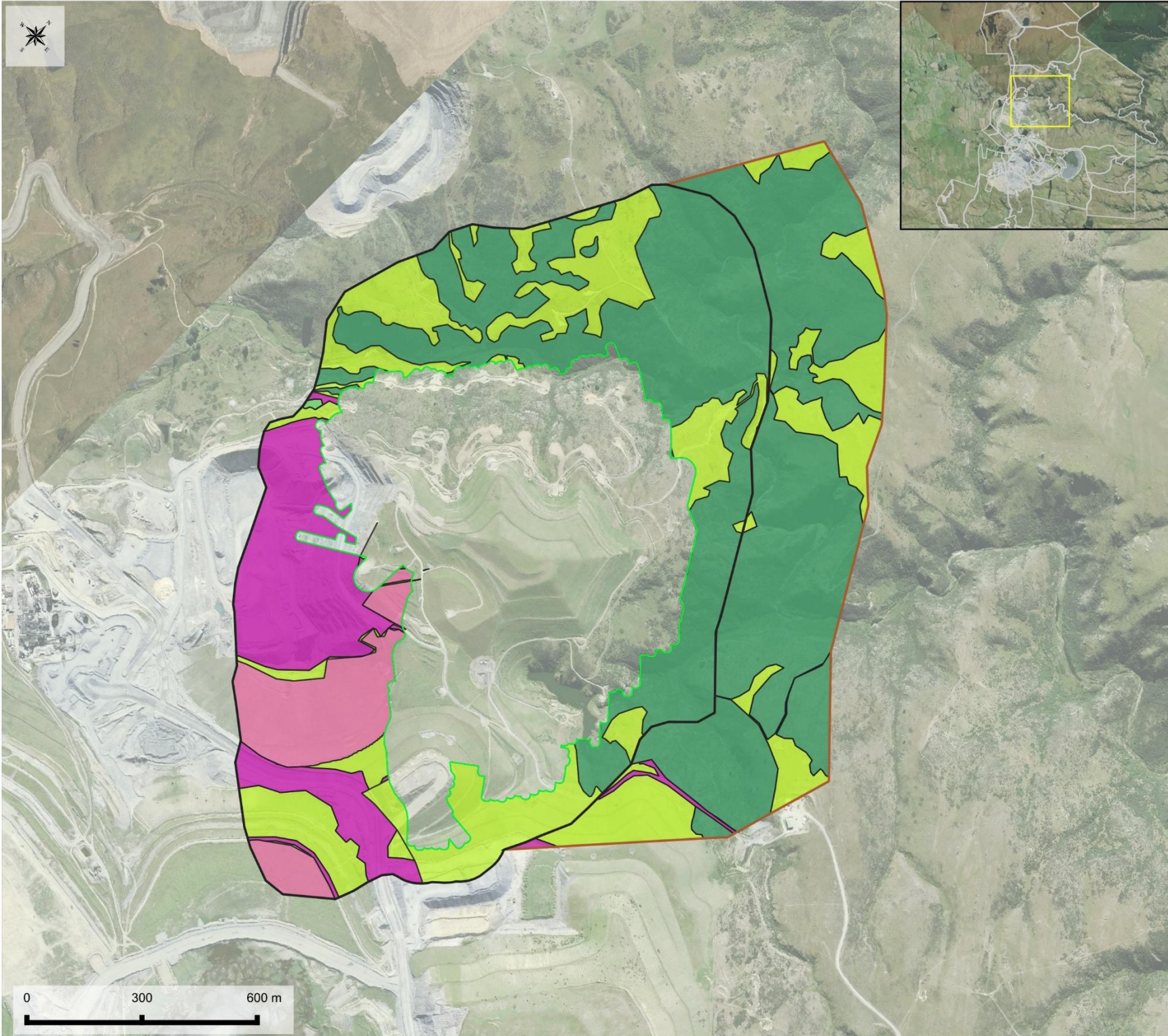
Date: 30/06/2026
Drawn By: MA
Client: OceanaGold New Zealand Ltd
Scale: 1:15,000

Legend

- OGL landholdings
- Coronation North Ecosystems
 - Ephemeral Wetland
 - Exotic Grassland
 - Gorse
 - Mine - disturbed
 - Pine
 - Pine forest (felled)
 - Pond
 - Rehabilitated mine workings
 - Riparian - Freshwater Herbaceous
 - Riparian - Sedgeland
 - Road
 - Rock
 - Shrubland
 - Tussock - Dense
 - Tussock - Moderately Dense
 - Wetland - Freshwater Herbaceous
 - Wetland - Sedgeland
 - Wetland - Seepage
 - Wetland - Shrubland

SOURCES
LINZ Basemap aerial

MAP PROJECTION
NZGD2000 / New Zealand Transverse
Mercator 2000



Golden Point Underground ecosystem extents (impact area only)

Date: 24/08/2026

Drawn By: MS

Client: OceanaGold New Zealand Ltd

Scale: 1:13,361

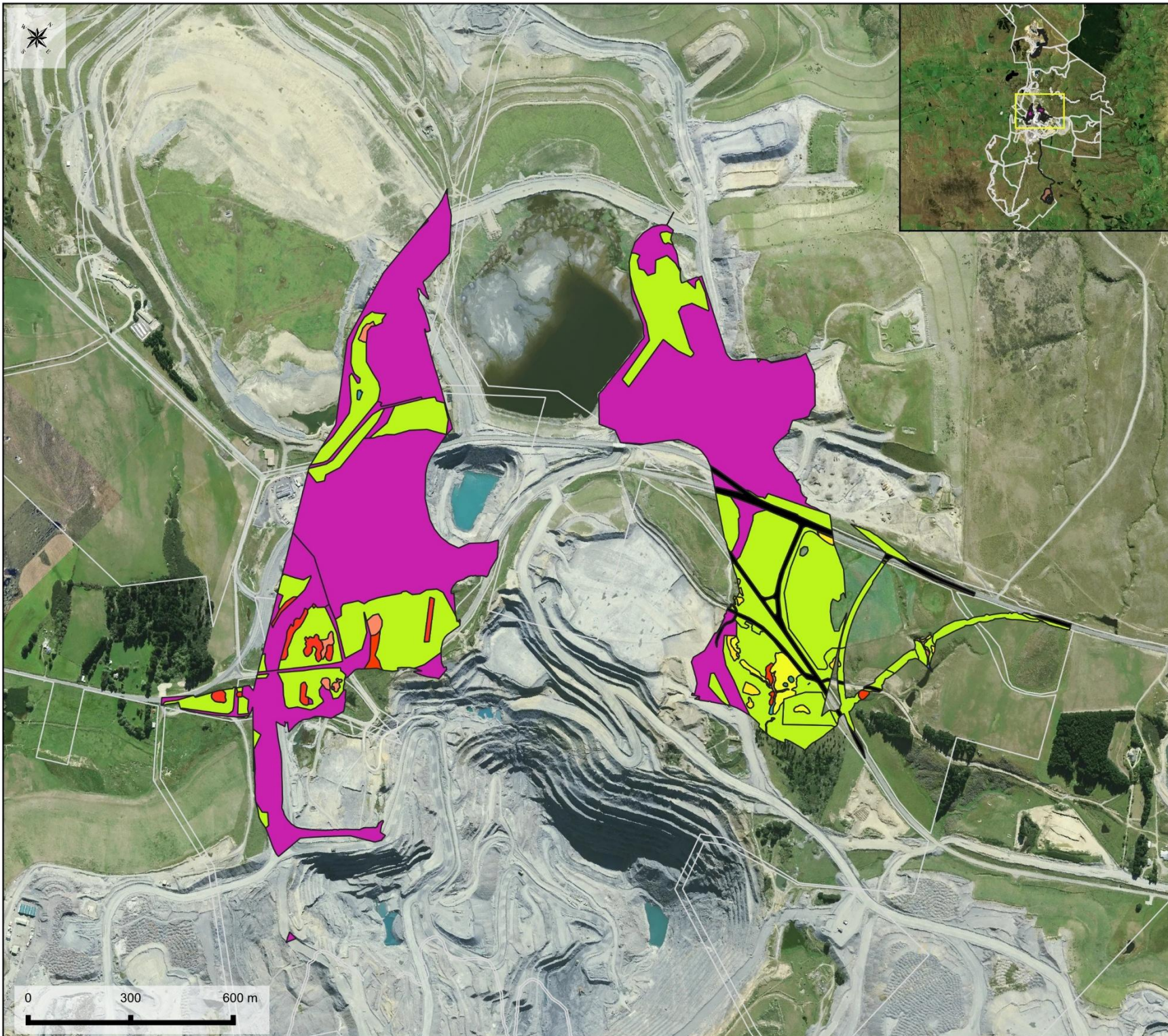
Legend

-  GPUG Boundary
-  GPUG Extension
-  GPUG consented area
- GPUG Ecosystem Extent**
 -  Exotic Grassland
 -  Mine - disturbed
 -  Rehabilitated mine workings
 -  Shrubland

SOURCES
LINZ Basemap aerial

MAP PROJECTION
NZGD2000 / New Zealand Transverse
Mercator 2000

Bioresearches 
A Babbage Company



Central Mining Area ecosystem extents (impact area only)

Date: 30/06/2026

Drawn By: MA

Client: OceanaGold New Zealand Ltd

Scale: 1:15,000

Legend

- OGL landholdings
- Central Mining Area Ecosystems
 - Exotic Grassland
 - Gorse
 - Mine - disturbed
 - Pine
 - Pond
 - Rehabilitated mine workings
 - Road
 - Shrubland
 - Tussock - Dense
 - Tussock - Moderately Dense
 - Wetland - Freshwater Herbaceous
 - Wetland - Sedgeland
 - Woody Exotic

SOURCES
LINZ Basemap aerial

MAP PROJECTION
NZGD2000 / New Zealand Transverse
Mercator 2000

Bioresearches
A Babbage Company



Golden Bar Haul Road ecosystem extents (impact area only)

Date: 30/06/2026
Drawn By: MA
Client: OceanaGold New Zealand Ltd
Scale: 1:15,000

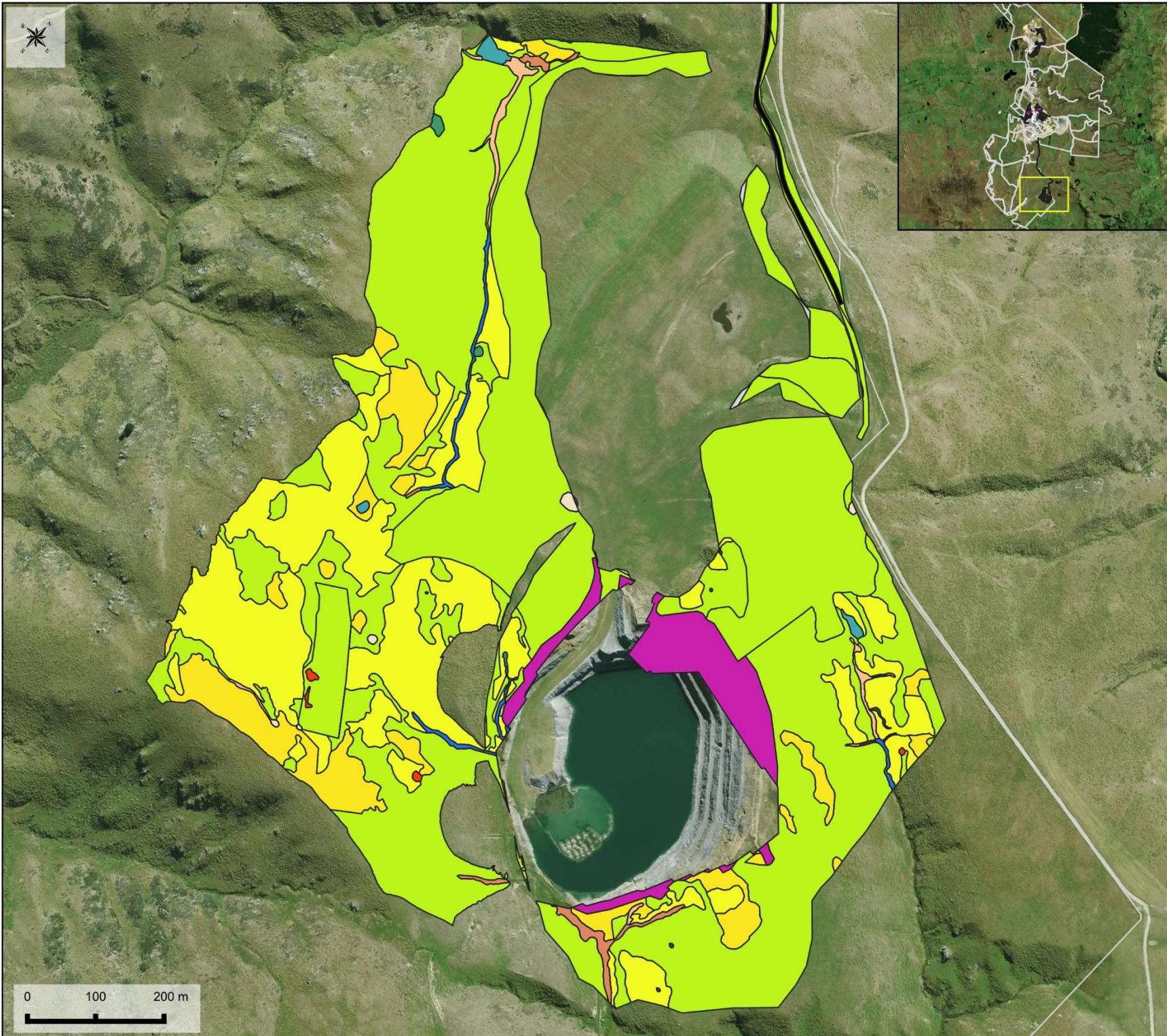
Legend

- OGL landholdings
- Golden Bar Haul Road Ecosystems
 - Exotic Grassland
 - Road
 - Tussock - Dense
 - Tussock - Moderately Dense

SOURCES
LINZ Basemap aerial

MAP PROJECTION
NZGD2000 / New Zealand Transverse
Mercator 2000

Bioresearches
A Babbage Company



Golden Bar Mining Area ecosystem extents (impact area only)

Date: 30/06/2026

Drawn By: MA

Client: OceanaGold New Zealand Ltd

Scale: 1:7,500

Legend

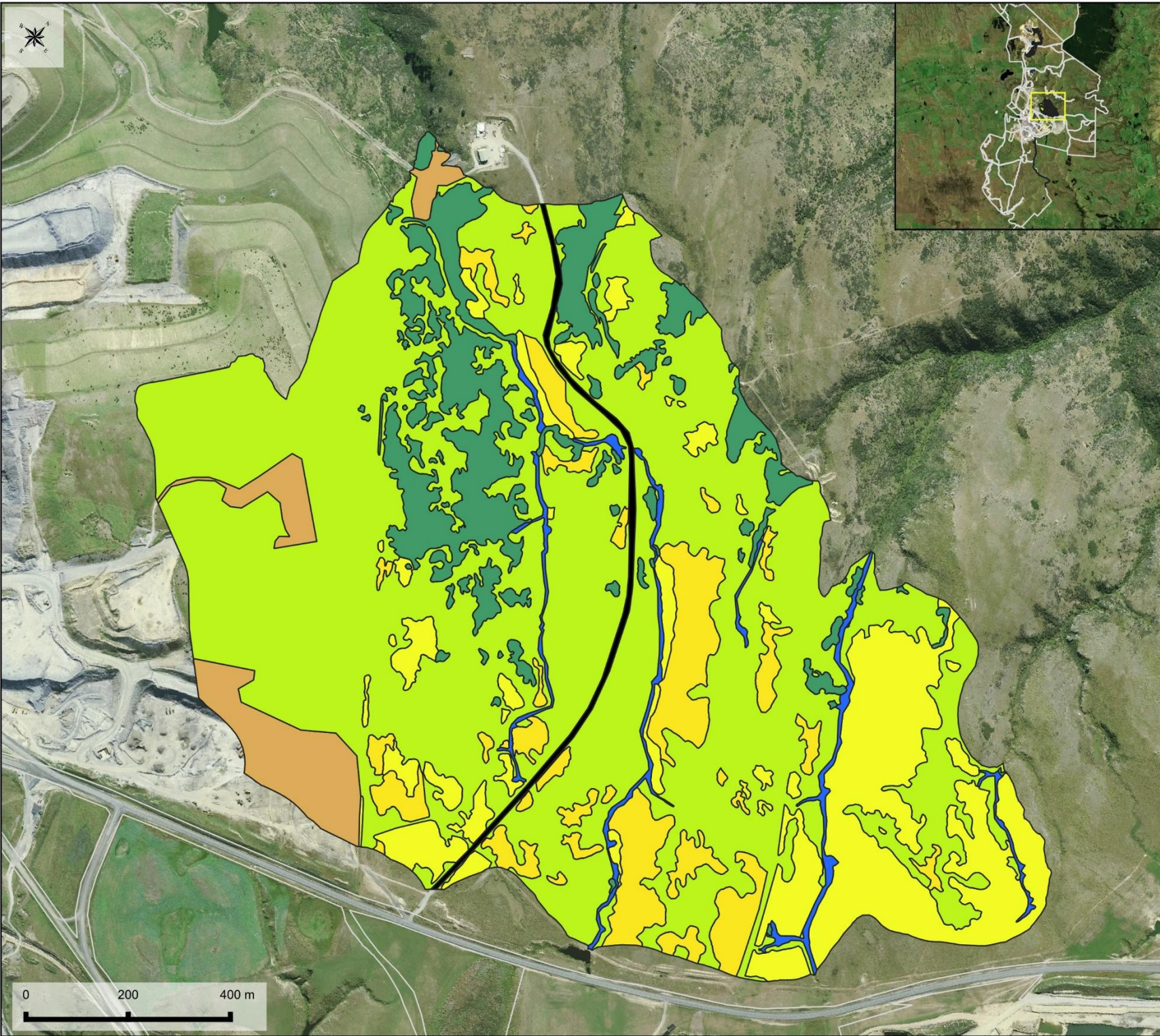
- OGL landholdings
- Golden Bar Ecosystems
 - Ephemeral Wetland
 - Exotic Grassland
 - Gorse
 - Mine - disturbed
 - Pond
 - Rehabilitated mine workings
 - Riparian - Sedgeland
 - Riparian - Shrubland
 - Road
 - Rock
 - Shrubland
 - Tussock - Dense
 - Tussock - Moderately Dense
 - Wetland - Freshwater Herbaceous
 - Wetland - Sedgeland
 - Wetland - Shrubland

SOURCES

LINZ Basemap aerial

MAP PROJECTION

NZGD2000 / New Zealand Transverse
Mercator 2000



Back Road Waste Rock Stack ecosystem extents (avoided loss)

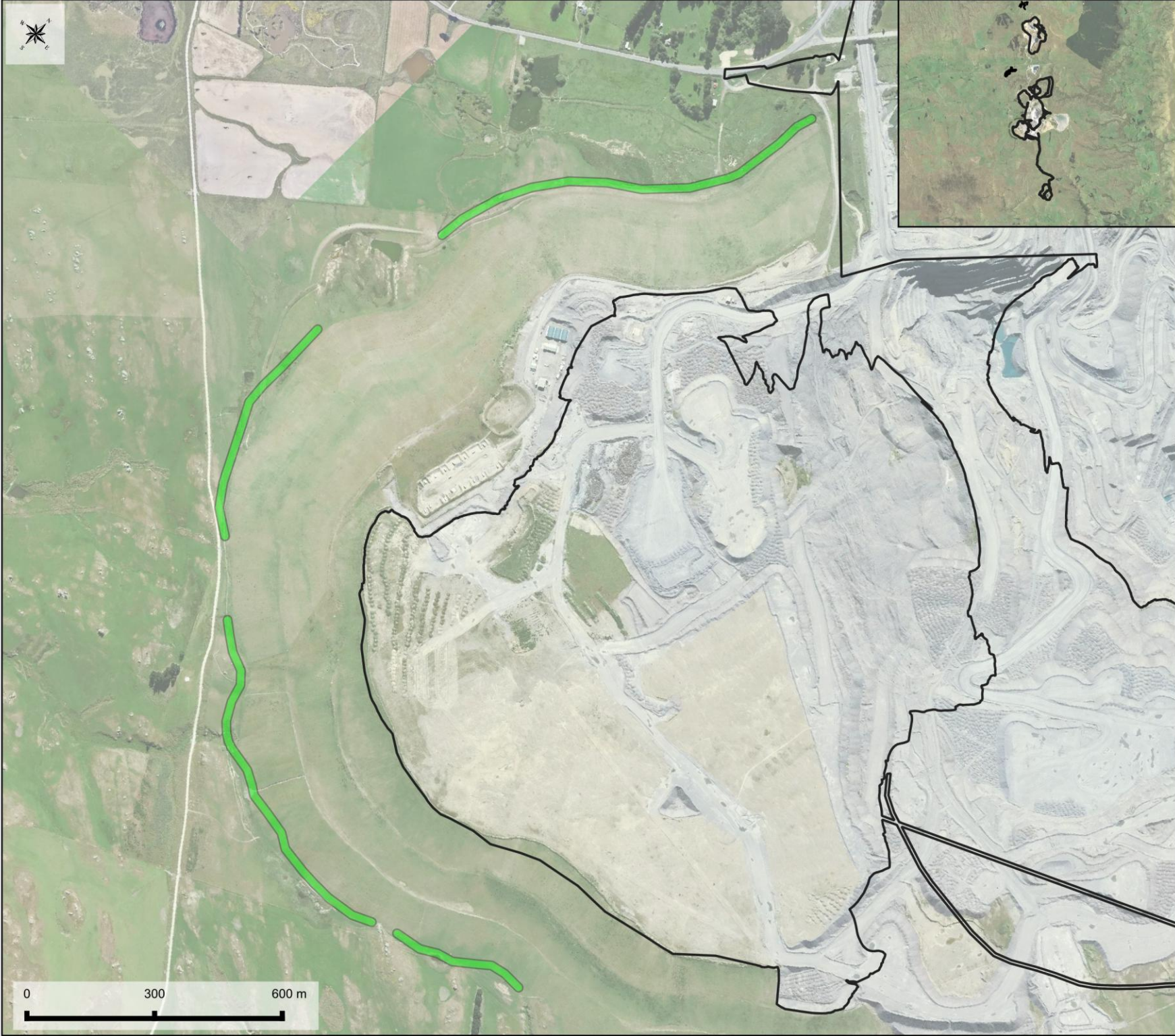
Date: 30/06/2026
Drawn By: MA
Client: OceanaGold New Zealand Ltd
Scale: 1:10,000

Legend

- OGL landholdings
- BRWRS Ecosystems
 - Exotic Grassland
 - Road
 - Shrubland
 - Tussock - Dense
 - Tussock - Moderately Dense
 - Mine - disturbed
 - Riparian

SOURCES
LINZ Basemap aerial

MAP PROJECTION
NZGD2000 / New Zealand Transverse
Mercator 2000



Fraser's West - French Drain (impact area only)

Date: 30/06/2026
Drawn By: MA
Client: OceanaGold New Zealand Ltd
Scale: 1:12,040

Legend

-  OGL landholdings
-  Fraser's West French Drain - 5.5 Ha (Exotic Grassland)
-  MP4 Components

SOURCES
LINZ Basemap aerial

MAP PROJECTION
NZGD2000 / New Zealand Transverse
Mercator 2000

4 Summary of Values Assessments

This section provides a summary of the ecological values as identified and described in the Ecological Assessment documents listed in Table 2-2. Values were assessed and detailed in individual reports for Vegetation and Wetlands (Whirika 2026), Invertebrates (Bioresearches 2026b), Lizards (Bioresearches 2026c), Avifauna (Bioresearches 2026d), and Bats (Bioresearches 2026e). A values assessment for wetlands located adjacent to the SCD's is provided in **APPENDIX**. The below provides a summary of the key elements of each of those assessments relevant to the EclA.

4.1 Vegetation and Wetlands

Desktop investigations were undertaken to characterise the ecological context of the Macraes ED, to identify previously recorded ecological features and threatened species in the wider Macraes area, and to inform the field survey methodology. This review covered several published and unpublished sources of literature and several databases and online sources.

Vegetation surveys were undertaken on multiple occasions between 2019 and 2026. Overall, 69 days of survey effort were involved. All plant species (indigenous and exotic) were recorded during a walk-through survey of the Project footprint and 100m buffer surrounding the footprint. Survey paths traversed the most botanically interesting areas and provided coverage across all vegetation communities. As well as walk-through surveys, vegetation plots were used to quantify the species composition and percentage cover of representative vegetation patches. Within each plot, the percentage cover of each plant species was assessed visually. In addition to the systematic walk-through and plot-based surveys, targeted searches were undertaken in areas known or likely to support nationally or regionally Threatened, At Risk or Data Deficient plant species. These targeted searches focused on rock outcrops, ephemeral wetlands, seepages, and gully heads.

Wetlands within the ESA were delineated in accordance with the New Zealand Wetland Delineation Protocols (MfE 2022). The full suite of delineation tools — vegetation, soils, hydrology, and the pasture test — was applied where wetland indicator species were present. Three broad wetland types were identified, including ephemeral wetlands, riparian wetlands and seepage wetlands.

A summary of terrestrial vegetation and habitat types identified within the MP4 impact area are presented in Table 4-1 and Figure 4.1.

The main vegetation types (and subtypes of riparian plant communities) of the Project footprint and surrounding 100 m buffer were manually mapped based on the results of vegetation plots, ground-survey, examination of aerial photographs. These results are summarised in Table 4-2.

Table 4-1. Summary of terrestrial Vegetation and habitat types within the MP4 impact area.

Terrestrial Environment	General description
Exotic grassland	Exotic grassland is the most extensive mapped land cover type within the impact area. It includes rough pasture, improved pasture and exotic-dominated grassland, typically dominated by exotic grasses and herbs such as cocksfoot, browntop, sweet vernal, Yorkshire fog and ryegrass. These areas generally contain few indigenous plant species, although some modified grassland may provide habitat for mobile indigenous fauna or scattered rare plant records.
Gorse	Small areas dominated by gorse, generally associated with modified pasture margins, disturbed land or regenerating woody exotic cover. These areas are exotic-dominated and have low botanical value but may provide limited structural habitat for fauna.
Mine-disturbed land	Existing or recent mine-disturbed areas, including pits, waste rock storage areas, disturbed ground, operational surfaces and other modified landforms. These areas generally have negligible botanical value, although some may be undergoing passive colonisation by exotic grasses or herbs.
Pine	Standing pine plantation or shelterbelt vegetation, principally exotic conifers. These areas are exotic-dominated and have limited indigenous botanical value.
Pine forest, felled	Recently felled pine plantation areas, including disturbed substrates, slash and early colonising vegetation. These areas are exotic-dominated and generally have low botanical value.
Pond	Constructed or modified pond habitat associated with the mining and pastoral landscape. Botanical values are variable and should be considered alongside wetland and freshwater assessments where relevant.
Rehabilitated mine workings	Former mine-disturbed areas that have been rehabilitated, typically to exotic pasture or exotic grassland. Some localised indigenous planting or tussock establishment may be present, but these areas are generally modified.
Road	Existing road corridor, tracks and associated road margins. These areas are highly modified and generally support exotic grasses, herbs and disturbed-ground vegetation.
Woody exotic vegetation	Areas dominated by woody exotic species, including broom and/or gorse. These areas are exotic-dominated and generally have low botanical value.
Ephemeral wetland	Ephemeral wetlands occur in shallow depressions subject to periodic inundation and drying. Both short-inundation and long-inundation forms are present. Vegetation composition varies from exotic grass-dominated examples to sites retaining indigenous turf-forming herbs, sedges and

Terrestrial Environment	General description
	wetland grasses. Ephemeral wetlands are a naturally uncommon and threatened ecosystem. Values vary by location, with Very High value examples at Coronation Mining Area, High value examples at Central Mining Area and Golden Bar Haul Road, and Moderate value examples at Golden Bar.
Riparian freshwater herbaceous vegetation	Herbaceous vegetation associated with damp gullies, drainage lines and riparian margins. These communities are commonly affected by grazing and exotic grass, rush and herb cover, but may retain indigenous wetland and riparian species. At Coronation Mining Area this vegetation type is assessed as High ecological value because it supports Regionally TAR plant species.
Riparian Red tussock	Riparian red tussock vegetation is associated with damp riparian or gully settings. It is not recorded in the current direct impact area but is present within the wider 100 m assessment area. Its ecological value should be confirmed against the wetland and vegetation values assessment where it may be affected by indirect pathways.
Riparian sedgeland	Sedgeland vegetation associated with riparian and damp gully environments, commonly including pukio/ <i>Carex secta</i> and other sedges within an exotic grass and herb matrix. These areas are generally modified by grazing, pugging and weed invasion. Riparian sedgeland is assessed as Moderate ecological value where it retains indigenous sedgeland structure and local riparian function.
Riparian shrubland	Small areas of shrubland associated with riparian or gully margins. These areas are localised and may include indigenous shrubs within a modified riparian setting.
Rock habitat	Rock outcrops and rocky habitat associated with gullies, slopes and schist features. Rock habitat is limited in extent but can support distinctive indigenous plant assemblages and rare plant records and also provides habitat structure for lizards and invertebrates.
Shrubland	Shrubland associated with riparian or gully margins. These areas are limited within the direct impact area, but more extensive within the wider 100 m assessment area. Riparian shrubland may include indigenous shrubs, including regionally At Risk <i>Olearia bullata</i> , within a modified riparian setting and can provide habitat structure, buffering and fauna habitat along gullies and drainage lines, and has been assessed as Moderate value.
Snow tussock grassland	Snow tussock grassland dominated by <i>Chionochloa rigida</i> , generally with tussocks at moderate to high cover and a variable inter-tussock component of indigenous and exotic herbs and grasses. Condition varies by location, with higher-value examples at Coronation Mining Area and Golden Bar.
Wetland freshwater herbaceous vegetation	Freshwater herbaceous wetland vegetation associated with wetland margins, damp ground, seepage-influenced areas and seasonally wet gullies. These communities are commonly modified by grazing, pugging and exotic wetland plants, but some examples support indigenous wetland

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Terrestrial Environment	General description
	herbs and Regionally TAR plant species. Ecological value ranges from Low to High depending on condition, indigenous diversity and rare plant habitat.
Wetland sedgeland	Wetland sedgeland commonly includes <i>Carex secta</i> and other wetland sedges in damp gullies, wetland margins or seepage-influenced areas. These areas are often degraded by grazing, pugging and exotic grass or herb cover. Ecological value ranges from Low to Moderate, reflecting variation in intactness, indigenous diversity and local wetland function.
Wetland seepage	Small seepage wetland areas associated with persistent groundwater or spring-fed moisture. These features are limited in extent but may be ecologically important because seepages are naturally uncommon and can support distinctive wetland conditions. The seepage wetland recorded at Coronation Mining Area is assessed as High ecological value.
Wetland shrubland	Small areas of wetland shrubland associated with damp gullies or wetland margins. These areas are localised and may include indigenous wetland shrubs, including At Risk <i>Olearia bullata</i> , and associated herbaceous species. Wetland shrubland is assessed as Moderate ecological value where present.



Figure 4.1. A selection of photographs of showing some of the identified habitat types within the MP4 Project Area.

Table 4-2. Extent of indigenous terrestrial and wetland plant communities within the MP4 project footprint and the corresponding ecological value per habitat/community

Indigenous habitat or Community	Ecological Value	Coronation Mining Area (ha)	Macraes Central (ha)	Golden Bar and Haul Road (ha)	Total (ha)
Dry Shrubland	Moderate	2.76	0.05	0.25	3.06
Snow Tussock grassland	Very High	63.24	2.37	24.40	90.01
Rock	Very High	0.17	0.00	0.09	0.26
Ephemeral wetland	High to Very High	0.39	3.26	1.23	4.88
Sedgeland	Low to Moderate	0.58	0.38	1.84	2.80
Freshwater herbaceous	Low to High	1.89	0.09	1.02	3.00
Seepage	High	0.02	0.00	0.00	0.02
Shrubland wetland	Moderate	0.01	0.00	0.02	0.03
Red tussock	Moderate	0.076	0.00	0.00	0.076

4.1.1 Summary of Threatened and At Risk flora species

Twenty-two Regionally Threatened plant species are recorded within the MP4 ZOI, comprising two Regionally Critical species, ten Regionally Endangered species and ten Regionally Vulnerable species. A further twenty-six At Risk species are recorded in the ZOI, comprising nine Declining species, thirteen Naturally Uncommon species and four Data Deficient species. An additional two species that are uncommon in the ecological district, but classified as Not Threatened at the regional level are found in the ZOI. Most Threatened or At Risk (TAR) flora records are associated with Coronation Mining Area, particularly the Trimbells Waste Rock Stack Height Raise and Extension area, Coronation Mining Area Pit Disturbance area and Coronation Pit extension areas. A smaller number of Threatened plant records occur within or near the Golden Bar Mining Area, the Golden Bar Haul Road and the Central Mining assessment areas.

Threatened plants occur across several habitat types, including rock outcrops, clay banks, damp gully bottoms, wetland margins, seepages, ephemeral wetlands, tussock grassland and short open vegetation. Several species are represented by small numbers of plants or localised patches. Records within the Project footprint or the 20 m buffer are treated as potentially unable to be avoided unless otherwise confirmed through final design and pre-clearance checks. Records in the wider buffer are relevant to indirect effects assessment and management planning.

The highest concentration of Regionally Threatened plant records occurs within Coronation Mining Area, particularly Trimbells Gully and associated rock, clay bank, damp gully, seepage, wetland and tussock grassland habitats. Golden Bar supports fewer Regionally Threatened records within the direct impact area, but contains important associated rare plant habitat, including tussock grassland, wetland margins, riparian features, shrubland and rock habitat. Golden Bar Haul Road includes several Threatened plant records within the wider buffer, which are relevant to indirect effects and should be considered during construction planning and ecological supervision. The Central Mining area includes several ephemeral wetlands known to support Threatened plant species.

Table 4-3 identifies 50 TAR and locally uncommon flora plant species recorded within the zone of influence that have an elevated conservation status, or are locally uncommon.

Table 4-3. List of 50 regionally (Jarvie *et al.* 2026) and nationally (de Lange *et al.* 2023) Threatened and At Risk plant species recorded within the MP4 Zone of Influence (note two not threatened but 'locally uncommon' species are also recorded).

Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
Dwarf broom, <i>Carmichaelia corrugata</i>	Threatened - Regionally Critical	Threatened - Nationally Vulnerable	10 plants (Trimbell's WRS)	Coronation Mining Area, Trimbell's WRS Height Raise footprint	Central Mining Area	Small creeping broom associated with dryland short grassland. Four sites containing approximately 10 plants are recorded in the Trimbell's WRS Height Raise footprint.
Indigenous St John's wort, <i>Hypericum rubicundulum</i>	Threatened - Regionally Critical	Threatened - Nationally Endangered	3 plants (Coronation Mining Area)	Coronation Mining Area, Trimbell's WRS Height Raise footprint	Golden Bar Haul Road wider buffer	Small creeping herb recorded from schist outcrop overhangs and clay banks. Three plants or patches are recorded in the Trimbell's WRS Height Raise footprint, with a larger buffered population near Golden Bar Haul Road.
<i>Carex kaloides</i>	Threatened - Regionally Endangered	At Risk - Declining	-	Coronation Mining Area	Coronation Mining Area wider buffer	Sedge associated with damp gully bottoms. One plant forming a small patch is recorded in the 20 m buffer, with a larger population recorded in the wider buffer.
Slender wine sedge, <i>Carex tenuiculmis</i>	Threatened - Regionally Endangered	At Risk - Declining	-	Coronation Mining Area, Trimbell's WRS Raise footprint	Coronation Mining Area wider buffer; Golden Bar Haul Road wider buffer	Wetland sedge associated with damp gully bottoms and wetlands. One plant is recorded within the Trimbell's WRS Raise footprint, with additional records in wider buffer areas.

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Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
<i>Euchiton ensifer</i>	Threatened – Regionally Endangered	At Risk - Declining			Central Mining Area	Diminutive creeping herb of ephemeral wetlands and damp areas. Recorded from within the wider Central area buffer.
<i>Gratiola aff. concinna</i> (AK 251855; South Island)	Threatened – Regionally Endangered	Threatened – Nationally Critical			Central Mining Area	Creeping, mat-forming herb of open wetland or riparian environments. Recorded from the wider Central mining buffer area.
Wetland daisy, <i>Lagenophora barkeri</i>	Threatened - Regionally Endangered	At Risk - Declining	3 plants (Coronation Mining Area)	Coronation Mining Area, Trimbells WRS Raise footprint and Coronation Mining Area Pit Disturbance area	Coronation Mining Area wider buffer; Golden Bar Haul Road / Pit wider buffer	Wetland daisy associated with damp gully bottoms, wetlands and seeps. Three plants or patches are recorded within the direct impact area, with further records in wider buffers.
Creeping button daisy, <i>Leptinella pusilla</i>	Threatened - Regionally Endangered	At Risk - Declining	One plant (Coronation Mining Area)	Coronation Mining Area, Trimbells WRS Height Raise footprint		Creeping herb recorded as a localised patch in shaded habitat, generally at the base of rock outcrops or similar sheltered sites.
<i>Rytidosperma thomsonii</i>	Threatened - Regionally Endangered	At Risk - Declining	Four plants (Coronation Mining Area and Golden Bar)	Coronation Mining Area Pit Disturbance area		Small dryland grass recorded within tussock grassland in the Coronation Mining Area Pit Disturbance footprint.
<i>Lobelia ionantha</i>	Threatened - Regionally Endangered	At Risk - Declining	One population (Central Mining Area)	Central Mining Area		Recorded from the Central Mining Area. Associated with wetland or damp habitat values in the vegetation assessment.

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Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
<i>Wurmbea novae-zelandiae</i>	Threatened – Regionally Endangered	Threatened – Nationally Endangered			Central Mining Area	One population recorded in a wetland within the wider buffer area for the Central Mining Area.
<i>Sonchus</i> aff. <i>novae-zelandiae</i> (a) (CHR 517718; “grassland”)	Threatened - Regionally Vulnerable	Threatened - Nationally Endangered	Two plants (Coronation Mining Area)	Coronation Mining Area, Trimbells WRS Height Raise footprint		Dryland daisy recorded on a schist outcrop within the Trimbells WRS Height Raise area. This is the current threat-list taxon name for eastern South Island dryland plants previously treated as <i>Sonchus novae-zelandiae</i> .
Narrow-leaved speargrass, <i>Aciphylla subflabellata</i>	Threatened - Regionally Vulnerable	At Risk - Declining	One plant (Coronation Mining Area) possible second plant on road edge of Central Mining Area	Coronation Mining Area, Trimbells WRS Height Raise footprint	Golden Bar Haul Road wider buffer; Golden Bar Pit wider buffer	Dryland short grassland species. One plant is recorded within the Trimbells WRS Height Raise footprint, another has been noted on road margin of Central Mining Area, with additional records in wider Golden Bar buffer areas.
Tufted hair grass, <i>Deschampsia cespitosa</i>	Threatened - Regionally Vulnerable	At Risk - Declining	c.440 plants across five wetlands (Coronation Mining Area)	Coronation Mining Area Pit Disturbance, Coronation Pit Backfill and Coronation Pit	Central Mining Area	Wetland grass associated with permanently damp environments. Multiple records occur within Coronation Project components.
Marsh willowherb, <i>Epilobium chionanthum</i>	Threatened – Regionally Vulnerable	At Risk – Declining	-		Golden Bar Haul Road and Pit wider buffer	Wetland willowherb recorded in damp gully heads within the wider Golden Bar Haul Road buffer. No direct impact or 20

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
						m buffer records are identified in the vegetation assessment table.
<i>Epilobium insulare</i>	Threatened - Regionally Vulnerable	At Risk - Declining	c.10 plants (Coronation Mining Area, Golden Bar)	Coronation Mining Area, Trimbells WRS Height Raise footprint; Golden Bar WRS Extension	Central Mining Area	Wetland willowherb associated with damp ground and wetland habitats. Records occur within both Coronation Mining Area and Golden Bar direct impact areas.
<i>Euchiton polylepis</i>	Threatened - Regionally Vulnerable	At Risk - Declining	One plant (Coronation Mining Area)	Coronation Mining Area, Trimbells WRS Height Raise footprint		Creeping cudweed associated with damp places. One plant is recorded within the Trimbells WRS Height Raise footprint.
<i>Lachnagrostis striata</i>	Threatened – Regionally Vulnerable	Not Threatened		Central Mining Area	Central Mining Area	Small and delicate grass associated with wetlands and riparian margins. Recorded in both the 20 m and wider buffer of the Central Mining Area.
Dwarf greenhood orchid, <i>Pterostylis tristis</i>	Threatened - Regionally Vulnerable	At Risk - Declining	Six plants (Coronation Mining Area)	Coronation Mining Area, Trimbells WRS Height Raise footprint		Small dryland greenhood orchid recorded within the Trimbells WRS Height Raise footprint.
Dwarf rush, <i>Juncus pusillus</i>	Threatened - Regionally Vulnerable	At Risk - Naturally Uncommon	One plant (Central Mining Area)	Central Mining Area	Central Mining Area	Recorded from the Central Mining Area. Associated with wetland or damp habitat values in the vegetation assessment.

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Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
<i>Lobelia perpusilla</i>	Threatened - Regionally Vulnerable	Not Threatened	One population (Central Mining Area)	Central Mining Area	Central Mining Area	Recorded from the Central Mining Area. Associated with wetland or damp habitat values in the vegetation assessment.
<i>Bidibidi, Acaena buechananii</i>	Threatened - Regionally Vulnerable	At Risk - Declining	One plant (Coronation Mining Area)	Coronation Mining Area, Trimbell's WRS Height Raise footprint		Creeping dryland herb recorded as a small patch within the Trimbell's WRS Height Raise footprint.
Delicate bluegrass, <i>Anthosachne falcis</i>	At Risk - Regionally Declining	At Risk - Declining	Four populations (Coronation Mining Area and Central Mining Area)	Coronation Mining Area, including Trimbell's WRS Height Raise footprint; Central Mining Area	Coronation Mining Area wider buffer	Grass species recorded from Coronation Mining Area and Central Mining. Generally associated with open grassland or modified indigenous grassland habitats.
<i>Carex dipsacea</i>	At Risk – Regionally Declining	Not Threatened			Central Mining Area wider buffer	Sedge species recorded from Central mining buffer areas. Associated with wetlands and riparian margins. Relevant mainly to indirect effects.
Desert broom, <i>Carmichaelia petriei</i>	At Risk - Regionally Declining	At Risk - Declining	c.150 plants (Coronation Mining Area, Golden Bar, Golden Bar Haul Road, Central Mining Area)	Coronation Mining Area; Golden Bar Mining Area; Golden Bar Haul Road 20 m buffer, Central Mining Area	Coronation Mining Area wider buffer; Golden Bar Haul Road / Pit wider buffer, Central Mining Area	Dryland shrub associated with open grassland and shrubland. Records are concentrated at Coronation Mining Area and Golden Bar, with scattered individuals or clusters.

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
<i>Colobanthus strictus</i>	At Risk - Regionally Declining	Not Threatened		Coronation Mining Area, including Coronation Mining Area Pit Disturbance and Trimbells WRS Height Raise footprint	Coronation Mining Area wider buffer	Small dryland herb recorded from Coronation Mining Area, including the Trimbells WRS Height Raise area.
Mountain carrot, <i>Gingidia grisea</i>	At Risk - Regionally Declining	At Risk - Naturally Uncommon	-	Golden Bar WRS 20 m buffer		Associated with rocky, exposed and cliff-like microhabitats. Recorded in the Golden Bar WRS buffer.
<i>Juncus distegus</i>	At Risk - Regionally Declining	Not Threatened	Seven plants (Coronation Mining Area, Central Mining Area)	Coronation Mining Area; Central Mining Area; Golden Bar Mining Area	Central Mining Area	Rush species recorded from multiple MP4 areas, including wetland or damp ground habitats.
New Zealand mint / hīoi, <i>Mentha cunninghamii</i>	At Risk - Regionally Declining	At Risk - Declining	Two plants (Coronation Mining Area)	Coronation Mining Area, Trimbells WRS Height Raise footprint; Golden Bar WRS 20 m buffer	Central Mining Area	Localised species associated with moisture-influenced terrestrial microsites and damp habitat margins.
<i>Rytidosperma buechananii</i>	At Risk - Regionally Declining	At Risk - Declining	Three plants (Coronation Mining Area)	Coronation Mining Area Pit Disturbance area		Grass species recorded within Coronation Mining Area. Associated with open indigenous or semi-natural grassland habitats.

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
<i>Shawia lineata</i>	At Risk – Regionally Declining	At Risk – Declining	-		Coronation Mining Area wider buffer	Recorded from the Coronation Mining Area wider buffer. Relevant mainly to indirect effects and construction controls.
Wetland grass, <i>Agrostis pallescens</i>	At Risk - Regionally Naturally Uncommon	At Risk - Naturally Uncommon	Three populations (Coronation Mining Area)	Coronation Mining Area, Coronation Pit Backfill and Coronation Pit Extensions Stages 6 to 8		Wetland grass associated with ephemeral wetland and seasonally wet habitat. Recorded covering an area of approximately 500m ² in Coronation ephemeral wetland sites.
<i>Brachyscome longiscapa</i>	At Risk - Regionally Naturally Uncommon	At Risk - Naturally Uncommon	Twenty-four plants (Coronation Mining Area)	Coronation Mining Area Pit Disturbance, Coronation Pit Backfill, Coronation Pit Extension Stage 7 and Trimbells WRS Height Raise footprint	Coronation Mining Area wider buffer	Small herb associated with open or moisture-influenced habitats. Several records occur within Coronation Mining Area.
<i>Carex purpurata</i>	At Risk - Regionally Naturally Uncommon	At Risk - Naturally Uncommon	-		Golden Bar Haul Road / Pit wider buffer	Sedge recorded in the wider Golden Bar Haul Road / Pit buffer. Relevant mainly to indirect effects.
Hooker's mountain daisy, <i>Celmisia hookeri</i>	At Risk - Regionally	At Risk - Naturally Uncommon	c.300 plants across 40 sites (Coronation)	Coronation Mining Area; Central Mining Area; Golden Bar	Coronation Mining Area wider buffer; Golden Bar Haul Road / Pit wider buffer	Associated with open, rocky and sparsely vegetated habitats. Recorded from several MP4 areas and wider buffers. Estimated

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
	Naturally Uncommon		Mining Area, Golden Bar)	Mining Area; Golden Bar WRS 20 m buffer		1,500 plants are within the direct impact and 20 m buffer areas.
<i>Euchiton traversii</i>	At Risk – Regionally Naturally Uncommon	Not Threatened			Central Mining Area	A small silvery herb of open, damp ground. Recorded from within the wider Central buffer area.
<i>Lagenophora pinnatifida</i>	At Risk - Regionally Naturally Uncommon	Not Threatened		Coronation Mining Area, Trimbells WRS Height Raise footprint		Small herb recorded from Coronation Mining Area. Associated with open or damp habitat conditions.
<i>Poa pusilla</i>	At Risk - Regionally Naturally Uncommon	Not Threatened	One plant (Coronation Mining Area)	Coronation Mining Area		Small grass recorded within Coronation Mining Area. Habitat association should be confirmed against the final plant records layer.
<i>Shawia bullata</i>	At Risk - Regionally Naturally Uncommon	Not Threatened	Many plants (Coronation Mining Area, Central Mining Area)	Coronation Mining Area; Central Mining Area; Golden Bar Mining Area		Indigenous shrub recorded from several MP4 areas, including wetland or gully margins and shrubland contexts. The current national and regional threat lists use <i>Olearia bullata</i> .
<i>Oxalis rubens</i>	Regionally Data Deficient	Not Threatened	One plant (Coronation Mining Area)	Coronation Mining Area	Coronation Mining Area wider buffer	Small herb recorded from Coronation Mining Area and the wider buffer.

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
<i>Cress, Cardamine grandiscapa</i>	Regionally Data Deficient	At Risk – Naturally Uncommon	-	Golden Bar WRS 20 m buffer		Localised herb recorded at Golden Bar. Associated with small, discrete moisture-influenced or herbfield microsites.
<i>Geranium homeanum</i>	Regionally Data Deficient	Not Threatened	-		Central Mining Area	Grassland herb typically found growing amongst tussock. Relevant mainly to indirect effects unless future design changes affect the record.
Porcupine shrub, <i>Melicytus aff. alpinus</i> (c) (CHR 541568; Otago)	Regionally Data Deficient	Data Deficient	c.20 plants (Golden Bar)	Golden Bar WRS Extension	Coronation Mining Area wider buffer; Golden Bar WRS buffer	Data Deficient shrub taxon recorded from Golden Bar shrubland and wider buffer locations.
<i>Ranunculus aff. Reflexus</i> (CHR 394270; Mt Peel)	Regionally Data Deficient	At Risk – Declining	-		Golden Bar Haul Road / Pit wider buffer	Buttercup taxon recorded from the wider Golden Bar Haul Road / Pit buffer. Relevant mainly to indirect effects unless future design changes affect the record.
<i>Argyrotegium mackayi</i>	Regionally Naturally Uncommon	Not Threatened	-		Central Mining Area	Montane to alpine bogs, herbfield and grassland, often in wet sites and more common in wetter areas.
<i>Epilobium komarovianum</i>	Regionally Naturally Uncommon	Not Threatened			Central Mining Area	Mat-forming creeping willowherb of wetland environments. Relevant mainly to indirect effects unless future design changes affect the record.

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Regional conservation status	National conservation status	Direct Loss	20 m edge	Locations in surrounding landscape (beyond edge, to 100 m)	Habitat / notes
<i>Gentianella amabilis</i>	Regionally Naturally Uncommon	Not Threatened			Central Mining Area	Small flowering bulb requiring damp, open ground. Recorded from the wider Central area buffer. Relevant mainly to indirect effects unless future design changes affect the record.
<i>Lilaeopsis ruthiana</i>	Regionally Naturally Uncommon	Not Threatened			Central Mining Area	Small wetland plant recorded from the wider Central Mining Area buffer. Relevant mainly to indirect effects unless future design changes affect the record.
Climbing fuchsia, <i>Fuchsia perscandens</i>	Regionally Not Threatened	Not Threatened		Golden Bar WRS Extension		Localised vine recorded from shrubland associated with the Golden Bar WRS footprint. Retained in this table as locally uncommon within the vegetation assessment.
Kōwhai / small-leaved kōwhai, <i>Sophora microphylla</i>	Regionally Not Threatened	Not Threatened		Golden Bar WRS Extension		One individual recorded within Golden Bar WRS shrubland habitat. Retained in this table as locally uncommon within the vegetation assessment.

4.2 Fauna

4.2.1 Overview

The results of field investigations and desktop studies of fauna within the MP4 Project ZOI are detailed in separate values assessments (Table 2-2). A summary of their key findings is provided below.

4.2.2 Invertebrates

Native terrestrial invertebrates occur throughout the Project area. Surveyed habitats included snow tussock grassland, shrubland, rock outcrops, riparian margins, ephemeral wetlands, wetland vegetation, exotic grassland, felled pine, ponds, pine, woody exotic vegetation and mine-disturbed land. All mapped habitat types were assessed as potentially suitable for indigenous terrestrial invertebrates, although habitat quality varied between locations.

The highest invertebrate values were associated with habitats that retain structural complexity, indigenous vegetation, rock features, damp microsites, riparian margins, wetland vegetation or extensive snow tussock grassland. Golden Point Underground and BRWRS were assessed as Very high value for invertebrate communities due to their relatively extensive shrubland, tussock, rock, and gully habitat mosaics, as well as the presence of 'At Risk' species. Golden Bar was assessed as High value, due to the invertebrate community being representative of modified tussock habitats and the presence of 'Threatened' and 'At Risk' species, including *Orocrambus sophistes*, *Pasiphila* sp. A (NZAC 04285480 "Carmichaelia"), *Bityla sericea*, and *Nyctemera annulata*. The Coronation and Central Mining Areas were assessed as Moderate value, reflecting modified but functional habitat and the presence of 'At Risk' or 'Data Deficient' taxa. Golden Bar Haul Road and Frasers West French Drain were assessed as Low value because habitats are more modified, structurally simple or restricted in extent.

Seventeen invertebrate species of conservation interest have been recorded within the MP4 Project area or surrounding OGNZL landholdings (Table 4-4). These records include the moth *Orocrambus sophistes* ('Threatened – Nationally Vulnerable'); the moths *Agrotis admirationis*, *Asaphodes recta*, *Dasyuris partheniata*, *Nyctemera annulata*, *Pasiphila* sp. A (NZAC 04285480 "Carmichaelia"), *Patagoniodes farinaria*, *Samana acutata*, *Theoxena scissaria* (all 'At Risk – Declining'); the praying mantis *Orthodera novaezealandiae* ('At Risk – Declining'); the moth *Bityla sericea* ('At Risk – Uncommon'); and the moths *Wiseana fuliginea* and *Wiseana mimica* and stonefly *Zelandobius uniramus* ('Data Deficient'). All species except *D. partheniata* were recorded during dedicated surveys undertaken as part of the MP4 Project. In addition, large-bodied invertebrates of interest include the Otago ground wētā (*Hemiandrus maia*; 'Not Threatened'), a putative new *Mecodema* beetle species from the Central Mining Area, and the poorly known moth *Orocrambus* cf. *cyclopicus*. These are notable and included in the effects assessment because their taxonomy, distribution and conservation significance remains uncertain.

Overall, invertebrate values within the Project area are variable. Most modified mine, pasture and road-margin habitats support Low to Moderate values, while structurally complex tussock, shrubland, rock, riparian and wetland-margin habitats support higher values. The presence of 'Threatened', 'At Risk', 'Data Deficient' and potentially undescribed taxa indicates that invertebrate values should be carried through the effects assessment and considered in relation to habitat loss, habitat fragmentation, vegetation clearance, indirect effects, and residual effects management.

Table 4-4. 'Threatened', 'At Risk', 'Data Deficient', and other notable invertebrates recorded within the MP4 Project area or surrounding OGL Macraes landholdings.

Species	National threat status	Habitat description	Known distribution and MP4 records
<i>Orocrambus sophistes</i>	Threatened – Nationally Vulnerable	Tussock-associated moth. Larvae are presumed to feed on native tussock grasses. Females are short-winged and flightless, indicating limited dispersal ability and a strong association with suitable local tussock habitat.	Endemic to the drier inland South Island, with a localised distribution in the Mackenzie Basin and Central Otago. One male was recorded in Golden Bar WRS in May 2022. Targeted follow-up surveys at Golden Bar and wider OGL Macraes landholdings did not detect further individuals.
<i>Agrotis admirationis</i>	At Risk – Declining	Its host plant is unknown and is likely polyphagous. Patrick <i>et al.</i> (2011) mention it feeds on herbs in open areas.	One individual collected at Coronation and one record from Redbank Covenant. This species has a patchy distribution throughout both the North and South Islands.
<i>Asaphodes recta</i>	At Risk – Declining	Associated with tussockland and wetted boglands. Larval host plants include <i>Ranunculus</i> , <i>Senecio</i> , and <i>Bellis</i> (Patrick 2000).	Two individuals caught day-flying over wetted areas in MEEA (other individuals observed); and one individual collected at light at Coronation. This species has been found in Canterbury, Otago, and Southland.
<i>Dasyuris partheniata</i>	At Risk – Declining	Moth associated with speargrass, including <i>Aciphylla subflabellata</i> . Suitable habitat is likely to include dryland short grassland, snow tussock grassland and open vegetation where speargrass occurs.	Recorded historically from Coronation, based on a larva found on speargrass approximately 550 m south-west of the Coronation spillway in August 2014. It was not detected during MP4 surveys, but suitable host plant habitat occurs in parts of the Project area.
<i>Nyctemera annulata</i>	At Risk – Declining	Day-flying moth associated with host plants including cineraria, groundsel, ragwort and other species in the <i>Senecio</i> group. It can use modified habitats where host plants occur.	Recorded during February to April 2026 surveys at Coronation, Macraes Road Realignment, GPUG, Cranky Jims, Golden Bar, MEEA and Redbank Covenant. Records were generally of single individuals, but the species appears relatively widespread within the OGL Macraes landscape.

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<i>Orthodera novaezealandiae</i>	At Risk – Declining	Native mantid associated with shrubland, rank grassland, dryland vegetation and structurally complex vegetation providing prey, shelter and egg-laying substrates.	An egg case was recorded at GPUG, and live adults were observed at Cranky Jims shrubland and vegetation near the crib rooms on Golden Point Road. The species is likely to occur more widely in shrubland and other vegetated habitats within the wider Project area.
<i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia")	At Risk – Declining	Found in association with native <i>Carmichaelia</i> spp. Has been given a 'Range Restricted' qualifier under the NZTCS recognising its dependence on areas of good quality <i>Carmichaelia</i> shrubland.	Individuals collected from Golden Bar, BRWRS, Cranky Jim's, and Redbank Covenant. Undescribed species with a patchy distribution across both main islands.
<i>Patagoniodes farinaria</i>	At Risk – Declining	Moth associated with host plants including shore groundsel or ragwort. Suitable habitat may include modified grassland, shrubland margins, road margins and other areas supporting host plants.	Recorded in March 2026 from Road Realignment, Golden Bar, BRWRS, Coronation, Cranky Jims, MEEA and Redbank Covenant. Records were generally of single individuals. The species appears relatively widespread within the OGL Macraes landscape.
<i>Samana acutata</i>	At Risk – Declining	Moth associated with <i>Carmichaelia</i> species. Suitable habitat is likely to include shrubland, tussock-shrubland and dryland vegetation supporting native broom species.	Recorded as single individuals at RHIMSPIM, BRWRS, Island Block Covenant and Redbank Covenant. It has not been confirmed within the active MP4 impact footprint but occurs within the surrounding OGL Macraes landscape.
<i>Theoxena scissaria</i>	At Risk – Declining	Larvae unknown; related species (in genus <i>Samana</i>) feed on <i>Carmichaelia</i> . Considered local and rare. It is almost certainly associated with dry shrublands. Female unknown and possibly flightless, limited dispersal and increasing need for conservation.	Single individual caught in moth trap in BRWRS.
<i>Bityla sericea</i>	At Risk – Naturally Uncommon	Moth with an uncertain host plant, possibly associated with <i>Muehlenbeckia</i> species. Suitable habitat may include shrubland, dryland vegetation, tussock-shrubland and vegetated gullies.	Recorded as single individuals at Golden Bar, BRWRS, Murphys Creek and Redbank Covenant during 2025 and 2026 surveys. The species is widespread in Otago but generally not recorded in large numbers.

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<i>Wiseana fuliginea</i>	Data Deficient	Poorly known moth. Available information indicates larval association with pasture or grassland habitats, but the species remains difficult to detect, and its ecology is not well resolved.	Detected by eDNA in a headwater tributary of Māori Hen Creek in the Trimbells WRS area of Coronation Mining Area in March 2026. DNA was present in two of five replicates. The result indicates presence in or upstream of the sampling location but does not confirm local abundance or habitat use.
<i>Wiseana mimica</i>	Data Deficient	Higher-altitude populations appear to be associated with moss/ sedge bogs. Such populations are sympatric with <i>Dioxyzanus fuscus</i> (B.H. Patrick, pers. comm.) (Dugdale 1994). Of economic importance because the penultimate and final-instar larvae compete with stock for spring pasture growth (Barratt <i>et al.</i> 1990) (Dugdale 1994).	Poorly known species. Characteristic of open country east of Fiordland and the Southern Alps. Present at 1,100 m asl on the Lammermoor Range Central Otago and at 1,200 m asl on the Kyeburn (Mt Buster) diggings Central Otago, and a dead specimen was found at 1,700 m on Mt Pisa by B.H. Patrick. Single individual collected in Murphys Creek catchment. It was not detected within MP4 Project impact areas, but adults may occur more widely in the surrounding landscape.
<i>Zelandobius uniramus</i>	Data Deficient	Stonefly associated with freshwater habitats, with flighted adult stages that may occur in adjacent terrestrial or riparian habitats. Included as a conservative component of the terrestrial invertebrate assessment because eDNA detections occurred in the wider landscape.	eDNA was detected at Highlay, Camp Creek, Cranky Jims, Murphys and Coal Creek in March 2026. It was not detected within MP4 Project impact areas, but adults may occur more widely in the surrounding landscape.
<i>Hemiandrus maia</i>	Not Threatened	Abundant in areas of tussock and shrubland, and around rocky features. Also present, but in lower abundance, in exotic grassland areas.	Widespread distribution across Otago and parts of Southland (not Regionally endemic, despite its common name). On OGNZL landholdings, dozens of individuals were captured in live pitfalls traps for lizards in the Murphys Creek area and at Coronation.
<i>Mecodema</i> sp. "Oamaru"	Not listed	Poorly known but recorded in rank exotic grassland/ modified tussock.	Single observation from the Innes Mills area of the Central Mining Area. The specimen was captured during the CCP2 lizard salvage operation and was relocated to Island Block Covenant in accordance with the salvage conditions.

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<i>Orocrambus cf. cyclopicus</i>	Not listed	Poorly known but recorded in tussock habitat. Possibly endemic to inland tussock grasslands (R. Hoare, pers. comm, 2025).	Two individuals recorded at Golden Bar. The status of this new entity remains unclear, with its presence known from two Central Otago sites—Bendigo and Macraes (R. Hoare, pers. comm. 2025). Its apparent absence from Canterbury and Nelson support the assumption that it may be endemic to inland Otago drylands. Work is currently underway by Dr R. Hoare to dissect material from the Mackenzie Basin to further elucidate the range of this new species.
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4.2.3 Lizards

The Project area supports widespread and locally abundant indigenous lizard populations. Three indigenous lizard species have been confirmed within the MP4 impact areas: McCann's skink (*Oligosoma maccanni*), southern grass skink (*Oligosoma chionocholes*) and kōrero gecko (*Woodworthia "Otago/Southland large"*). McCann's skink is classified as 'Not Threatened' nationally and regionally. Southern grass skink and kōrero gecko are classified as 'At Risk – Declining' nationally and 'At Risk - Regionally Declining' in Otago (Jarvie *et al.* 2025; Hitchmough *et al.* 2026).

Lizard habitat occurs across a range of vegetation and land-cover types, including rock outcrops, tussock grassland, shrubland, exotic grassland, felled pine, riparian margins, ephemeral wetlands, wetland margins and some disturbed mine-edge habitats. Rock outcrops, tussock grassland, shrubland and dense grassland provide the highest habitat value. Kōrero geckos are strongly associated with schist rock outcrops, rock piles and rocky hillslopes, while southern grass skinks are most commonly associated with dense grass, tussock, damp gullies and wetland margins. McCann's skinks are widespread and occur across a broader range of habitats, including modified grassland, road margins and disturbed rocky substrates.

No Otago skink, grand skink, Otago green skink, herbfield skink or jewelled gecko populations were confirmed within areas proposed for direct disturbance under MP4 (Table 4-5). Otago skinks were confirmed at Murphys Creek, outside the MP4 impact footprint, during surveys of potential mitigation areas. A possible Otago green skink observation was made at Camp Creek, which is already consented and thus only subject to Wildlife Act considerations (see LMMP; Bioresearches 2026j). These records are important in the wider Macraes landscape context but are not relevant to the directly affected MP4 footprint areas.

Population estimates indicate that the MP4 impact areas support a large lizard population. The lizard values assessment estimates approximately 155,600 lizards within the total impact area, excluding GPUG and BRWRS, comprising approximately 62,000 McCann's skinks, 88,000 southern grass skinks and 6,000 kōrero geckos (Bioresearches 2026c). These estimates are indicative only and are subject to uncertainty because they rely on density extrapolation across habitat types and because of uncertainty surrounding density estimates for kōrero geckos.

Table 4-5. Indigenous lizard species recorded or considered in the MP4 lizard values assessment.

Species	Regional threat status	National threat status	Areas recorded	Key habitats and findings	Likely presence in MP4 impact area
McCann's skink, <i>Oligosoma maccanni</i>	Regionally Not Threatened	Not Threatened	Confirmed in all MP4 Project areas surveyed, including Coronation, Golden Point Underground, Central Mining Area, Golden Bar Haul Road, Golden Bar, BRWRS, Camp Creek, Coal Creek and Murphys Creek. Expected at Frasers West French Drain.	The most widespread and abundant lizard species recorded. Occurs across a broad range of habitats, including rock outcrops, tussock grassland, shrubland, exotic grassland, riparian margins, ephemeral wetland margins, road margins, haul road windrows and disturbed rocky substrates. It is relatively tolerant of modified habitats where suitable cover, basking sites, and refuges are present.	Confirmed – recorded in all MP4 impact areas.
Southern grass skink, <i>Oligosoma chionochloescens</i>	At Risk – Regionally Declining	At Risk – Declining	Confirmed in Coronation, Golden Point Underground, Central Mining Area, Golden Bar Haul Road, Golden Bar, BRWRS, Camp Creek, Coal Creek and Murphys Creek. Expected at Frasers West French Drain.	Common and locally abundant in dense grassland, rank exotic grass, tussock grassland, damp gullies, wetland margins, seepages and riparian margins. Also recorded from rocky habitat and shrubland. This species accounts for the largest estimated proportion of the lizard population within the MP4 direct impact area.	Confirmed – recorded in all MP4 impact areas.
Kōrero gecko, <i>Woodworthia</i> "Otago/Southland large"	At Risk – Regionally Declining	At Risk – Declining	Confirmed in Coronation, Golden Point Underground, Golden Bar, BRWRS, Camp Creek, Coal Creek and Murphys Creek. Not confirmed within the Central Mining Area, Frasers West French Drain, or Golden Bar Haul Road footprints, but is present in rocky habitat within surrounding 20 m and 80 m buffers.	Strongly associated with schist rock outcrops, rock tors, rock piles, talus, rocky hillslopes and creviced rock habitat. Also likely to use tussock, shrubland and dense vegetation for dispersal between rock features. Locally abundant where suitable rock habitat is present, particularly at Golden Point Underground, and areas outside of the MP4 impact area (BRWRS and parts of the wider Deepdell and Murphys Creek landscapes).	Confirmed – recorded in all MP4 impact areas where rocky habitat was available, except for Central Mining area.

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Species	Regional threat status	National threat status	Areas recorded	Key habitats and findings	Likely presence in MP4 impact area
Otago skink, <i>Oligosoma otagense</i>	Threatened – Regionally Endangered	Threatened – Nationally Increasing	Confirmed in Murphys Creek, outside the MP4 direct impact footprint. Historical or indirect evidence is also present in the wider OGNZL Macraes landscape, including mummified remains from the Coronation North 5 salvage.	Large-bodied, rock-dwelling skink associated with deeply creviced schist outcrops, bluffs, and adjacent indigenous vegetation. The Murphys Creek population is a remnant population occupying high-quality rocky gully habitat and is relevant to the Project due to its presences in the proposed MEEA compensation area. No live or dead Otago skinks have been recorded within the MP4 direct impact area despite targeted surveys of suitable habitat.	Highly unlikely due to the absence of large and suitable rock outcrop habitat required by this species and lack of detection during extensive surveys.
Grand skink, <i>Oligosoma grande</i>	Threatened – Regionally Endangered	Threatened – Nationally Increasing	Not confirmed within MP4 direct impact areas. Recorded from the wider OGL Macraes landholdings at Redbank Ecological Covenant and may be present in more remote and rugged habitats within wider landscape, outside of the MP4 Project footprint.	Large-bodied, rock-dwelling skink associated with warm, deeply creviced schist outcrops and adjacent indigenous vegetation. Despite targeted surveys of suitable rocky habitats, the species has not been recorded within the MP4 direct impact area. While its occurrence in isolated areas of high-quality habitat elsewhere within the wider landscape cannot be entirely ruled out, there is no evidence to indicate that grand skinks occur within the MP4 footprint.	Highly unlikely due to the absence of suitable rock outcrop habitat preferred by this species and lack of detection during extensive surveys.
Otago green skink, <i>Oligosoma aff. chloronoton</i> “eastern Otago”	At Risk – Regionally Declining	At Risk – Declining	Not confirmed within MP4 direct impact areas. A possible individual was observed at Camp Creek in 2026 (Bioresearches 2026c), and other potential records occur outside the MP4 footprint in the wider landscape (e.g., Deepdell Ecology Covenant; M. Tocher, pers. comm.).	Associated with well-vegetated open habitats, including tussock grassland, shrubland, wetlands, damp gullies, loose rock and dense herbaceous vegetation. Follow-up surveys at Camp Creek did not confirm species presence (Bioresearches 2026c). Accordingly, this species	Unlikely due to lack of detection during extensive surveys, general scarcity in the wider surrounding

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Species	Regional threat status	National threat status	Areas recorded	Key habitats and findings	Likely presence in MP4 impact area
				is not considered to be present in the MP4 impact area, but its potential presence remains relevant to Wildlife Act considerations for the existing consented Camp Creek area (see LMMP; Bioresearches 2026j).	landscape, and marginal quality habitat for this species within the impact footprint.
Herbfield skink, <i>Oligosoma murihiku</i>	At Risk – Regionally Declining	At Risk – Declining	Not confirmed within MP4 Project areas. Very few historical (2013) records from the wider OGNZL Macraes landholdings on covenant land, including Highlay Creek Covenant and Deepdell Station Covenant (Bioresearches 2026c).	Associated with tussock grassland, herbfields, scrub, wetland margins, seepages, flushes, and dense low vegetation. The species is rare and highly cryptic within the Macraes landscape and was not detected within the MP4 impact area despite extensive survey effort. Accordingly, it is not considered to be present for the purpose of this assessment. However, recognising its low detectability and potential occurrence within dense grassland and wetland-margin habitats, precautionary provision has been made within the LMMP (Bioresearches 2026c) to address the possibility of incidental encounters during Project activities.	Unlikely due to lack of detection during extensive surveys, general scarcity in the wider surrounding landscape, and marginal quality habitat for this species within the impact footprint.
Jewelled gecko, <i>Naultinus gemmeus</i>	At Risk – Regionally Declining	At Risk – Declining	Not recorded within the MP4 Project area or on OGNZL Macraes landholdings. Although the species has been recorded within approximately 20 km of the Project area, all known records occur outside the Macraes ED, within the neighbouring Waianakarua ED to the northeast.	Primarily arboreal and associated with shrubland, forest, dense woody vegetation and, in some inland Otago contexts, tussock grassland. Extensive surveys have not detected the species on OGNZL Macraes landholdings. Consequently, the likelihood of occurrence within the Project area is considered nil.	Highly unlikely due to lack of detection during extensive surveys, general absence in the wider surrounding landscape, and

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Species	Regional threat status	National threat status	Areas recorded	Key habitats and findings	Likely presence in MP4 impact area
					marginal quality habitat for this species within the impact footprint.

4.2.4 Avifauna

The Project area supports an avifauna assemblage typical of modified inland pastoral and mining environments in Central Otago. Habitats used by birds include exotic grassland, short pasture, mine-disturbed land, rehabilitated mine landforms, haul roads, road margins, sparsely vegetated ground, tussock grassland, shrubland, wetland margins, riparian margins, ponds and pit lakes. The assemblage is dominated numerically by introduced passerines and widespread indigenous open-country species, but several indigenous species of elevated conservation status have been confirmed within the Project Footprint or wider Project area.

The desktop assessment identified 53 bird species within a 10 km buffer of the MP4 footprint, including 33 indigenous species. Field surveys confirmed 31 bird species present within the Project Footprint or immediate vicinity, with an additional 16 species considered likely and six species considered unlikely based on habitat availability and survey results. Survey methods included five-minute bird counts, passive acoustic monitoring, targeted eastern falcon surveys, waterfowl pond counts, targeted fernbird playback surveys and incidental observations.

The key indigenous species of elevated ecological value confirmed within the Project Footprint or wider Project area are kārearea | eastern falcon, banded dotterel | pohowera, New Zealand pipit | pīhoihoi, South Island pied oystercatcher | tōrea, black shag | kōau, fernbird | mātātā and silvereye | tauhou. These species are the principal drivers of avifauna value within the MP4 assessment. Black-fronted dotterel was detected acoustically at low frequency, but because detections were not supported by desktop records or visual confirmation, it is treated as possibly present on a transient basis rather than as a confirmed resident or regularly occurring species.

Fernbird were not detected during targeted playback surveys but were detected at low frequency during passive acoustic monitoring. Anecdotal observations were also recorded in March 2026 from wetland habitats in the wider Macraes landscape. Current evidence indicates intermittent or transient use rather than confirmed resident occupancy within the MP4 impact area. Fernbird values are therefore associated with localised wetland, riparian and dense shrubland habitat, rather than broad use of the Project Footprint.

Overall, avifauna habitat value within the MP4 footprint is assessed as Moderate. Habitat values are Moderate at Coronation Mining Area, Central Mining Area, Golden Bar, BRWRS and the Murphys Ecological Enhancement Area, and Low at the Golden Bar Haul Road. Moderate values are driven primarily by repeated detection of open-country Threatened and At Risk species, particularly banded dotterel, South Island pied oystercatcher and New Zealand pipit, together with use of the wider landscape by kārearea. Black shag values are associated with ponds, pit lakes and riparian habitats, while silvereye values are associated with shrubland, gullies, scrub and woody vegetation.

Table 4-6 summarises indigenous avifauna species of elevated ecological value recorded or considered in the MP4 Avifauna Values Assessment.

Table 4-6. Indigenous avifauna species of elevated ecological value recorded or considered in the MP4 avifauna values assessment.

Species	Regional threat status	National threat status	Areas recorded	Key habitats and findings
Kārearea / eastern falcon, <i>Falco novaeseelandiae novaeseelandiae</i>	Regionally Vulnerable	Threatened - Nationally Vulnerable	Confirmed within the wider MP4 survey area through incidental observations and autumn five-minute bird counts. Records include Central Mining, GPUG, Camp Creek, Cranky Jims, MEEA, Coronation and the Golden Bar lizard salvage area.	Highly mobile raptor using the wider Macraes landscape for foraging, perching and movement. The MP4 footprint provides open-country foraging habitat within a broader territory-scale habitat mosaic. No active nest was identified within the impact footprint, but nesting habitat occurs within the wider landscape, and seasonal nest management remains required if birds are detected near works during the breeding season.
Banded dotterel / pohowera, <i>Charadrius bicinctus</i>	Regionally Vulnerable	At Risk - Declining	Confirmed within the Project area by passive acoustic monitoring and incidental observations. Key detections occurred at Coronation Mining Area and the Central Mining Area, including rehabilitated waste rock stacks and backfill habitats.	Ground-nesting open-country species associated with sparsely vegetated ground, gravel surfaces, short pasture, rehabilitated mine surfaces, road margins and disturbed substrates. Acoustic detections and incidental records indicate regular use of some open mine-modified habitats, including likely seasonal breeding use in low numbers.
South Island pied oystercatcher / tōrea, <i>Haematopus finschi</i>	Regionally Vulnerable	At Risk - Declining	Recorded widely across MP4 survey areas, including Coronation Mining Area, Frasers / Innes Mills, Golden Bar, BRWRS, Camp Creek, Coal Creek and MEEA.	Open-country and wet-margin species using short pasture, sparsely vegetated ground, road margins, open mine-modified habitats and wet margins for foraging, movement and potential breeding. It was one of the most frequently recorded TAR species,

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				including a group of 21 birds foraging on short sward habitat at Golden Bar.
Black shag / māpunga, <i>Phalacrocorax carbo</i>	Regionally Endangered	At Risk - Relict	Not confirmed within project footprint. Recorded in locations with aquatic habitats, including Coronation and Camp Creek. May potentially use Golden Bar pit pond and other open-water habitats but not observed.	Water-associated species using ponds, pit lakes, reservoirs and riparian habitats for foraging and loafing. No breeding colonies were identified within the Project footprint. Site value is therefore associated with localised foraging or loafing habitat rather than breeding habitat.
New Zealand pipit / pīhoihoi, <i>Anthus novaeseelandiae</i>	Regionally Not Threatened	At Risk - Declining	Confirmed within Coronation Mining Area, Frasers / Innes Mills, BRWRS, Coal Creek and open habitats elsewhere in the wider Project area.	Open-country species associated with tussock grassland, pasture, sparsely vegetated ground, rehabilitated mine landforms, road margins and disturbed substrates. The species may breed within suitable open habitats in the Project area, although nests are cryptic and difficult to confirm directly.
Silvereye / tauhou, <i>Zosterops lateralis</i>	Regionally Declining	Not Threatened	Recorded widely across MP4 survey areas, including Coronation Mining Area, Frasers / Innes Mills, Golden Bar, BRWRS, Camp Creek, Coal Creek and MEEA.	Mobile passerine associated with shrubland, scrub, woody vegetation, gullies, pine margins and modified habitats. It is widespread within the Project area and surrounding landscape but is more strongly associated with gullies and shrubland than open grassland.
Black-fronted dotterel, <i>Charadrius melanops</i>	Regional Vagrant	At Risk - Naturally Uncommon	Detected acoustically at low frequency at MEEA, Coal Creek, Coronation Mining Area Backfill and Frasers West WRS. Not confirmed by visual observation or desktop records within the footprint.	Acoustic detections may represent either brief transient use during dispersal or misclassification of similar banded dotterel calls. The species is not treated as a confirmed resident within the MP4

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				footprint but is acknowledged as possibly present on a transient basis.
Fernbird / māātātā, <i>Poodytes punctatus</i>	Regionally Declining	At Risk - Declining	Not detected during 17 targeted playback surveys undertaken between 1 and 29 April 2026. Two calls were detected at one location in CMA during autumn PAM surveys. Anecdotal observations were recorded on 13 and 14 March 2026 from wetland habitats associated with the BRWRS / GPUG extension area, but outside the project footprint.	Cryptic wetland and dense riparian species associated with dense sedgeland, rushland, wet shrubland and vegetated seepage habitats. Most surveyed sites within the Project footprint were marginal or unsuitable. The species may occur intermittently in isolated suitable wetland habitats in the wider Macraes landscape, but is considered unlikely to be present within the MP4 impacted areas.
Other indigenous bird species confirmed present	Mostly Regionally Not Threatened	Mostly Not Threatened	Confirmed across the Project area. Species include swamp harrier, white-faced heron, grey warbler, kererū, pied stilt, welcome swallow, southern black-backed gull, pūkeko, tūi, South Island fantail, Australasian shoveler, paradise shelduck, sacred kingfisher, spur-winged plover, grey teal and New Zealand scaup.	These species are typical of open-country, wetland-margin, pond, shrubland and modified pastoral environments. Most are widespread and regionally common. They contribute to local avifauna diversity but are assigned Low ecological value at the species level under the EIANZ framework.

4.2.5 Bats

A targeted bat / pekapeka assessment was undertaken for the Project area and surrounding landscape. The assessment considered both long-tailed bat (*Chalinolobus tuberculatus*) and southern lesser short-tailed bat (*Mystacina tuberculata tuberculata*), using a desktop review, site inspection by a DOC-accredited bat ecologist and a landscape-scale acoustic survey.

Automatic bat monitors were deployed across 27 locations in March 2026 under suitable environmental conditions (Bioresearches 2026e). Survey locations were selected to target habitats considered most likely to support bat activity within the Macraes landscape, including waterways, wetlands, forest edges, potential roost trees, rock tors, gullies and higher-quality habitat within proposed impact and offset areas. No bat calls were recorded during the acoustic survey.

The desktop review found no evidence of known bat populations within or near the MP4 Project area. The closest known long-tailed bat populations are more than 100 km from Macraes, and southern lesser short-tailed bats are only known to persist on the South Island mainland in Fiordland, more than 200 km from the site. The Macraes landscape is also highly deforested, climatically exposed and lacks the old-growth indigenous forest habitat required by short-tailed bats.

While long-tailed bats can use modified rural landscapes elsewhere in New Zealand, the combination of no acoustic detections, the absence of nearby known populations, limited roosting habitat, near-total deforestation and unfavourable landscape context provides a high level of confidence that bats are likely absent from the Project area and surrounding landscape.

Given the absence of bat detections and the lack of suitable landscape context for either species, bats are not identified as an ecological component of the MP4 Project. No bat ecological values are carried forward into the effects assessment, and no specific bat management measures are proposed on the basis of the current survey information.

5 Effects assessment methods

The assessment of ecological effects has been undertaken primarily in general accordance with the Environmental Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment Guidelines (EclAG). These guidelines provide a nationally recognised and transparent framework for identifying ecological values, characterising potential effects, and evaluating their magnitude and significance.

While the EclAG provide the primary technical framework for this assessment, they do not replace the need to consider the statutory and policy context relevant to the proposal. Accordingly, ecological effects have been evaluated with reference to both the EIANZ methodology and the applicable legislative, policy, and planning framework. Where relevant, professional judgement has been applied to ensure that conclusions regarding ecological effects, significance, and management responses are consistent with both ecological best practice and the matters that are relevant to decision making under the applicable regulatory framework.

This section focuses on assessing project-related effects on terrestrial and wetland ecological values, based upon the activities associated with the proposed works. The magnitude of these ecological effects and the consequent level of effects of each of these activities is described in the below sections.

5.1 Step 1: Assigning ecological value

This aspect is covered in values assessments (documents E2 E5, Table 2-2.), with values summarised in Section 4.

5.2 Step 2: Assessing the magnitude of effects

The magnitude of an effect is a measure of the extent or degree of change that would occur to a value because of an activity. It requires consideration of the timescale and permanence of the effect, whereby temporary (< 25 years), long-term (substantial improvement after 25 years) and permanent (beyond the span of a human generation) effects are considered.

The magnitude of habitat loss was informed by ecosystem extent information at both the Macraes' ED and local OGNZL landholdings scales. The ED provides important landscape context, consistent with the NPS-IB, for assessing significant ecological values. However, the OGNZL landholdings scale was generally adopted as the primary basis for assessing proportional loss and magnitude of effect because it reflects site-specific mapping refined through aerial imagery and ground-truthing. This approach is also precautionary, as it generally produces higher proportional loss estimates than assessment at the broader ED scale.

5.2.1 Scale used for magnitude of effects on TAR flora

An exception was made for TAR plant species, for which the pre-management magnitude of effect was assessed at the Macraes' ED scale because available information on species occurrence and distribution across the surrounding OGNZL landholdings was insufficient to support a reliable local-scale assessment. The post-management magnitude was then assigned with reference to the anticipated effectiveness of the proposed salvage, propagation, translocation and planting measures,

together with the level of confidence that those measures would achieve the intended ecological outcome. Where confidence in management success was High, the magnitude was reduced by one category. Where confidence was Moderate or Low, no reduction was applied. The residual level of effect was subsequently determined by combining the post-management magnitude with the ecological value assigned to each species.

5.2.2 Scale and extent of ecological loss

While there is no universally accepted percentage threshold that automatically defines a magnitude of loss as negligible, low, moderate, high, or very high (the EclAG approach avoids fixed percentages because magnitude depends on both the proportion lost and the ecological context, value, rarity, condition, and functionality of the affected feature), this assessment applies the criteria in Table 5-1 for indigenous terrestrial ecosystems and habitats. Additionally, it is noted that proportional loss can also minimise large-scale effects, where an ecosystem type/habitat is widespread. As such, consideration to areal loss (ha) is also analysed in consideration of magnitude. Note that where the proportional loss and areal loss differ, the higher of the two magnitudes is used as a more conservative measure.

Table 5-1. Criteria for assigning the magnitude of an effect. Note that the higher magnitude of proportional loss (column 1) and areal loss (column 2) are applied to effects assessments as a precautionary approach.

Proportional loss (%)	Areal loss (ha)	Magnitude	Description
<1%	< 1 ha	Negligible	Loss of the habitat/resource and no measurable reduction in ecological function.
1-5%	1 – 5 ha	Low	Ecological function largely maintained
5-20%	5 – 20 ha	Moderate	Noticeable reduction in habitat extent or function but viability maintained.
20-50%	20 – 100 ha	High	Substantial reduction in extent, connectivity, or ecological integrity.
>50%	>100 ha	Very High	Major alteration or loss of ecological function, viability, or representation.

Professional judgement has been applied to these thresholds to ensure that conclusions regarding ecological effects, significance, and management responses are consistent with both ecological best practice and ensure that a precautionary approach is presented. Therefore, these thresholds are adjusted upward or downward depending on:

- Ecological value (Very High, High, Moderate, etc.)
- Threat status of the ecosystem or species
- Fragmentation and connectivity effects
- ED context

- Whether the habitat is regionally representative or rare
- Whether the loss affects core habitat or peripheral habitat

5.2.3 Mapping Ecological features beyond the Impact area

The extent of ecological features beyond the ZOI is necessary to assess magnitude. The extent of indigenous vegetation and habitat types within OGNZL landholdings was determined through a combination of desktop mapping, aerial imagery interpretation, and field verification. Existing spatial datasets, including (LCDB6)², Otago Regional Council ecosystem mapping, and other available vegetation layers, were reviewed against recent high-resolution aerial photography and drone imagery. Habitat boundaries and classifications were subsequently refined through ecological field surveys and targeted ground-truthing undertaken between 2022 and 2026. This process identified areas where existing database layers either overestimated or underestimated the extent of indigenous habitats, resulting in both contraction and expansion of mapped ecosystem boundaries. The resulting habitat mapping is therefore considered more accurate and reliable than regional-scale database layers alone and was adopted as the primary basis for assessing proportional habitat loss and magnitude of effect.

The mapping was undertaken primarily to support ecological impact assessment and identify opportunities for avoidance, mitigation, offsetting, and compensation associated with MP4, rather than to produce a comprehensive inventory of all indigenous habitats across the approximately 13,063 ha of OGNZL landholdings. Consequently, mapping effort was focused on the Project footprint, surrounding assessment areas, and potential ecological management sites. While substantial areas of OGNZL landholdings were reviewed, some areas received a lower level of assessment, and it is possible that occurrences or extensions of some ecosystem types remain unmapped. Any such underestimation would result in a corresponding overestimation of the proportion of habitat affected by the Project and is therefore considered a precautionary basis for assessing magnitude of effect.

²<https://iris.scinfo.org.nz/layer/123148-lcdb-v60-land-cover-database-version-60-mainland-new-zealand/attachments/22464/>

5.3 Step 3: Assessing the level of effects

The **level** of an effect describes the overall severity of an effect, by combining the ecological values with the magnitude of the effect, as described in the matrix, Table 5-2.

Table 5-2. Criteria for describing the level of effects (EIANZ 2018). Where text is italicised, it indicates ‘more than minor effects’ where mitigation is required.

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

The EclAG specifies that:

- The ‘Level of Effect’ is used to guide the extent and nature of measures to demonstrably offset and/or compensate for residual effects.
- Offsetting or compensation measures are considered necessary where the level of effects is assessed as ‘Moderate’ or higher.

6 Assessment of Ecological Effects

6.1 Limitations and Constraints

Ecological investigations for the Project were undertaken over multiple years and incorporated a range of desktop, field-based and targeted surveys. Nevertheless, several limitations are acknowledged.

6.1.1 Wetlands

Wetland assessments were undertaken using field surveys, vegetation mapping, desktop information, and available hydrological and ecological data; however, several limitations are acknowledged. Wetland vegetation surveys were undertaken during the summer growing season, when some hydric and seasonally expressed wetland species may be less readily detectable. In addition, the assessment relied on a finite number of vegetation plots to characterise a range of wetland types and wetland mosaics across the Project Area, and some uncertainty remains regarding the extent, classification and condition and classification of a small number of wetland features. Assessment of indirect effects on wetlands, particularly those associated with groundwater drawdown, dewatering, drainage and altered surface-water inputs, was based on the best available hydrological information available at the time of assessment and remains subject to refinement through ongoing hydrological investigations and monitoring.

6.1.2 Terrestrial vegetation and flora

Terrestrial flora assessments were based on a combination of desktop investigations, vegetation mapping, walk-through botanical surveys, targeted threatened plant surveys, vegetation plots, and previous ecological investigations undertaken within the Macraes' ED. While survey effort was substantial and undertaken over multiple years, no botanical survey can guarantee detection of all species present. Rare, cryptic, seasonal, or non-flowering species may remain undetected, and surveys did not encompass the full seasonal range of plant expression, meaning some spring-flowering species may have been overlooked.

The wider landscape outside the mining footprints was not systematically surveyed, resulting in lower confidence regarding the regional distribution and ecological context of some vegetation communities and threatened plant populations. Small vegetation occurrences may not be represented at the mapping scale used, and some vegetation boundaries were derived through interpretation of aerial imagery and subsequent ground-truthing. Information sourced from previous investigations undertaken by other organisations could not always be independently verified for completeness or accuracy. Inter-annual variation in plant abundance, particularly for annual species and ephemeral wetland flora, is also not fully captured by the available survey data.

Flora surveys were focused primarily on vascular plant species and did not extend to comprehensive inventories of bryophytes, lichens, liverworts, or other non-vascular flora. This approach is consistent with standard practice for large-scale ecological impact assessments in New Zealand, where vascular plants generally provide the primary basis for vegetation classification, ecological significance assessments, ecological value assessments, and effects quantification. Additionally, comprehensive assessment of non-vascular flora is often constrained by the high diversity of taxa, taxonomic complexity, seasonal variability, and the limited availability of specialist expertise. Many species are

small, cryptic, and require microscopic or laboratory examination for reliable identification. While bryophyte and lichen species are likely to occur within the Project area, the habitats present are generally widespread within the wider Macraes landscape and no locations supporting known nationally significant bryophyte or lichen assemblages were identified during field investigations. Consequently, the omission of these groups is not considered likely to materially affect the overall conclusions regarding vegetation composition, ecological significance, ecological value, or the assessment of potential effects on terrestrial flora.

A precautionary approach has therefore been applied throughout the assessment (Section 6.2), with ecological values, threatened plant distributions, and habitat extents assessed conservatively where uncertainty exists.

Information relating to TAR plant species relied partly on previous survey records and specialist local botanical knowledge, with most targeted field investigations undertaken during summer and autumn seasons.

6.1.3 Avifauna

Avifauna assessments were designed to characterise species presence, habitat use and ecological values rather than to estimate population size. Consequently, no formal bird population estimates were undertaken. Bird assessments relied principally on acoustic monitoring undertaken during one breeding season and one non-breeding season, supplemented by five-minute bird counts and opportunistic observations collected during other ecological fieldwork.

Targeted surveys for waterfowl and māātātā/fernbird were undertaken during a single non-breeding season only. In addition, no vantage point surveys were completed, meaning the assessment of bird movements, flight paths and use of airspace relied on acoustic survey data, field observations and professional judgement.

Some species, particularly highly mobile, cryptic, nocturnal, or irregularly occurring species, may not have been detected during surveys despite being present intermittently (e.g. kereru, ruru). Breeding activity can also vary between years, and the distribution of nests and territories may change over time. Consequently, the absence of records for a species or breeding attempt during surveys should not be interpreted as evidence of permanent absence from a particular area

6.1.4 Lizards

Lizard assessments were informed by a substantial body of field investigations undertaken between 2022 and 2026, including systematic visual encounter surveys, rock scanning, habitat searches, aerial drone surveys, tracking tunnels, artificial cover objects, CritterPic monitoring, Gee's minnow trapping, and baseline pitfall trapping, representing over 515 person-hours of active searching and more than 2,000 pitfall trap days.

Despite this considerable survey effort, no survey programme can guarantee detection of all lizard species or individuals present. Lizard detectability is inherently influenced by weather conditions, season, time of day, reproductive status, habitat structure, and species-specific behaviour, with some species occurring at very low densities or occupying cryptic refuges that are difficult to survey effectively. Surveys were undertaken across multiple years and seasons; however, not all habitats

could be surveyed under optimal conditions at all times, and some areas of suitable habitat remain unsurveyed or only partially surveyed.

Consequently, the absence of records for a species should not necessarily be interpreted as evidence of true absence. However, for the larger or more habitat-specific species such as Otago green skink, Otago skink, grand skink, and herbfield skink, a combination of high survey effort and absence or very limited extent of suitable habitat suggests presence in the impact footprint is highly unlikely (Table 4-5). Notwithstanding, the assessment adopts a precautionary approach whereby suitable habitat is assumed to have the potential to support species known from the wider Macraes landscape unless sufficient evidence exists to conclude otherwise.

Population estimates were derived through extrapolation of density estimates obtained from N-mixture modelling, capture-mark-recapture analyses, historical monitoring, and salvage operations undertaken elsewhere within the Macraes operation. These methods necessarily assume that observed densities are representative of broader habitat areas; however, lizard populations are often patchily distributed and may vary substantially between sites and habitat types.

The assessment acknowledges that actual lizard densities may be considerably higher than estimated in some locations, with recent salvage operations recording densities substantially greater than those predicted by baseline monitoring. Accordingly, population estimates are intended to generally inform the assessment of ecological values, potential effects, and mitigation requirements, rather than to represent precise counts of individuals present within the Project area.

6.1.5 Invertebrates

Many invertebrate taxonomic groups remain poorly known in New Zealand, and comprehensive inventories are generally impractical within the scope of ecological impact assessments. Survey effort, therefore, focused on habitats and taxa considered most likely to support indigenous biodiversity values, including TAR or other notable species. Consequently, some taxonomic groups, particularly diverse groups such as beetles (Coleoptera), flies (Diptera), wasps and ants (Hymenoptera), were not comprehensively surveyed. These groups often contain numerous undescribed or poorly understood species, require specialist taxonomic expertise for identification, and may require targeted collection methods and seasonal survey timing beyond the scope of the assessment. As a result, the composition and distribution of some invertebrate communities within the Project Area may not be fully characterised.

6.2 Precautionary Approach

In recognition of these limitations, ecological values were assessed using conservative assumptions, including reliance on historical records where necessary, specialist local knowledge, habitat suitability assessments, and precautionary buffers around potential impact areas. Where uncertainty existed regarding the presence or extent of ecological values, the assessment generally adopted a precautionary assumption that values may be present unless sufficient evidence indicated otherwise.

6.2.1 Wetlands

Where uncertainty existed regarding wetland extent or classification, areas were conservatively treated as wetlands for the purposes of impact assessment. Wetland loss calculations included areas

where wetland function may be compromised, including some adjacent wetland margins and buffers, and uncertain wetland areas were retained within impact calculations to avoid underestimating effects. Potential indirect hydrological effects were assessed conservatively, recognising the sensitivity of wetland ecosystems to changes in groundwater and surface-water inputs.

The values assessment and wetland vegetation plots (Whirika, 2026) refer to “riparian” and “wetland” ecosystems of the same vegetation community (i.e. “Riparian – sedgeland” and “Wetland – sedgeland”). No distinction between these two vegetation types has been made and the vegetation communities described simultaneously and located within similar placements in the landscape. These riparian areas have been incorporated into the overall wetland extent due to similarities in vegetation communities.

Collectively, these measures ensure that the assessment is more likely to overestimate rather than underestimate potential effects on wetlands and provides a robust basis for effects management, monitoring and compensation planning.

6.2.2 Terrestrial Vegetation and Flora

A precautionary approach has been applied throughout the terrestrial vegetation and flora assessment to ensure ecological values and potential effects are not underestimated where uncertainty exists. This approach recognises the inherent limitations associated with ecological surveys, including imperfect species detectability, seasonal variation in vegetation expression, mapping scale constraints, and uncertainty regarding the distribution and abundance of uncommon species and communities.

Ecological values have generally been assessed conservatively. Where uncertainty exists regarding vegetation condition, ecological significance, community classification, or species presence, classifications and value assessments have typically favoured the higher ecological value outcome. Vegetation communities were assessed not only on their current condition, but also on their contribution to landscape-scale ecological patterns, indigenous biodiversity values, habitat functions, restoration potential, and their role in supporting indigenous fauna. Similarly, the highest applicable threat ranking has been adopted where species hold different regional and national threat classifications.

The assessment also recognises that rare, cryptic, seasonal, or otherwise difficult-to-detect plant species may remain undetected despite substantial survey effort. Accordingly, targeted threatened plant assessments have incorporated historical records, previous survey information, specialist botanical knowledge, habitat suitability assessments, and ecological inference in addition to contemporary field observations. Suitable habitat for TAR plant species has therefore been considered in the assessment even where current surveys did not confirm occupancy.

Vegetation loss assessments have likewise incorporated conservative assumptions. Direct loss calculations have generally been based on the full extent of mapped vegetation affected by Project activities, and for residual effects modelling an additional 20 m buffer has been included around areas of direct disturbance for indigenous vegetation, lizard habitat and invertebrate habitat. This approach assumes potential direct or indirect loss of ecological values within these areas despite vegetation plot data indicating that values within portions of the buffer are unlikely to be directly affected. The additional buffer recognises uncertainty associated with final works design, edge effects, construction disturbance, accidental encroachment, and potential degradation of adjacent retained habitats.

A precautionary approach has also been adopted where uncertainty exists regarding habitat function and biodiversity values. Modified indigenous vegetation, regenerating vegetation, habitat linkages, and vegetation communities supporting indigenous fauna have been recognised for their ecological contribution, even where vegetation condition may be reduced relative to less modified reference sites. This is consistent with the broader ecological assessment approach; whereby potential fauna habitat is assumed to provide ecological function unless sufficient evidence exists to conclude otherwise.

The residual effects assessment and offset modelling further incorporate conservative assumptions regarding habitat extent, habitat condition, restoration trajectories, time lags, uncertainty factors, and expected ecological gains. Similar precautionary assumptions have been applied across wetland, lizard, and terrestrial vegetation assessments, including the treatment of uncertain habitat areas as ecological habitat, the use of conservative confidence factors, and the adoption of reasonable worst-case assumptions where ecological outcomes cannot be predicted with certainty. Collectively, these measures are intended to ensure that ecological values, potential effects, and offset or compensation requirements are more likely to be overestimated than underestimated, providing a robust basis for ecological management, restoration, offsetting, and compensation planning.

6.2.3 Avifauna

In recognition of the limitations associated with bird detectability and temporal variability in habitat use, suitable habitat has generally been assumed to provide ecological function for indigenous bird species unless sufficient evidence exists to indicate otherwise. Habitat assessments have therefore considered the potential use of habitats by species known from the wider Macraes landscape, including species that were not recorded during all survey periods.

Where uncertainty exists regarding species presence, breeding activity, habitat use, or movement patterns, assessments have generally favoured the more conservative interpretation. Potential breeding habitat, foraging habitat, roosting habitat, and movement corridors have been recognised where habitat characteristics indicate these functions may occur, irrespective of whether direct evidence was recorded during surveys. Similarly, TAR species known from the wider locality have been considered in the assessment where suitable habitat is present.

The assessment of effects also incorporates precautionary assumptions. Potential effects have generally been assessed on the basis that indigenous bird species may utilise all suitable habitat affected by the Project, rather than limiting assessments solely to locations where birds were detected during surveys. In the absence of formal population estimates and vantage point surveys, assessments of disturbance effects, habitat loss, displacement, and movement-related effects have adopted conservative assumptions regarding habitat use and species occurrence. Mitigation, habitat management, restoration, and monitoring measures have similarly been developed conservatively to ensure that actual effects are unlikely to exceed those predicted. Collectively, these measures ensure that avifauna values and potential effects are more likely to be overestimated than underestimated, providing a robust basis for ecological management and effects mitigation.

6.2.4 Lizards

The assessment of effects similarly incorporates precautionary assumptions. Potential direct mortality, habitat loss, habitat fragmentation, and displacement effects have been assessed on the basis that

lizards may occupy all suitable habitat affected by the Project, irrespective of whether individuals have been detected within every area proposed for disturbance. As a result, the predicted magnitude of effects is likely to represent a reasonable worst-case scenario for many habitats.

Mitigation and management measures proposed for the Project have likewise been developed conservatively. Salvage effort, receiver site requirements, habitat enhancement, predator control, and long-term monitoring programmes have been designed on the assumption that lizard populations may be larger and more widely distributed than indicated by survey results alone. This approach provides an additional margin of confidence that mitigation outcomes will adequately address actual effects should populations prove larger than currently estimated.

Consequently, the principal uncertainty associated with the assessment is not that lizard values or effects have been underestimated, but rather that the assessment and mitigation framework are intentionally precautionary and may overestimate the extent of lizard occupancy, abundance, and potential effects in some locations.

6.2.5 Invertebrates

The invertebrate assessment places greater emphasis on potential habitats rather than solely on species records. Habitats known to support indigenous invertebrate communities, including indigenous grasslands, shrublands, rock tors, and other relatively unmodified habitats, have been conservatively assumed to support their characteristic invertebrate assemblages unless sufficient evidence exists to indicate otherwise. Potential habitat for TAR or notable invertebrates has been recognised irrespective of whether target species were detected during surveys.

For invertebrate species with known regional or national distributions, the magnitude of effects assessment explicitly considered the extent of those distributions. This approach was adopted because reliable information on population size is unavailable for most species. In the absence of population estimates, geographic distribution provides a useful surrogate for assessing the relative significance of Project effects. Accordingly, habitat loss or mortality affecting species with restricted distributions or small, localised populations was considered proportionately more significant than equivalent impacts on widespread and abundant species, as it is likely to affect a greater proportion of their overall population and available habitat. Conversely, impacts on species with broad distributions were generally assessed as being of lower magnitude, provided there was no evidence that population viability would be compromised.

6.3 Assessment of Ecological Values

6.3.1 Introduction

The Project comprises multiple discrete areas (see section 2.3.2 Impact Assessment Areas) with differing ecological characteristics and levels of modification. Ecological values are therefore assessed at three scales:

- (i) by vegetation and habitat type across the overall Project Area, using the EIANZ value attributes of representativeness, rarity and distinctiveness, diversity and pattern, and ecological context; and
- (ii) by assessment area, to reflect local ecological context and the distribution of effects;
- (iii) for individual Threatened, At Risk, Data Deficient, and locally uncommon species where relevant to the assessment. This recognises that ecological values may be best expressed at site, ecosystem, or species scales.

6.3.2 Overall Project Area terrestrial vegetation and habitats assessment

The ecological value of ecosystem types within the Project area has been assessed using the EIANZ framework, with consideration of representativeness, rarity and distinctiveness, diversity and pattern, and ecological context. The assessment below summarises the ecological values of the main terrestrial, wetland, riparian and modified ecosystem types recorded across the Project areas.

The value assigned to each ecosystem type reflects the highest or most ecologically relevant value recorded across the Project area, rather than an average across all locations. This approach is appropriate because several ecosystem types vary substantially in condition and ecological importance between assessment areas. For example, snow tussock grassland is of Very High value at Coronation Mining Area and Golden Bar, but Low value in more modified areas such as Central Mining and the Golden Bar Haul Road. Similarly, ephemeral wetlands range from Moderate to Very High value depending on condition, hydrological setting, indigenous plant diversity and rare plant habitat.

Overall, the highest ecological values within the Project area are associated with indigenous tussock grassland, rock habitat, ephemeral wetlands, wetland freshwater herbaceous vegetation, wetland seepage and riparian freshwater herbaceous vegetation. These ecosystem types support the principal indigenous vegetation values and provide habitat for Threatened, At Risk, Data Deficient and locally uncommon plant species, as well as indigenous fauna. Lower ecological values are associated with exotic grassland, pine, gorse, woody exotic vegetation, rehabilitated mine workings, roads and mine-disturbed land, although some of these modified habitats provide functional habitat for mobile fauna such as open-country birds and common lizard species

Table 6-1. Summary table of indigenous ecosystem and habitat values across the Project Area. Refer Table 6-2 for a site-specific breakdown.

Indigenous Ecosystem / habitat type	Representativeness	Rarity/ distinctiveness	Diversity and pattern	Ecological context	Overall ecological value
Snow tussock grassland	High	High	High	High	Very High
Rock outcrops and tors	High	High	High	High	Very High
Dry shrubland	Low	Moderate	Moderate	Low	Moderate
Ephemeral wetland (WL14 Herbfield [Ephemeral wetland])	Moderate	High	High	High	Very High
Riparian freshwater herbaceous vegetation	Moderate	High	High	Moderate	High
Riparian sedgeland	Moderate	Moderate	Moderate	Moderate	Moderate
Riparian shrubland	Moderate	Moderate	Moderate	Moderate	Moderate
Wetland freshwater herbaceous vegetation	Moderate	High	Moderate	High	High
Wetland sedgeland (WL22 where applicable)	Moderate	Moderate	Moderate	Moderate	Moderate
Wetland seepage	Moderate	High	Moderate	High	High
Wetland shrubland	Moderate	Moderate	Moderate	Moderate	Moderate

Table 6-2. Summary of ecological values assigned to ecosystem types recorded within the MP4 Project area, per location. Attribute values (i.e. representativeness, rarity/distinctiveness, diversity and pattern, and ecological context) are adapted from Whirika (2026) for each location and ecosystem type. Note where Whirika assign two rarity/distinctiveness values, the highest of those is applied here, and elevated along with 'Diversity and Pattern' where fauna components are considered. Attribute scores of 'Very High' are assigned 'High' to align with scoring used in Table 6 of EIANZ guidelines (2017)- refer Appendix A, EIANZ Table 6.

Ecosystem type	Site	Representativeness	Rarity/ distinctiveness	Diversity and pattern	Ecological context	Overall ecological value	Notes
Snow tussock grassland	Coronation Mining Area	High	High	High	High	Very High	Values adapted from Whirika (2026).
	Central Mining Area	Moderate	Moderate	Moderate	Low	Moderate	Rarity and Diversity values assessed as 'Low' by Whirika (2026) have been elevated in this assessment following consideration to fauna components, including TAR species and the role of tussock supporting transition of fauna through the landscape. Overall value (Very High) assigned with greater weighting to Coronation area.
	Golden Bar Mining Area	High	High	Moderate	Moderate	High	
	Golden Bar Haul Road	Moderate	High	Moderate	Low	Moderate	
	Overall (Project-wide)	High	High	High	High	Very High	
Rock outcrops and tors	Coronation Mining Area	High	High	High	High	Very High	Values adapted from Whirika (2026).
	Central Mining Area	Low	Moderate	Moderate	Low	Low	Rarity and Diversity values assessed as 'Low' by Whirika (2026) have been elevated in this assessment following consideration of fauna components, including TAR species and the role of rock habitats supporting transition of fauna through the landscape.
	Golden Bar Mining Area	High	High	Moderate	Moderate	High	
	Golden Bar Haul Road	Low	Moderate	Moderate	Low	Low	
	Overall (Project-wide)	High	High	High	High	Very High	
Dry Shrubland	Coronation Mining Area	Low	Moderate	Moderate	Low	Moderate	Values adapted from Whirika (2026).

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Ecosystem type	Site	Representativeness	Rarity/ distinctiveness	Diversity and pattern	Ecological context	Overall ecological value	Notes
	Central Mining Area	Low	Moderate	Moderate	Low	Moderate	Rarity and Diversity values assessed as 'Low' by Whirika (2026) have been elevated in this assessment following consideration to fauna components, including TAR species and the role of shrubland supporting transition of fauna through the landscape.
	Golden Bar Mining Area	Low	Moderate	Low	Low	Moderate	
	Golden Bar Haul Road	Low	Moderate	Moderate	Low	Moderate	
	Overall (Project-wide)	Low	Moderate	Moderate	Low	Moderate	
Ephemeral wetland	Coronation Mining Area	Moderate	High	High	High	Very High	Coronation example is the long-inundation subtype; Central, Golden Bar and Golden Bar Haul Road examples are the short-inundation subtype (Whirika, 2026). All examples are a subtype of a Naturally Uncommon, Critically Endangered ecosystem and national priority for protection (Williams et al., 2007; Holdaway et al., 2012; Ministry for the Environment & Department of Conservation, 2007). Confidence: Moderate, all regions (Whirika, 2026).
	Central Mining Area	Low	High	High	High	Very High	
	Golden Bar Mining Area	Low	High	High	Moderate	High	
	Golden Bar Haul Road	Low	High	High	Moderate	High	
	Overall (Project-wide)	Moderate	High	High	High	Very High	
Riparian freshwater herbaceous vegetation	Coronation Mining Area	Moderate	High	High	Moderate	High	n/a = not recorded within the assessed footprint of Central, Golden Bar or Golden Bar Haul Road in Whirika (2026); absence from the source table means the type was not identified or assessed there, not that it is present at low value. Confidence: Moderate-High at Coronation (Whirika, 2026).
	Central Mining Area	n/a	n/a	n/a	n/a	n/a	
	Golden Bar Mining Area	n/a	n/a	n/a	n/a	n/a	
	Golden Bar Haul Road	n/a	n/a	n/a	n/a	n/a	

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Ecosystem type	Site	Representativeness	Rarity/ distinctiveness	Diversity and pattern	Ecological context	Overall ecological value	Notes
	Overall (Project-wide)	Moderate	High	High	Moderate	High	
Riparian sedgeland	Coronation Mining Area	Moderate	Moderate	Moderate	Moderate	Moderate	n/a = not recorded within the assessed footprint of Golden Bar Haul Road in Whirika (2026). Confidence: Moderate-High at Coronation, Central and Golden Bar mining areas(Whirika, 2026).
	Central Mining Area	Moderate	Moderate	Moderate	Moderate	Moderate	
	Golden Bar Mining Area	Moderate	Moderate	Moderate	Moderate	Moderate	
	Golden Bar Haul Road	n/a	n/a	n/a	n/a	n/a	
	Overall (Project-wide)	Moderate	Moderate	Moderate	Moderate	Moderate	
Riparian shrubland	Coronation Mining Area	n/a	n/a	n/a	n/a	n/a	n/a = not recorded within the assessed footprint of Coronation or Golden Bar Haul Road in Whirika (2026). Confidence: Moderate-High (Whirika, 2026).
	Central Mining Area	Moderate	Moderate	Moderate	Moderate	Moderate	
	Golden Bar Mining Area	Moderate	Moderate	Moderate	Moderate	Moderate	
	Golden Bar Haul Road	n/a	n/a	n/a	n/a	n/a	
	Overall (Project-wide)	Moderate	Moderate	Moderate	Moderate	Moderate	
Wetland freshwater herbaceous vegetation	Coronation Mining Area	Moderate	High	High	Moderate	High	Rarity shown is the higher of community-level and rare-flora-habitat scores (Whirika, 2026); some Coronation examples support Regionally Threatened or At Risk wetland plant species. Confidence: Moderate-High, all regions (Whirika, 2026).
	Central Mining Area	Low	Moderate	Low	Low	Low	
	Golden Bar Mining Area	Moderate	High	Moderate	Moderate	High	

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Ecosystem type	Site	Representativeness	Rarity/ distinctiveness	Diversity and pattern	Ecological context	Overall ecological value	Notes
	Golden Bar Haul Road	Low	Moderate	Low	Low	Low	
	Overall (Project-wide)	Moderate	High	Moderate	High	High	
Wetland sedgeland	Coronation Mining Area	Moderate	Moderate	Moderate	Moderate	Moderate	Confidence: Moderate-High, all regions (Whirika, 2026).
	Central Mining Area	Moderate	Moderate	Low	Low	Moderate	
	Golden Bar Mining Area	Moderate	Moderate	Moderate	Moderate	Moderate	
	Golden Bar Haul Road	Moderate	Moderate	Low	Low	Moderate	
	Overall (Project-wide)	Moderate	Moderate	Moderate	Moderate	Moderate	
Wetland seepage	Coronation Mining Area	Moderate	High	High	Moderate	High	n/a = not recorded within the assessed footprint of Central, Golden Bar or Golden Bar Haul Road in Whirika (2026); recorded only at Coronation. A Naturally Uncommon, Endangered ecosystem and national priority for protection (Ministry for the Environment & Department of Conservation, 2007; Williams et al., 2007; Holdaway et al., 2012). The Whirika (2026) sub-criterion table (Table 14) rates this example as High; the whole-of-Project summary in the same report (Table 1) rates the same 0.02 ha feature as Very High. Confidence: Moderate (Whirika, 2026).
	Central Mining Area	n/a	n/a	n/a	n/a	n/a	
	Golden Bar Mining Area	n/a	n/a	n/a	n/a	n/a	
	Golden Bar Haul Road	n/a	n/a	n/a	n/a	n/a	
	Overall (Project-wide)	Moderate	High	Moderate	High	High	
Wetland shrubland	Coronation Mining Area	Moderate	Moderate	Moderate	Moderate	Moderate	n/a = not recorded within the assessed footprint of Central or Golden Bar Haul

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Ecosystem type	Site	Representativeness	Rarity/ distinctiveness	Diversity and pattern	Ecological context	Overall ecological value	Notes
	Central Mining Area	n/a	n/a	n/a	n/a	n/a	Road in Whirika (2026); recorded only at Coronation, where one species present is Regionally At Risk due to a lack of recruitment. Confidence: Moderate-High at Coronation and Golden bar (Whirika, 2026).
	Golden Bar Mining Area	Moderate	Moderate	Moderate	Moderate	Moderate	
	Golden Bar Haul Road	n/a	n/a	n/a	n/a	n/a	
	Overall (Project-wide)	Moderate	Moderate	Moderate	Moderate	Moderate	

6.3.3 Threatened and At-Risk Species Values

When assigning ecological value to a species, the information provided by both the national and regional threat classification systems is used as they contribute to the known rarity of individuals and the condition or health of populations. Following the EciAG methods, threat classifications are used when assigning value to terrestrial species, with higher threat classifications indicating higher ecological value. Here, following a conservative approach, value is assessed using the highest threat classification a species possesses, whether that be a national or a regional classification.

Table 6-3. Ecological values assigned to individual species recorded or considered within the MP4 Project area.

Species name	National threat status	Regional threat status	Assigned ecological value
Threatened, At Risk, Data Deficient and locally uncommon plants			
Dwarf broom, <i>Carmichaelia corrugata</i>	Threatened - Nationally Vulnerable	Threatened - Regionally Critical	Very High
Indigenous St John's wort, <i>Hypericum rubicundulum</i>	Threatened - Nationally Endangered	Threatened - Regionally Critical	Very High
<i>Sonchus aff. novae-zelandiae</i>	Threatened - Nationally Endangered	Threatened - Regionally Endangered	Very High
<i>Wurmbea novae-zelandiae</i>	Threatened - Nationally Endangered	Threatened - Regionally Endangered	Very High
<i>Carex kaloides</i>	At Risk - Declining	Threatened - Regionally Endangered	Very High
Slender wine sedge, <i>Carex tenuiculmis</i>	At Risk - Declining	Threatened - Regionally Endangered	Very High
<i>Euchiton ensifer</i>	At Risk - Declining	Threatened - Regionally Endangered	Very High
<i>Gratiola aff. concinna</i> (AK 251855; South Island)	At Risk - Declining	Threatened - Regionally Endangered	Very High
Wetland daisy, <i>Lagenophora barkeri</i>	At Risk - Declining	Threatened - Regionally Endangered	Very High
Creeping button daisy, <i>Leptinella pusilla</i>	At Risk - Declining	Threatened - Regionally Endangered	Very High
<i>Lobelia ionantha</i>	At Risk - Declining	Threatened - Regionally Endangered	Very High
<i>Rytidosperma thomsonii</i>	At Risk - Declining	Threatened - Regionally Endangered	Very High
Bidibidi, <i>Acaena buchananii</i>	At Risk - Declining	Threatened - Regionally Vulnerable	Very High
Narrow-leaved speargrass, <i>Aciphylla subflabellata</i>	At Risk - Declining	Threatened - Regionally Vulnerable	Very High
Tufted hair grass, <i>Deschampsia cespitosa</i>	At Risk - Declining	Threatened - Regionally Vulnerable	Very High
Marsh willowherb, <i>Epilobium chionanthum</i>	At Risk - Declining	Threatened - Regionally Vulnerable	Very High
<i>Epilobium insulare</i>	At Risk - Declining	Threatened - Regionally Vulnerable	Very High

Species name	National threat status	Regional threat status	Assigned ecological value
<i>Euchiton polylepis</i>	At Risk - Declining	Threatened - Regionally Vulnerable	Very High
<i>Juncus pusillus</i>	At Risk – Naturally Uncommon	Threatened – Regionally Vulnerable	Very High
<i>Lachnagrostis striata</i>	Not Threatened	Threatened – Regionally Vulnerable	Very High
Dwarf greenhood orchid, <i>Pterostylis tristis</i>	At Risk - Declining	Threatened - Regionally Vulnerable	Very High
<i>Lobelia perpusilla</i>	Not Threatened	Threatened - Regionally Vulnerable	Very High
Delicate bluegrass, <i>Anthosachne falcis</i>	At Risk - Declining	At Risk - Regionally Declining	High
<i>Carex dipsacea</i>	Not Threatened	At Risk - Regionally Declining	High
Desert broom, <i>Carmichaelia petriei</i>	At Risk - Declining	At Risk - Regionally Declining	High
<i>Colobanthus strictus</i>	Not Threatened	At Risk - Regionally Declining	High
Mountain carrot, <i>Gingidia grisea</i>	At Risk - Naturally Uncommon	At Risk - Regionally Declining	High
<i>Juncus distegus</i>	Not Threatened	At Risk - Regionally Declining	High
New Zealand mint/hīoi, <i>Mentha cunninghamii</i>	At Risk - Declining	At Risk - Regionally Declining	High
<i>Rytidosperma buechananii</i>	At Risk - Declining	At Risk - Regionally Declining	High
<i>Shawia lineata</i>	At Risk - Declining	At Risk - Regionally Declining	High
Wetland grass, <i>Agrostis pallescens</i>	At Risk - Naturally Uncommon	At Risk - Regionally Naturally Uncommon	Moderate
<i>Argyrotegium mackayi</i>	Not Threatened	At Risk - Regionally Naturally Uncommon	Moderate
<i>Brachyscome longiscapa</i>	At Risk - Naturally Uncommon	At Risk - Regionally Naturally Uncommon	Moderate
<i>Carex purpurata</i>	At Risk - Naturally Uncommon	At Risk - Regionally Naturally Uncommon	Moderate
Hooker's mountain daisy, <i>Celmisia hookeri</i>	At Risk - Naturally Uncommon	At Risk - Regionally Naturally Uncommon	Moderate
<i>Epilobium komarovianum</i>	Not Threatened	At Risk - Regionally Naturally Uncommon	Moderate
<i>Euchiton traversii</i>	Not Threatened	At Risk - Regionally Naturally Uncommon	Moderate
<i>Geranium homeanum</i>	At Risk – Naturally Uncommon	At Risk – Regionally Naturally Uncommon	Moderate
<i>Gentianella amabilis</i>	Not Threatened	At Risk - Regionally Naturally Uncommon	Moderate
<i>Lilaeopsis ruthiana</i>	Not Threatened	At Risk - Regionally Naturally Uncommon	Moderate
<i>Lagenophora pinnatifida</i>	Not Threatened	At Risk - Regionally Naturally Uncommon	Moderate
<i>Poa pusilla</i>	Not Threatened	At Risk - Regionally Naturally Uncommon	Moderate

Species name	National threat status	Regional threat status	Assigned ecological value
<i>Shawia bullata</i>	Not Threatened	At Risk - Regionally Naturally Uncommon	Moderate
<i>Oxalis rubens</i>	Not Threatened	Regionally Data Deficient	Moderate
Cress, <i>Cardamine grandiscapa</i>	At Risk - Naturally Uncommon	Regionally Data Deficient	Moderate
Porcupine shrub, <i>Melicytus aff. alpinus</i> (c) (CHR 541568; Otago)	Data Deficient	Regionally Data Deficient	Moderate
<i>Ranunculus aff. reflexus</i> (CHR 394270; Mt Peel)	At Risk - Declining	Regionally Data Deficient	Moderate
Climbing fuchsia, <i>Fuchsia perscandens</i>	Not Threatened	Regionally Not Threatened/locally uncommon	Moderate
Kōwhai/small-leaved kōwhai, <i>Sophora microphylla</i>	Not Threatened	Regionally Not Threatened/locally uncommon	Moderate
Invertebrates			
<i>Orocrambus sophistes</i>	Threatened – Nationally Vulnerable	-	Very high
<i>Agrotis admirationis</i>	At Risk – Declining	-	High
<i>Asaphodes recta</i>	At Risk – Declining	-	High
<i>Dasyuris partheniata</i>	At Risk – Declining	-	High
<i>Nyctemera annulata</i>	At Risk – Declining	-	High
<i>Orthodera novaezealandiae</i>	At Risk – Declining	-	High
<i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia")	At Risk – Declining	-	High
<i>Patagoniodes farinaria</i>	At Risk – Declining	-	High
<i>Samana acutata</i>	At Risk – Declining	-	High
<i>Theoxena scissaria</i>	At Risk – Declining	-	High
<i>Bityla sericea</i>	At Risk – Uncommon	-	Moderate
<i>Wiseana fuliginea</i>	Data Deficient	-	Moderate
<i>Wiseana mimica</i>	Data Deficient	-	Moderate
<i>Zelandobius uniramus</i>	Data Deficient	-	Moderate
<i>Hemiandrus maia</i>	Not Threatened	-	Low
<i>Mecodema</i> sp. "Oamaru"	Not listed	-	Moderate
<i>Orocrambus cf. cyclopicus</i>	Not listed	-	Moderate
Lizards			
McCann's skink, <i>Oligosoma maccanni</i>	Not Threatened	Regionally Not Threatened	Low
Southern grass skink, <i>Oligosoma chionocholescens</i>	At Risk - Declining	At Risk - Regionally Declining	High
Kōrero gecko, <i>Woodworthia</i> "Otago/Southland large"	At Risk - Declining	At Risk - Regionally Declining	High
Avifauna			

Species name	National threat status	Regional threat status	Assigned ecological value
Kārearea/eastern falcon, <i>Falco novaeseelandiae novaeseelandiae</i>	Threatened - Nationally Vulnerable	Regionally Vulnerable	Very High
Banded dotterel/pohowera, <i>Charadrius bicinctus</i>	At Risk - Declining	Regionally Vulnerable	Very High
South Island pied oystercatcher/tōrea, <i>Haematopus finschi</i>	At Risk - Declining	Regionally Vulnerable	Very High
Black shag/māpunga, <i>Phalacrocorax carbo</i>	At Risk - Relict	Regionally Endangered	Very High
New Zealand pipit/pīhoihoi, <i>Anthus novaeseelandiae</i>	At Risk - Declining	Regionally Not Threatened	High
Silveryeye/tauhou, <i>Zosterops lateralis</i>	Not Threatened	Regionally Declining	High
Black-fronted dotterel, <i>Charadrius melanops</i>	At Risk - Naturally Uncommon	Regional Vagrant	Considered but not confirmed as directly affected
Fernbird/mātātā, <i>Poodytes punctatus</i>	At Risk - Declining	Regionally Declining	Considered but not confirmed as directly affected
Australasian shoveler/kuruwhengu, <i>Spatula rhynchotis</i>	Not Threatened	Regionally Not Threatened	Low
Grey teal/tētē-moroiti, <i>Anas gracilis</i>	Not Threatened	Regionally Not Threatened	Low
Grey warbler/riroriro, <i>Gerygone igata</i>	Not Threatened	Regionally Not Threatened	Low
Kererū/New Zealand pigeon, <i>Hemiphaga novaeseelandiae</i>	Not Threatened	Regionally Not Threatened	Low
New Zealand scaup/pāpango, <i>Aythya novaeseelandiae</i>	Not Threatened	Regionally Not Threatened	Low
Paradise shelduck/pūtangitangi, <i>Tadorna variegata</i>	Not Threatened	Regionally Not Threatened	Low
Pied stilt/poaka, <i>Himantopus leucocephalus</i>	Not Threatened	Regionally Not Threatened	Low
Pūkeko, <i>Porphyrio melanotus</i>	Not Threatened	Regionally Not Threatened	Low
Sacred kingfisher/kōtare, <i>Todiramphus sanctus</i>	Not Threatened	Regionally Not Threatened	Low
South Island fantail/pīwakawaka, <i>Rhipidura fuliginosa fuliginosa</i>	Not Threatened	Regionally Not Threatened	Low
Southern black-backed gull/karoro, <i>Larus dominicanus</i>	Not Threatened	Regionally Not Threatened	Low
Spur-winged plover, <i>Vanellus miles</i>	Not Threatened	Regionally Not Threatened	Low
Swamp harrier/kāhu, <i>Circus approximans</i>	Not Threatened	Regionally Not Threatened	Low
Tūī, <i>Prosthemadera novaeseelandiae</i>	Not Threatened	Regionally Not Threatened	Low
Welcome swallow/warou, <i>Hirundo neoxena</i>	Not Threatened	Regionally Not Threatened	Low
White-faced heron/matuku moana, <i>Egretta novaehollandiae</i>	Not Threatened	Regionally Not Threatened	Low
Bats			

Species name	National threat status	Regional threat status	Assigned ecological value
Long-tailed bat/pekapeka-tou-roa, <i>Chalinolobus tuberculatus</i>	Threatened - Nationally Critical		Considered but not present in ZOI
Southern lesser short-tailed bat/pekapeka-tou-poto, <i>Mystacina tuberculata tuberculata</i>	At Risk - Recovering		Considered but not present in ZOI

6.3.4 Ecological Values by MP4 assessment area

6.3.4.1 Coronation Mining Area

Coronation Mining Area comprises a modified open-country mining and pastoral landscape that retains a mosaic of indigenous grassland, shrubland, riparian, wetland and rocky habitats of ecological significance. Snow tussock grassland is the dominant vegetation type, with smaller areas of shrubland, rock habitat, riparian vegetation and inland wetlands (Figure 6.1).

Tussock Grassland

Snow tussock grassland covers approximately 63.24 ha of the impact area (direct loss plus additional 20 m) and is assessed as **Very High ecological value**. Although widespread locally and regionally, the affected grassland exhibits relatively high ecological integrity and plant diversity and provides habitat for Regionally TAR plant species. Historic burning and grazing have influenced its condition.

Rock Outcrops and Tors

Rock habitats occupy approximately 0.17 ha (direct loss plus 20 m) and are assessed as **Very High ecological value** due to their high intactness and importance as habitat for Regionally TAR plant species, and also other fauna (lizards, invertebrates, birds). These habitats are concentrated around Trimbells Gully and represent a relatively uncommon habitat type outside Otago.

Dry Shrubland

Approximately 2.67 ha (direct loss plus 20 m) of shrubland is affected and is assessed as **Moderate ecological value**. These communities are generally species-poor and modified by historical grazing and burning, although they provide habitat for Regionally At Risk plant species. Matagouri contributes localised structural diversity within mixed dry shrubland.

Wetlands

Wetland and riparian habitats include ephemeral wetlands, freshwater herbaceous vegetation, sedgelands, seepages and wetland shrublands. Ephemeral wetlands (0.39 ha) are assessed as **Very High ecological value** because they represent a long-inundation subtype of a Naturally Uncommon, Critically Endangered ecosystem and support Regionally TAR plant species.

Riparian and wetland freshwater herbaceous vegetation (0.80 ha and 0.45 ha, respectively) are assessed as **High ecological value**, reflecting moderate indigenous diversity and the presence of TAR plant species. Wetland seepages (0.02 ha) are also assessed as **High ecological value** because they represent a Naturally Uncommon Endangered ecosystem.

Riparian sedgeland (0.11 ha), wetland sedgeland (0.30 ha), and wetland shrubland (0.01 ha) are assessed as **Moderate ecological value**. These habitats are naturally species-poor and have been modified by grazing and weed invasion.

Invertebrates

Invertebrate values are assessed as **Moderate overall**. Habitats are largely representative of the surrounding modified tussock landscape, and five TAR invertebrate species have been recorded.

Overall, Coronation Mining Area supports a range of ecological values, including **Very High value** rock and ephemeral wetland habitats, **High value** snow tussock grassland, freshwater herbaceous wetlands

and seepages, and **Moderate value** sedgeland and wetland shrubland communities. Fauna values comprise **Moderate** avifauna, lizard and invertebrate values.

Lizards

Lizard values are also assessed as **Moderate overall**. McCann's skink, southern grass skink and kōrero gecko have been recorded within the area. Rocky habitats are particularly important for kōrero gecko and McCann's skink, while southern grass skink occupies a wider range of grassland and wetland habitats.

Avifauna

Avifauna values are assessed as **Moderate overall**. The area supports a typical inland Otago open-country bird assemblage, including South Island pied oystercatcher, banded dotterel and New Zealand pipit (all nationally At Risk). Habitats provide foraging and potential breeding opportunities for ground-nesting species, including threatened NZ falcon although no confirmed nesting sites have been identified.

Summaries of the ecological values and ecological value criteria for Coronation Mining Area are presented in Table 6-4 and Table 6-4.

Table 6-4. Summary of ecological values for Coronation Mining Area.

Ecological component	Ecological value
Tussock grassland	Very High
Rock habitat	Very High
Shrubland	Moderate
Ephemeral wetland	Very High
Riparian freshwater herbaceous vegetation	High
Riparian sedgeland	Moderate
Wetland freshwater herbaceous vegetation	High
Wetland sedgeland	Moderate
Wetland seepage	High
Wetland shrubland	Moderate
Invertebrates	Moderate
Lizards	Moderate
Avifauna	Moderate

Table 6-5. Summary of ecological value criteria for Coronation Mining Area.

Criterion	Value assigned	Explanation
Representativeness	High	Coronation Mining Area supports a representative modified inland Otago open-country habitat mosaic, including extensive snow tussock grassland, shrubland, rock habitat, riparian vegetation and natural inland wetland communities. The vegetation assessment assigns High representativeness to snow tussock grassland and rock habitat, with Moderate representativeness assigned to most wetland and riparian communities. Avifauna, lizard and invertebrate representativeness is Moderate, reflecting an indigenous open-country assemblages typical of modified inland Otago grassland systems.
Rarity / distinctiveness	Very High	Rarity and distinctiveness are elevated by the presence of Very High value ephemeral wetland and rock habitat, and by habitat for Regionally TAR plant species. The ephemeral wetland is a locally uncommon long-inundation subtype of a Naturally Uncommon Critically Endangered ecosystem and a priority for protection. The rock habitat also supports Regionally TAR plant species. Avifauna rarity/distinctiveness is High because the area supports nationally At Risk species, including South Island pied oystercatcher, banded dotterel and New Zealand pipit. At Risk lizard and invertebrates are present.
Diversity and pattern	High	Coronation Mining Area supports a diverse ecological mosaic relative to the wider modified mining landscape, comprising dryland tussock grassland, rock habitat, shrubland, riparian vegetation, ephemeral wetland and other wetland communities. The vegetation assessment identifies High diversity and pattern for snow tussock grassland, rock habitat and ephemeral wetland, with Moderate diversity and pattern for several riparian and wetland communities. Avifauna diversity and pattern is Low because native bird richness is consistent but not exceptional, and the assemblage is typical of a modified open-country habitat. The lizard and invertebrate diversity is typical of modified tussock, interspersed with riparian, habitats.
Ecological context	High	Coronation Mining Area contributes to the broader Macraes open-country ecological network through its extent of indigenous tussock grassland, wetland and riparian habitats, rock outcrops and fauna habitat. The vegetation assessment identifies High ecological context for key vegetation receptors such as snow tussock grassland, rock habitat and ephemeral wetland. For avifauna (particularly ground-nesting open-country taxa), lizards and invertebrates, the area provides foraging and potential breeding habitat

Criterion	Value assigned	Explanation
		and is functionally connected to the surrounding pastoral and mining landscape.
Overall ecological value	Very High	Coronation Mining Area is assessed as having Very High overall ecological value at the mining-area scale. This reflects the presence of Very High value ephemeral wetland and rock habitat, High value snow tussock grassland, riparian freshwater herbaceous vegetation, wetland freshwater herbaceous vegetation and wetland seepage, and multiple Regionally TAR plant records. Fauna values are lower but still contribute to the site value, with Moderate avifauna value, Moderate lizard value and Moderate invertebrate value.



Figure 6.1. Habitats within the Coronation Mining Area. The top image (northern extent of Coronation) shows tussock grassland and pasture with the existing Trimbells WRS, visible in the left part of the image. Lower image (southern extent of Coronation) shows tussock on the eastern side of the proposed Coronation backfill.

6.3.4.2 Golden Point Underground Extension

The Golden Point Underground Extension (GPUG) involves the continuation and expansion of the existing underground mining operation. Unlike the open-pit and waste rock stack components of the Project, GPUG is predominantly subterranean and is not expected to require substantial new surface disturbance. Surface activities are largely confined to existing access points, ventilation infrastructure, haul roads, and operational support areas. Consequently, potential ecological effects are expected to arise primarily through indirect pathways, including vibration from underground blasting, noise, hydrological change, subsidence, and limited disturbance associated with existing surface infrastructure.

The surface assessment area covers approximately 52.58 ha (direct loss plus 20 m), comprising 47.17 ha of indigenous shrubland, 4.75 ha of exotic grassland, and 0.66 ha of mine-disturbed land. Indigenous shrubland is the dominant habitat type and provides habitat continuity within the wider Macraes landscape, supporting indigenous birds, lizards, and invertebrates associated with shrubland, tussock-shrubland, rocky hillslopes, and gully systems (

Figure 6.2). Exotic grassland and mine-disturbed areas are more modified and generally support lower ecological values, although they may still be used by mobile fauna.

Indigenous Terrestrial Vegetation

Vegetation values are concentrated within indigenous shrubland, tussock-shrubland, rock outcrops, rocky hillslopes, and densely vegetated gullies associated with the Deepdell Creek catchment. These habitats are structurally more diverse than many operational areas within the MP4 footprint and contribute to important habitat connectivity and fauna habitat quality, particularly for lizards. In absence of plot data for indigenous terrestrial vegetation within GPUG, the terrestrial vegetation values, including tussock, dry shrubland and rock outcrops are assessed as **Very High** ecological value.

Wetlands

Wetland and stream values associated with Deepdell Creek, and adjacent gullies are addressed separately through freshwater and hydrogeological assessments. While no direct wetland or stream loss is proposed, potential indirect effects associated with groundwater drawdown, altered seepage, subsidence, vibration, or hydrological change require consideration.

Invertebrates

Invertebrate values are assessed as **Very High overall** owing largely to the extensive area of highly suitable habitat and presence of at least two At Risk species. Suitable habitat occurs within shrubland, tussockland, rocky features, riparian vegetation, and, to a lesser extent, exotic grassland.

Lizards

Lizard values are assessed as **Very High overall**. McCann's skink, southern grass skink, and kōrero gecko have been recorded within the GPUG area. Habitat includes tussockland, tussock-shrubland, rock outcrops, rocky hillslopes, and densely vegetated gullies typical of the Deepdell Creek catchment. The confirmed presence of multiple indigenous lizard species, including two At Risk species, combined with the quality and extent of habitat, underpins the Very High value assessment. Rocky habitats are particularly important for kōrero gecko, while grassland and shrubland margins provide habitat and dispersal opportunities for skinks.

Avifauna

Avifauna values are assessed as **Moderate overall**. The area supports indigenous bird species associated with shrubland, tussockland, rocky slopes, gullies, and modified open-country habitats. Records from the wider project area indicate use by a range of open-country and shrubland species, including eastern falcon during the non-breeding season. Of note, fernbird were only recorded from near this location and BRWRS (avoided by the Project). Given negligible surface disturbance, direct habitat loss for birds is expected to be minimal.

Overall, the GPUG supports extensive indigenous shrubland and associated fauna habitat. Although direct surface habitat loss is expected to be limited, ecological effects may arise through indirect mechanisms. Therefore, the assessment focussed on the potential effects of vibration, dewatering, hydrological change, subsidence, noise, lighting, and associated surface works on vegetation, lizard habitat, avifauna, invertebrates, and connected freshwater ecosystems.

Summaries of the ecological values and ecological value criteria for Coronation Mining Area are presented in Table 6-6 and Table 6-7.

Table 6-6. Summary of ecological values for GPUG.

Ecological component	Ecological value
Avifauna	Moderate
Lizards	Very High
Invertebrates	Very High
Tussock-Shrubland	Very High
Wetlands	High*

*conservatively assumed to be high

Table 6-7. Summary of ecological value criteria for the Golden Point Underground extension.

Criterion	Value assigned	Explanation
Representativeness	High	The GPUG Extension surface assessment area is dominated by indigenous shrubland, mixed tussock-shrubland, rocky hillslopes, rock outcrops and densely vegetated gullies associated with the Deepdell Creek catchment. These habitats are more structurally complex than many of the highly modified operational areas within the MP4 footprint and are representative of the more natural shrubland, tussockland and rocky gully habitats present on OGNZL landholdings and within the wider Macraes ED. Lizard and invertebrate community representativeness are considered High.

Criterion	Value assigned	Explanation
Rarity / distinctiveness	High	The area supports indigenous shrubland assessed as High ecological value, together with rocky and gully habitats that support indigenous fauna. Three lizard species have been confirmed from GPUG, including two At Risk – Declining species, and at least two At Risk invertebrate taxa are present. The lizard and invertebrate values assessment assign High rarity / distinctiveness for GPUG.
Diversity and pattern	Moderate	GPUG supports a habitat mosaic comprising shrubland, tussock-shrubland, rock outcrops, rocky hillslopes, densely vegetated gullies, exotic grassland and mine-disturbed land. This provides greater structural diversity than many operational mining areas. Lizard diversity is typical of modified tussock and shrubland habitats in the Macraes' ED, with three species confirmed, but larger-bodied threatened lizards are not known from the GPUG area. Invertebrate and avifauna values are both assessed as Moderate.
Ecological context	High	The shrubland, rocky and gully habitat mosaic contributes to indigenous habitat continuity within the wider Macraes landscape and the Deepdell Creek catchment. These habitats provide functional habitat for indigenous avifauna, lizards and invertebrates. For lizards, GPUG provides ecological connections to modified and more natural tussock habitats to the north, east and south, contributing to wider population connectivity and ecosystem function.
Overall ecological value	Very High	GPUG Extension is assessed as High overall ecological value at the mining-area scale, based on the known surface ecological values. This reflects the presence of a substantial area of High value indigenous shrubland, Very High lizard values, Moderate avifauna values and Very High invertebrate values. The rating is limited to known terrestrial values; wetland, stream and freshwater values are not assigned here because the EclA identifies these as requiring confirmation from the freshwater, wetland and hydrogeological assessments.



Figure 6.2. Examples of the indigenous shrubland, tussock-shrubland, rock outcrops, rocky hillslopes, and densely vegetated gullies associated with the Deepdell Creek catchment within the GPUG extension area.

6.3.4.3 Central Mining Area

The Central Mining Area encompasses the Innes Mills pit extensions, Frasers Tailings Storage Facility Stage 3, Macraes Road realignment, backfill areas, waste rock storage, tailings relocation activities, and associated mining infrastructure. It is a highly modified mining and pastoral landscape dominated by existing mine disturbance, roads, exotic grassland, pine plantations, and other developed land cover. Proposed works include expansion of the Innes Mills open pits, use of the Frasers Pit void for additional tailings storage, and associated waste rock and haulage activities.

The impact area, including a 20 m edge (beyond the direct loss footprint), covers approximately 119.4 ha, of which 116.24 ha comprises exotic or highly modified land cover. Indigenous and semi-natural vegetation occupies only 3.20 ha and includes ephemeral wetland (0.55 ha), snow tussock grassland (2.37 ha), shrubland (0.05 ha), wetland freshwater herbaceous vegetation (0.03 ha), and wetland sedgeland (0.12 ha). A constructed pond of approximately 0.13 ha is also present (Figure 6.3).

Vegetation values are generally lower than those identified at Coronation Mining Area and Golden Bar due to the extensive history of mining, pasture development, and weed invasion. Indigenous vegetation persists primarily as small, fragmented remnants of tussock grassland, shrubland, wetland vegetation, and ephemeral wetland habitat.

Tussock Grassland

Snow tussock grassland occupies approximately 2.37 ha and is assessed as **Low ecological value**. Although it retains some indigenous species, including golden speargrass, matagouri, creeping pōhuehue, hard tussock, and buttercup, it is heavily modified by grazing and exotic plant invasion and is common within the local and regional landscape.

Wetlands

Ephemeral wetland vegetation is the most significant vegetation feature within the CMA and is assessed as **High ecological value**. Approximately 0.55 ha occurs within or adjacent to the Innes Mills Pit Extension footprint, with a further 1.35 ha occurring within areas that can largely be avoided. These wetlands represent a locally uncommon short-inundation subtype of a Naturally Uncommon, Critically Endangered ecosystem and provide habitat for Regionally TAR plant species, despite varying levels of degradation.

Wetland sedgeland (0.12 ha) and wetland freshwater herbaceous vegetation (0.03 ha) are both assessed as **Low ecological value** due to their small extent, degraded condition, and low indigenous species diversity. Similarly, the limited shrubland present (0.05 ha), comprising low-stature matagouri and occasional *Shawia bullata*, is assessed as **Low ecological value**.

Rare plant values are locally important. Regionally Threatened, Data Deficient, and At Risk species recorded within the area include *Lobelia ionantha*, *Juncus pusillus*, *Lobelia perpusilla*, *Juncus australis*, *Anthosachne falcis*, *Juncus distegus*, *Celmisia hookeri*, and *Shawia bullata*. These records should be specifically addressed in the effects mitigation planning, particularly where they overlap proposed infrastructure.

Invertebrates

Invertebrate values are assessed as **Moderate overall**. Habitats are largely modified and support a relatively typical invertebrate community associated with pasture, exotic grassland, and small areas of

tussock and gully vegetation. While these habitats retain some ecological function, they do not support values warranting a higher assessment.

Lizards

Lizard values are assessed as **Moderate overall**. Habitat quality is generally lower than in other mining areas and is dominated by improved pasture and rank exotic grassland, with smaller areas of tussock, shrubland, and gullies providing more suitable habitat. McCann's skink and southern grass skink have been recorded, while kōrero gecko has not been detected within the footprint, likely due to the absence of rocky habitat. The Moderate rating reflects the presence of indigenous skinks but recognises limited habitat quality, low species diversity, and reduced ecological connectivity caused by active mining infrastructure.

Avifauna

Avifauna values are assessed as **High overall**. The area supports a modified open-country bird assemblage associated with pasture, tussock grassland, exposed substrates, haul roads, and rehabilitated landforms. Indigenous species recorded include New Zealand pipit, banded dotterel, South Island pied oystercatcher, grey warbler, morepork, New Zealand fantail, paradise shelduck, pied stilt, silvereye, southern black-backed gull, spur-winged plover, swamp harrier, and welcome swallow. The High rating reflects repeated use by nationally At Risk species and the suitability of disturbed open habitats for foraging and potential breeding.

Overall, the CMA supports predominantly modified ecological values. Key features include **High-value** ephemeral wetland habitat, **High** avifauna values, **Moderate** lizard values, and localised rare plant populations. Most remaining vegetation communities are of **Low ecological value**. Ecological assessment should focus on avoiding or minimising effects on ephemeral wetlands and rare plants, managing impacts on open-country bird habitat, implementing lizard management measures where required, and addressing potential hydrological effects on wetlands and connected freshwater ecosystems.

Summaries of the ecological values and ecological value criteria for Coronation Mining Area are presented in Table 6-8Table 6-6 and Table 6-9Table 6-7Table 6-4Table 6-4.

Table 6-8. Summary of ecological values for Central Mining area.

Ecological component	Ecological value
Avifauna	High
Lizards	Moderate
Invertebrates	Moderate
Ephemeral wetland	High
Snow tussock grassland	Low
Shrubland	Low
Wetland freshwater herbaceous vegetation	Low
Wetland sedgeland	Low
Rare plants	Moderate to Very High, species-dependent

Table 6-9. Summary of ecological value criteria for the Golden Point Underground extension.

Criterion	Value assigned	Explanation
Representativeness	Low	The CMA is a highly modified mining and pastoral landscape dominated by mine-disturbed land, exotic grassland, roads and pine. Indigenous or semi-natural vegetation is limited in extent and occurs mainly as small remnants of snow tussock grassland, shrubland, wetland freshwater herbaceous vegetation, wetland sedgeland and ephemeral wetland. The remaining indigenous vegetation is not strongly representative of intact Macraes ED ecosystems because of its small extent, fragmentation, weed influence and surrounding operational mining context. The lizard and invertebrate communities are generally representative of the modified and degraded habitats present in the area.
Rarity / distinctiveness	High	Rarity and distinctiveness are primarily associated with localised ephemeral wetland vegetation, rare plant records, and presence of At Risk lizards and invertebrates. Ephemeral wetland is a naturally uncommon ecosystem type and is assessed as High ecological value in the vegetation values assessment. However, the overall area is dominated by modified land cover, and the rare or distinctive features are small and spatially localised. Two At Risk – Declining lizard and two At Risk – Declining invertebrate species are known from the area.
Diversity and pattern	Moderate	The area contains a mosaic of modified open-country habitats, remnant tussock grassland, ephemeral wetland, small wetland remnants, shrubland, constructed pond habitat and disturbed substrates. This provides some ecological diversity across the assessment area, particularly for mobile avifauna and common lizard species. However, indigenous vegetation diversity is limited by the small extent and modified condition of remaining habitats.
Ecological context	Low	The ecological context of the CMA is constrained by the dominance of active and historic mine disturbance, roads, pits and operational areas. Some retained habitats contribute local ecological function, including ephemeral wetland habitat, rare plant habitat, lizard and invertebrate habitats, and modified open-country habitat used by indigenous birds. However, habitat connectivity, buffering and landscape-scale ecological function are limited relative to less modified parts of the MP4 area.
Overall ecological value	Moderate	CMA is assessed as having Moderate overall ecological value at the mining-area scale. This reflects the predominance of Low value modified land cover, limited indigenous vegetation extent and low ecological context, balanced against discrete higher-value

		receptors, including High value ephemeral wetland vegetation and presence of At Risk lizards and invertebrates and localised rare plant records. Freshwater, constructed pond and stream values should remain subject to confirmation through the relevant freshwater and wetland assessments.
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Figure 6.3. Habitats within the Central Mining area. The top image includes exotic scrub, exotic grassland, and pine trees. Lower image is of parts of the proposed Innes Mills Pit and Frasers Backfill.

6.3.4.4 Golden Bar Haul Road

The Golden Bar Haul Road comprises a proposed road realignment and associated infrastructure to support mining operations within the Golden Bar and wider MP4 areas. Works include upgrading an existing private haul road, installation of a pipeline and pump stations, and development of an ore stockpiling and loading area within the Golden Bar Waste Rock Stack footprint.

The assessment area covers approximately 32.7 ha (including the road footprint and 20 m precautionary buffer) and is dominated by modified habitats, including exotic grassland (22.5 ha), road corridor (5.8 ha), and mine-disturbed land (0.7 ha). Indigenous and semi-natural vegetation is limited, comprising snow tussock grassland (3.5 ha), ephemeral wetland (0.14 ha), shrubland, rock habitat, wetland freshwater herbaceous vegetation, and wetland sedgeland (Figure 6.4).

Terrestrial Indigenous Vegetation

Vegetation values are generally **low** due to historic disturbance, grazing, and the dominance of exotic vegetation and infrastructure. Snow tussock grassland is assessed as **Low ecological value**, reflecting its widespread distribution, low indigenous diversity, and modified condition, although it provides habitat for a Regionally Declining plant species.

Other indigenous vegetation communities, including shrubland, rock habitat, wetland freshwater herbaceous vegetation, and wetland sedgeland, are all assessed as **Low ecological value** due to their small extent, degraded condition, and low indigenous diversity.

Wetlands

Ephemeral wetland vegetation is assessed as **High ecological value** despite its limited extent. These wetlands represent a short-inundation subtype of a Naturally Uncommon, Critically Endangered ecosystem and are a priority for protection. Additional ephemeral wetlands occur within the project buffer and can largely be avoided through project design.

Rare plant values are localised, with two records of the Regionally At Risk species *Carmichaelia petriei* occurring within the corridor. These individual plants should be addressed through project management and monitoring measures.

Invertebrates

Invertebrate values are also assessed as **Low overall**, reflecting the predominance of exotic grassland, road margins, and disturbed substrates. Small areas of tussock, wetland margin, shrubland, and rock habitat provide limited ecological function, but no TAR invertebrate species have been recorded.

Lizards

Lizard values are assessed as **Low overall**. Only McCann's skink (Not Threatened) was recorded in this area. Overall lizard habitat quality and diversity are low.

Avifauna

Avifauna values are assessed as **Low overall**. The corridor supports a modified open-country bird assemblage typical of pastoral and mining landscapes. Although At Risk species including South Island pied oystercatcher, banded dotterel, and New Zealand pipit have been recorded, habitat quality is low and widely represented throughout the surrounding landscape.

Overall, the Golden Bar Haul Road supports predominantly **Low ecological values**, with the exception of **High-value ephemeral wetland habitat**. Ecological management should focus on avoiding impacts to wetlands, protecting *Carmichaelia petriei* populations, minimising disturbance to open-country birds during the breeding season, and implementing lizard management measures where suitable habitat is affected.

Summaries of the ecological values and ecological value criteria for Coronation Mining Area are presented in Table 6-10 and Table 6-11.

Table 6-10. Summary of ecological values for Golden Bar haul road.

Ecological component	Ecological value
Avifauna	Low
Lizards	Low
Invertebrates	Low
Ephemeral wetland	High
Snow tussock grassland	Low
Rock habitat	Low
Shrubland	Low
Wetland freshwater herbaceous vegetation	Low
Wetland sedgeland	Low
Rare plants	Species-dependent; <i>Carmichaelia petriei</i> records present

Table 6-11. Summary of ecological value criteria for Golden Bar Haul Road.

Criterion	Value assigned	Explanation
Representativeness	Low	The Golden Bar Haul Road corridor is dominated by modified habitats, including exotic grassland, existing road corridor and mine-disturbed land. Indigenous vegetation is limited to small areas of snow tussock grassland, ephemeral wetland, wetland vegetation, shrubland and rock habitat. Most indigenous communities within the corridor are small, edge-affected and modified by grazing, previous haul road disturbance and surrounding mining activity.
Rarity/distinctiveness	Low	Most habitats within the corridor are common, modified and of limited distinctiveness. Ephemeral wetland vegetation is present and is assessed as High ecological value, and two records of desert broom (<i>Carmichaelia petriei</i>) occur within the corridor. However, these features are small and localised within a predominantly modified road and pasture context, and do not substantially elevate the rarity or distinctiveness of the corridor as a whole. One species of common, Not Threatened lizard is present and the invertebrate fauna is represented by common, generalist species.

Criterion	Value assigned	Explanation
Diversity and pattern	Low	Habitat diversity within the corridor is limited. The area comprises a relatively simple linear corridor of exotic grassland, road margin, mine-disturbed land and small remnants of indigenous vegetation. Snow tussock grassland is the largest indigenous component but is assessed as Low ecological value. Wetland, shrubland and rock habitats are present only in very small areas. Fauna diversity is low due to the relatively low value habitat quality.
Ecological context	Low	The corridor has a limited ecological context because it is narrow, fragmented and strongly influenced by existing roads and mining disturbance. It provides some local habitat function for open-country birds, common lizards and invertebrates, and scattered indigenous vegetation, but its contribution to broader habitat connectivity and landscape-scale ecological function is limited.
Overall ecological value	Low	The Golden Bar Haul Road corridor is assessed as Low overall ecological value at the mining-area scale. This reflects the dominance of modified habitats, Low fauna values, limited indigenous vegetation extent, and Low ratings for representativeness, rarity/distinctiveness, diversity and pattern, and ecological context. The localised High value ephemeral wetland and desert broom records should still be recognised and managed as discrete receptors, but they do not alter the overall corridor-scale value rating.



Figure 6.4. Examples of the highly modified landscape, comprising grazed grassland, and an existing road corridor within the Golden Bar Haul Road area. Indigenous vegetation is limited to small areas of snow tussock grassland, ephemeral wetland, wetland vegetation, shrubland and rock habitat.

6.3.4.5 Golden Bar Mining Area

The Golden Bar Mining Area comprises the Golden Bar Pit Extension Stages 2 and 3, the Golden Bar Waste Rock Stack Extension, associated ore stockpiling areas, haul-road connections and ancillary operational infrastructure. The pit extension involves expansion of the existing open pit, principally to the east and northeast, to access additional ore. Much of the proposed footprint occurs within previously disturbed or rehabilitated mining landforms, although indigenous tussock grassland and other semi-natural habitats will also be affected. The Golden Bar Waste Rock Stack will be raised and extended laterally to provide additional waste rock storage capacity. Progressive rehabilitation, contouring and revegetation will occur during operations and following mine closure.

The assessment area, comprising the direct impact footprint and the additional 20 m precautionary buffer, encompasses approximately 78.9 ha. Modified land cover predominates, including approximately 52.04 ha of exotic grassland and 2.72 ha of mine-disturbed land, together with smaller areas of road, ponds, rehabilitated mine workings and gorse or other woody exotic vegetation (Figure 6.5).

Indigenous vegetation includes approximately 14.87 ha of dense snow tussock grassland and 6.02 ha of moderately dense snow tussock grassland, comprising approximately 20.89 ha in total. This is one of the larger areas of affected tussock grassland within the MP4 footprint outside the Coronation Mining Area. Additional indigenous and semi-natural habitats include approximately 0.23 ha of shrubland, localised rock habitat, approximately 0.13 ha of ephemeral wetland, approximately 0.37 ha of riparian sedgeland, and smaller areas of riparian shrubland, freshwater herbaceous wetland, wetland sedgeland and wetland shrubland (Figure 6.5).

Tussock Grassland

Snow tussock grassland is assessed as High ecological value. Although parts of the grassland have been modified by grazing, fire and historic mining activity, some areas retain moderate to high indigenous cover, structural complexity and ecological integrity. The tussock grassland provides habitat for indigenous plants, lizards, terrestrial invertebrates and open-country birds and contributes to a broader network of dryland habitat in the Golden Bar landscape.

Dry Shrubland

Shrubland is limited in extent and is assessed as **Low ecological value** at the vegetation-community level because of its small area, modified condition and generally low structural and floristic diversity. Localised shrubland nevertheless provides habitat for indigenous plants, lizards and invertebrates, including Data Deficient and locally uncommon taxa.

Rock Outcrops and Tors

Rock habitat is assessed as **High ecological value**. The affected rock features are limited in mapped extent but provide distinctive microsites for indigenous flora and habitat for lizards and terrestrial invertebrates. Rock-associated plant values include Threatened, At Risk, Data Deficient and locally uncommon species.

Wetlands

Wetland freshwater herbaceous vegetation is assessed as **High ecological value**. Riparian sedgeland, riparian shrubland, wetland sedgeland and wetland shrubland are assessed as Moderate ecological value. These communities occur principally within shallow gullies, damp ground, wetland margins and seasonally wet areas around the existing pit and waste rock stack. They increase local habitat diversity and provide moisture-influenced habitat for indigenous plants, invertebrates, lizards and wetland-associated birds.

Ephemeral wetlands within the Golden Bar Mining Area are assessed as **Moderate ecological value**. Ephemeral wetlands are a naturally uncommon and nationally Critically Endangered ecosystem type. However, the affected Golden Bar examples are small and modified and generally support lower indigenous diversity than the long-inundation ephemeral wetlands at Coronation Mining Area. Their

naturally uncommon status and contribution to the local wetland mosaic nevertheless remain important considerations.

TAR Flora

Threatened, At Risk, Data Deficient and locally uncommon plant species occur within, or are associated with, the tussock grassland, rock, wetland, riparian and shrubland habitats. Golden Bar supports fewer Regionally Threatened plant records than Coronation Mining Area but includes important plant habitat and direct or near-footprint records associated with the Golden Bar Waste Rock Stack Extension. The ecological values of individual plant species are assessed separately according to their national or regional conservation status.

Invertebrates

The Golden Bar Mining Area supports an invertebrate assemblage associated with modified tussock grassland, riparian vegetation, wetlands, shrubland and isolated rock outcrops. Larger-bodied indigenous ground beetles are well represented in more densely vegetated parts of the area, and the tussock and riparian habitats support a diverse moth assemblage.

Conservation-significant invertebrate records include a single record of the Threatened – Nationally Vulnerable moth *Orocrambus sophistes*, two At Risk – Declining moths, *Nyctemera annulata* and *Pasiphila* sp. A (NZAC 04285480 “Carmichaelia”), and the At Risk – Uncommon moth *Bityla sericea*. Two individuals of the poorly known *Orocrambus* cf. *cyclopicus* have also been recorded. Although targeted surveys have not redetected *O. sophistes*, its record and the presence of other conservation-significant taxa elevate the rarity and distinctiveness of the assemblage. The Golden Bar invertebrate community is assessed as **High ecological value**.

Lizards

Three indigenous lizard species have been confirmed within the Golden Bar Mining Area: McCann’s skink (*Oligosoma maccanni*), southern grass skink (*Oligosoma chionocholescens*) and kōrero gecko (*Woodworthia* “Otago/Southland large”). McCann’s skink is widespread across grassland, rocky and modified habitats. Southern grass skink occurs particularly in tussock grassland, dense grass and damp gully vegetation. Kōrero gecko is associated with isolated schist outcrops and other rocky habitats, although it is less abundant than the two skink species.

Approximately 73.9 ha of suitable lizard habitat occurs within the Golden Bar assessment area. Population modelling provides an indicative estimate of approximately 48,200 lizards, comprising approximately 18,900 McCann’s skinks, 27,500 southern grass skinks and 1,800 kōrero geckos. These estimates are subject to uncertainty because they rely on density extrapolation across mapped habitat types and kōrero gecko densities are difficult to estimate reliably. The lizard community and associated habitat are assessed as High ecological value, reflecting the presence of two At Risk – Declining species, the large, estimated population, and the extent of tussock, dense grassland, gully and rocky habitat.

Avifauna

Avifauna habitat within the Golden Bar Mining Area is assessed as **Moderate ecological value**. The area supports an indigenous bird assemblage associated with open pasture, tussock grassland, sparsely vegetated ground, ponds, pit-lake habitat and mine-modified landforms. Indigenous species recorded

include South Island pied oystercatcher, silvereve, paradise shelduck, pied stilt, New Zealand fantail, southern black-backed gull, spur-winged plover, swamp harrier and welcome swallow.

South Island pied oystercatcher and silvereve are the conservation-status drivers confirmed within the Golden Bar survey area. A group of 21 South Island pied oystercatchers was recorded foraging on short pasture, demonstrating periodic congregation and locally important foraging use. Silvereve use is associated principally with vegetated margins and woody vegetation.

A breeding colony of southern black-backed gull or karoro is present on the existing Golden Bar pit lake. Karoro is nationally and regionally Not Threatened and is an adaptable species that uses natural and artificial nesting habitats. The colony demonstrates that the artificial pit lake provides breeding habitat but does not materially increase the overall avifauna value of the Golden Bar Mining Area. The area nevertheless provides functional open-country foraging habitat, open-water and pond habitat, and movement habitat for a range of indigenous birds.

Overall, the Golden Bar Mining Area is assessed as having **Very High ecological value** at the assessment-area scale. This reflects the presence of High-value snow tussock grassland, rock habitat and wetland freshwater herbaceous vegetation; High lizard and invertebrate values; Moderate avifauna, ephemeral wetland, riparian and other wetland values; and habitat for Threatened, At Risk, Data Deficient and locally uncommon species. Ecological values are spatially variable, and a substantial proportion of the assessment area comprises modified land cover of Low or Negligible ecological value.

Summaries of the ecological values and ecological value criteria for Coronation Mining Area are presented in Table 6-14 and Table 6-15.

Table 6-12. Summary of ecological values for Golden Bar mining area.

Ecological component	Ecological value
Avifauna	Moderate
Lizards	High
Invertebrates	High
Snow tussock grassland	High
Rock habitat	High
Wetland freshwater herbaceous vegetation	High
Ephemeral wetland	High
Riparian sedgeland	Low
Riparian shrubland	Low
Wetland sedgeland	Low
Wetland shrubland	Low
Shrubland	Low
Rare plants	Species-dependent

Table 6-13. Summary of ecological value criteria for Golden Bar Mining Area.

Criterion	Value assigned	Explanation
Representativeness	High	The Golden Bar Mining Area supports a representative inland Otago dryland habitat mosaic, including snow tussock grassland, shrubland, rock habitat, riparian sedgeland, riparian shrubland, ephemeral wetland and wetland vegetation. Although the area has been modified by historic burning, grazing, wildfire and mining, the affected snow tussock grassland retains moderate to high intactness in places and is assessed as High ecological value. Rock habitat and wetland freshwater herbaceous vegetation are also assessed as High ecological value. Three lizard species are present, but kōrero geckos are not common, and the invertebrate assemblage may be broadly representative of the predominantly tussock-dominated habitats characteristic of the wider area
Rarity/distinctiveness	High	The area supports several ecological receptors with elevated rarity or distinctiveness, including High value snow tussock grassland, High value rock habitat and High value wetland freshwater herbaceous vegetation. The rock habitat supports indigenous plants, including Regionally Declining or locally uncommon species, and the shrubland provides habitat for a Regionally Data Deficient plant species and locally uncommon species. Ephemeral wetland is present and represents a naturally uncommon ecosystem type, although the affected examples are assessed as having Moderate ecological value because of their small extent, low indigenous diversity and modified condition. Two At Risk- Declining lizard species, two At Risk – Declining invertebrate species and one Threatened moth are present.
Diversity and pattern	Moderate	Golden Bar Mining Area supports a varied but modified vegetation mosaic, including tussock grassland, shrubland, rock habitat, riparian vegetation, wetland vegetation, ephemeral wetland, exotic grassland and mine-disturbed land. The dryland and wetland vegetation communities provide habitat for Threatened, At Risk, Data Deficient and locally uncommon plant species. Fauna values are also present, including Moderate avifauna value, Moderate lizard value and Moderate invertebrate value. Diversity and pattern are therefore greater than in the Golden Bar Haul Road corridor, but remain influenced by modification, grazing, wildfire and historic mining.
Ecological context	Moderate	Golden Bar Mining Area contributes to the wider Macraes open-country ecological network through its extent of indigenous tussock grassland, localised wetland and riparian habitats, rock habitat and associated fauna habitat.

Criterion	Value assigned	Explanation
		The area provides functional habitat for open-country birds, indigenous lizards, invertebrates and rare plants. However, its ecological context is moderated by the previously disturbed and pastoral land use, fragmentation, and the presence of modified land cover within the assessment area.
Overall ecological value	High	The Golden Bar Mining Area is assessed as High overall ecological value at the mining-area scale. This reflects the presence of High value snow tussock grassland, rock habitat and wetland freshwater herbaceous vegetation, together with Moderate value ephemeral wetland, riparian vegetation, wetland sedgeland and wetland shrubland, and habitat for Threatened, At Risk, Data Deficient and locally uncommon plant, lizard and invertebrate species. Fauna values are generally High.



Figure 6.5. Vegetation composition and habitats within the Golden Bar area. The top images include the existing pit and pit lake, which will be expanded. The WRS expansion area includes several smaller waterbodies, including induced ephemeral wetlands and man-made ponds (bottom).

6.3.4.6 Back Road Waste Rock Stack

The BRWRS was previously consented under the Macraes Phase III Project but will not proceed as part of MP4. OGNZL proposes to surrender all existing resource consents that provide for the construction of BRWRS as a component of MP4.

The consented area covers approximately 172 ha on slopes draining into Deepdell Creek downstream of the existing Macraes operation. The landscape is dominated by tussock grassland, dry shrubland, and grazed exotic grassland, with stream gullies, riparian margins, and rocky outcrops providing greater habitat diversity.

Terrestrial Indigenous Vegetation

The BRWRS area contains approximately 38.53 ha of snow tussock grassland, 17.16 ha of shrubland and 2.90 ha of riparian habitat, occurring within a wider mosaic of grazed exotic grassland, rocky outcrops and modified land. Snow tussock grassland is the most extensive indigenous vegetation type and (in absence of quantitative data) is assigned **Very High** ecological value as per other large areas of tussock within OGNZL landholdings (such as Coronation). Shrubland occurs as interspersed patches and in association with gullies and other less modified parts of the site and is assigned **Very High** ecological value, reflecting its habitat function for Threatened and At Risk fauna and flora. For example, high value fernbird have been recorded nearby). Riparian vegetation occurs along stream gullies and drainage margins and is assigned **High** ecological value. Collectively, these vegetation types provide approximately 58.6 ha of indigenous-dominated habitat within the BRWRS area and contribute to a relatively diverse habitat mosaic associated with the Deepdell Creek catchment. In the absence of a separate vegetation values assessment for BRWRS, these ecological values have been assigned precautionarily using the available habitat mapping, flora and fauna information.

Invertebrates

Invertebrate values are assessed as **Very High overall**. While the area occurs within a modified pastoral and mining landscape, tussock grassland, shrubland, and riparian habitats retain some ecological function and habitat value.

Lizards

Lizard values are **Very High overall**. McCann's skink, southern grass skink, and kōrero gecko are all widespread and abundant. McCann's skink is common within rocky gully habitats, southern grass skink occupies both rocky and grassland environments, and kōrero gecko has been recorded at all surveyed rock outcrops. Although no larger Threatened lizard species have been confirmed despite extensive survey effort, the possibility of small remnant populations cannot be entirely excluded.

Avifauna

Avifauna values are assessed as **Moderate overall**, reflecting the presence of tussock, shrubland, and riparian habitats that support indigenous open-country bird species, including nationally At Risk taxa. Of note, fernbird were only recorded from a location near BRWRS and GPUG, where associated

habitats would not be removed. Overall, the BRWRS area comprises a substantial area of modified but ecologically high value and functional habitat, including tussock grassland, dry shrubland, riparian gullies, rocky outcrops, and associated fauna. Surrendering consents for the construction of BRWRS avoids loss of high value ecological features.

Summaries of the ecological values and ecological value criteria for Coronation Mining Area are presented in Table 6-14 and Table 6-15.

Table 6-14. Summary of ecological values for Back Road Waste Rock Stack.

Ecological component	Ecological value
Avifauna	Moderate
Lizards	Very High
Invertebrates	Very High
Snow tussock grassland	Very High
Shrubland	Very High
Riparian habitat	High

Table 6-15. Summary of ecological value criteria for Back Road Waste Rock Stack.

Criterion	Value assigned	Explanation
Representativeness	High	The BRWRS area supports a large modified open-country habitat mosaic, including tussock grassland, dry shrubland, riparian gullies, rocky habitats, exotic grassland and mine-disturbed land. The area includes approximately 38.53 ha of tussock habitat, 17.16 ha of shrubland and 2.90 ha of riparian habitat. These habitats are representative of modified Macraes open-country systems, although formal vegetation-community value ratings for BRWRS have not been provided in the available values table. The lizard and invertebrate assemblages are largely representative of the types of habitat present in the area and within the wider surrounding landscape.
Rarity/distinctiveness	High	Known rarity and distinctiveness values are primarily associated with indigenous fauna and habitat. Three species of lizard, including two At Risk – Declining species, are widespread and abundant within BRWRS. No larger threatened lizard species have been confirmed, although the assessment does not fully dismiss the possibility of small relict populations in isolated habitats. Avifauna values include South Island pied oystercatcher and New Zealand pipit, both nationally At Risk – Declining.

Criterion	Value assigned	Explanation
		Four At Risk – Declining invertebrate species are present.
Diversity and pattern	High	BRWRS contains a broad habitat mosaic relative to many modified mining areas, including tussock grassland, dry shrubland, riparian gullies, rocky habitats, exotic grassland and mine-disturbed land. Avifauna surveys recorded a range of indigenous open-country and wet-margin species, including New Zealand pipit, South Island pied oystercatcher, pied stilt, Eurasian coot, grey warbler, silvereye, southern black-backed gull, spur-winged plover and swamp harrier. Lizard and invertebrate diversity are moderate, reflecting the modified and disturbed tussock habitat.
Ecological context	High	The area forms part of the broader Macraes open-country ecological network and provides habitat for indigenous birds, lizards and invertebrates within a modified mining and pastoral landscape. It is located on slopes draining into Deepdell Creek downstream of the current Macraes mining operation, with stream gullies, riparian margins and abundant rock outcrops contributing to habitat function.
Overall ecological value	Very High	BRWRS is assessed as Very High overall ecological value at the mining-area scale, based on the known avoided terrestrial values. This rating is driven by the large extent of retained tussock grassland, shrubland, riparian and rocky habitats, and by the comparatively important lizard and invertebrate values. Avifauna values are Moderate and invertebrate values are Low. Formal vegetation-community, wetland and freshwater value ratings have not been assigned in the available material, so this overall rating should be treated as a site-level synthesis of known terrestrial values rather than a substitute for detailed vegetation value ratings.

6.3.5 Overall summary of the ecological values

An overall summary of the ecological values for each mining area is presented in Table 6-16.

Table 6-16. Summary of terrestrial, wetland and fauna ecological values as described and assessed in documents E2 – E5 (refer Table 2-2). Note that not all values are provided, as some ecosystems do not include all ecosystem types.

Ecological receptor/land-cover type	Coronation Mining Area	BRWRS	GPUG	Central Mining Area	Golden Bar Haul Road	Golden Bar Mining Area
Terrestrial vegetation						
Snow tussock grassland	High	Very High	Very High	Low	Low	High
Shrubland	Low	Very High	High	Low	Low	Low

Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Ecological receptor/land-cover type	Coronation Mining Area	BRWRS	GPUG	Central Mining Area	Golden Bar Haul Road	Golden Bar Mining Area
Rock habitat	Very High	Very High	Very High		Low	High
Freshwater/Wetland						
Ephemeral wetland	Very High			High	High	High
Riparian freshwater herbaceous vegetation	High					
Riparian sedgeland	Moderate					Moderate
Riparian shrubland						Moderate
Wetland freshwater herbaceous vegetation	High			Low	Low	Low
Wetland sedgeland	Moderate			Low	Low	Low
Wetland seepage	High					
Wetland shrubland	Moderate					
Fauna						
Avifauna	Moderate	Moderate	Moderate	Moderate	Low	Moderate
Lizards	Moderate	Very High	Very High	Moderate	Low	High
Invertebrates	Moderate	Very High	Very High	Moderate	Low	High

6.4 Assessment of Magnitude and Level of Effect

The Project has the potential to result in a range of direct and indirect adverse effects on indigenous vegetation through vegetation clearance, landform modification, excavation, waste rock placement, road construction, and associated mining activities. This section describes the nature and extent of those effects, assesses and justifies their magnitude, and then determines the resulting level of effect by considering the assigned ecological value of the affected vegetation or habitat.

6.4.1 Terrestrial Vegetation and flora

The principal indigenous terrestrial habitat and vegetation communities affected by MP4 are:

- Moderate value dry Shrubland;
- Very High value snow tussock grassland; and
- Very High value rock and tor habitats and associated vegetation and flora communities.

These indigenous ecosystem types provide important ecological functions within the Macraes' ED, including habitat for indigenous flora and fauna, ecological connectivity, ecosystem resilience, nutrient cycling, soil stabilisation, and support for Threatened and At-Risk species. Snow tussock grassland and rock habitats are also important components of the remaining indigenous vegetation mosaic within the wider Macraes landscape.

6.4.1.1 Direct Effects

Direct effects are generally those effects that will occur within the direct loss footprint, such as vegetation clearance, resulting in loss of habitats, including mortality to flora and fauna, and potentially displacement and habitat loss to mobile fauna. These are discussed and described below

6.4.1.1.1 Loss of ecosystem extent

The Project will result in permanent removal of indigenous vegetation communities within the direct impact footprint.

Overall, tussock grassland accounts for approximately 97% of all indigenous vegetation loss within the ZOI and therefore represents the dominant vegetation effect of the Project.

Dry shrubland loss is relatively limited in extent and occurs primarily within Coronation Mining Area. Rock habitat loss is very small in absolute area but is ecologically important because of the specialised ecological functions and habitat values (flora and fauna) associated with schist outcrops and rocky substrates.

Tables and Table 6-18 summarise the extents (ha) of direct loss and additional potential edge effect, up to 20 m from direct loss) of indigenous vegetation. Figure 6.6 identifies the mapped extents of ecosystems within the wider OGNZL landholdings). These effects and their magnitudes are described below.

Table 6-17. Extent of direct loss of terrestrial ecosystems per project area

Ecosystem	Coronation Mining Area	Central	Golden Bar / Haul Road	Total Affected Area (ha)
Dry shrubland	2.09	0.05	0.08	2.22
Tussock grassland	55.41	1.60	18.41	75.42
Rock	0.13	0.00	0.03	0.16

Table 6-18. Extent of predicted effect (direct loss plus additional 20 m edge) of MP4 on terrestrial ecosystems per project area

Ecosystem	Coronation Mining Area	Central	Golden Bar / Haul Road	Total Affected Area (ha)
Dry shrubland	2.76	0.05	0.25	3.06
Tussock grassland	63.24	2.37	24.40	90.01
Rock	0.17	0.00	0.09	0.26

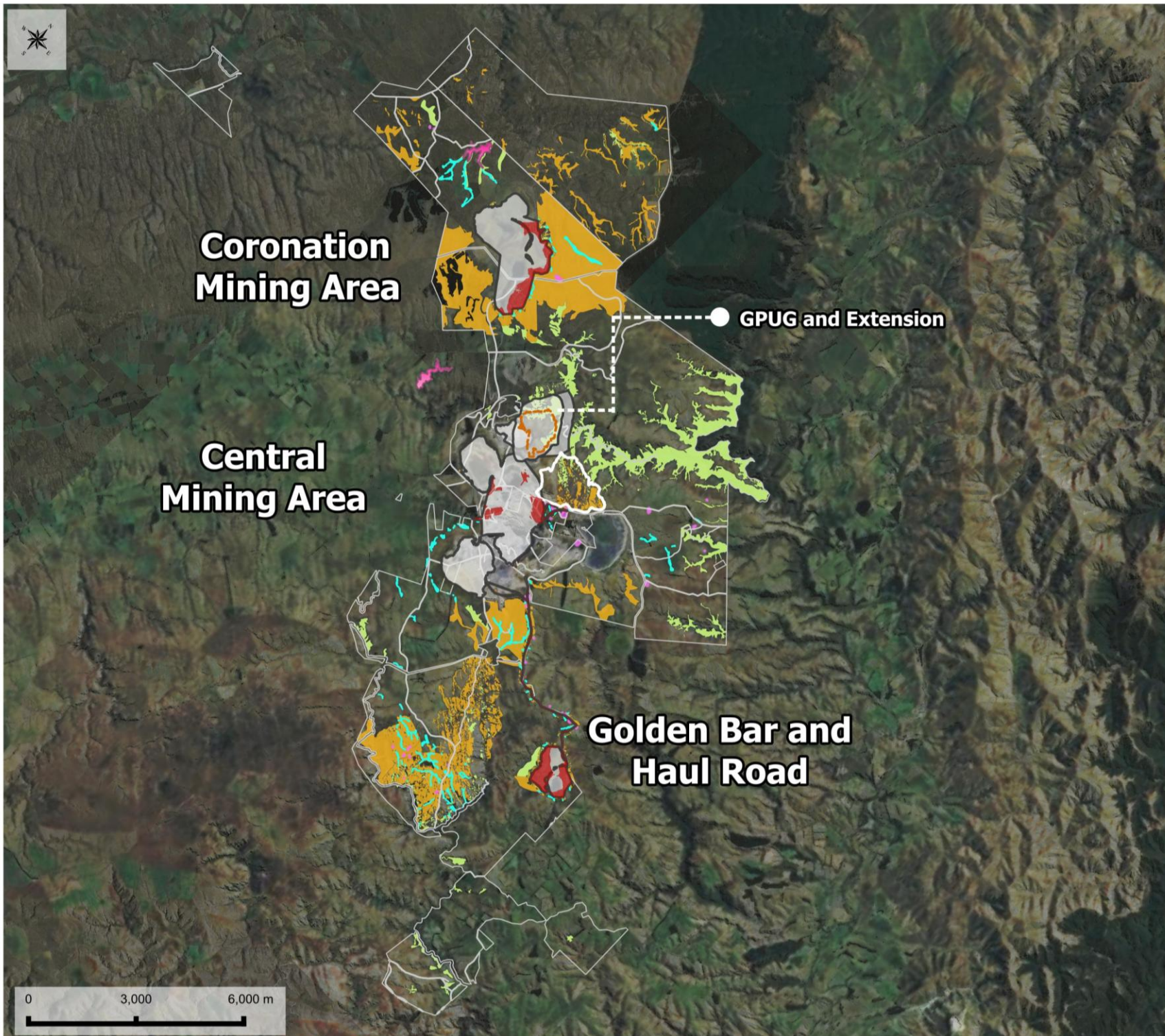
Table 6-19. Proportional impact on indigenous terrestrial ecosystems, based on extent mapped within OGNZL landholdings (refer Figure 6.6) for all of MP4.

Ecosystem	Coronation Mining Area	Central	Golden Bar / Haul Road	Affected Area (ha)	Proportion of Loss (%)	Total Magnitude
Dry shrubland	2.76	0.05	0.25	3.06	0.38	Low
Tussock grassland	63.24	2.37	24.40	90.01	4.51	High*
Rock	0.17	0.00	0.09	0.26	0.84	Low**

**Proportional loss is low (<5%), however areal extent (90 ha) is high.*

*** Magnitude of 'Negligible' (proportion and area) increased to 'Low' to acknowledge Very High Value'*

Figure 6.6 (Over-page). Map showing extent of mapped tussock, shrubland and wetland within OGNZL landholdings



Ecosystem Extents OGL Landholdings

Date: 07/08/2026

Drawn By: MS

Client: OceanaGold New Zealand Ltd

Scale: 1:142,857

Legend

OGL Landholdings: 15,018.44 ha

Camp and Coal Creek

Back Road Waste Rock Stack

MP4 Impact Areas

GPUG Consented Boundary

Areas of habitat/vegetation loss within the MP4 Project

Indicative Ecosystem Types within OGL Landholdings

Tussock Grassland: 1,913.46 ha

Dry Shrubland: 1,294.38 ha

Wetlands

Gully: 45.66 ha

Ephemeral: 9.70 ha

Vegetation boundaries and classifications were interpreted from LINZ aerial imagery and validated where possible through selected ground-truthing and desktop aerial analysis. Vegetation types and boundaries should be regarded as indicative.

SOURCES

LINZ Basemap aerial

MAP PROJECTION

NZGD2000 / New Zealand Transverse
Mercator 2000

Bioresearches
A Babbage Company

6.4.1.1.2 Loss of habitat supporting Threatened and At-Risk flora Species.

Vegetation clearance will result in the loss or modification of habitat supporting tall tussock grassland, Threatened, At Risk, Data Deficient and locally uncommon plant species.

The highest concentration of Threatened and At-Risk plant records occurs within Coronation Mining Area, particularly within tussock grassland which supports the highest area of indigenous vegetation loss. Vegetation removal may therefore result in direct loss of individual plants, reduction in habitat extent, and fragmentation of remaining habitat.

A total of twenty-nine TAR flora species occur within the direct loss footprint, including two Regionally critical species at (Dwarf broom, *Carmichaelia corrugata*) and St. John's wort *Hypericum rubicundulum*), thirteen other regionally threatened species and fourteen At-Risk species. All of these species occur at Coronation Mining Area, while a few are also present at other project locations (four spp. each also occur at Golden Bar and Macraes Central).

6.4.1.1.3 Habitat fragmentation and Connectivity

Vegetation clearance may reduce connectivity between remaining indigenous vegetation remnants.

Although the wider Macraes landscape is already highly modified by pastoral land use and mining activities, indigenous tussock grassland and shrubland remnants provide ecological linkages for indigenous flora and fauna. Additional vegetation removal may further reduce continuity of these habitats at a local scale, and impact areas are generally associated with the current edges of existing infrastructure, including at Golden Bar, where works would re-impact previously disturbed vegetation environments where some indigenous vegetation is naturally regenerating. Overall fragmentation and connectivity effects would be **low**.

6.4.1.2 TAR flora

At the Macraes' ED scale, within direct impact areas, the pre-management magnitude of effect was assessed as:

- **Very High** for five Threatened or At-Risk plant species,
- **High** for six species,
- **Moderate** for seven species,
- **Low** for nine species, and
- **Negligible** for two species.

High magnitudes were generally assigned where the Project would affect a substantial proportion of the known local population, remove one of only a small number of known sites, affect the largest known local population, or affect species with highly restricted distributions and elevated regional threat status. Moderate magnitudes were assigned where losses could represent an appreciable proportion of the known local population, or where limited distributional and taxonomic information warranted a precautionary assessment. Low magnitudes generally applied where only a small number or proportion of plants would be affected relative to populations elsewhere in the ED, notwithstanding

the regional conservation status of the species or the overall size of the Project footprint. A detailed, species-specific analysis is provided in Table 6-20 below.

Table 6-20. Threatened and At-Risk plant species within the direct loss footprint, assessed pre-management magnitude with ED context.

Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect	Rationale
Dwarf broom (<i>Carmichaelia corrugata</i>)	Coronation Mining Area	Threatened – Regionally Critical	Threatened – Nationally Vulnerable	Very High	Very High	The species has only recently been discovered to inhabit the Macraes area which, together with a few sites in the Waitaki Valley, represents a southern grouping of the species where none of the sites contains more than 10's of plants. The species is declining in Otago where it is classified as Regionally Critical, hence the Very High magnitude of effect. The species is more frequently recorded in inland Canterbury and on the Canterbury Plains hence the Low magnitude of effect at a national scale.
Indigenous St John's wort (<i>Hypericum rubicundulum</i>)	Coronation Mining Area	Threatened – Regionally Critical	Threatened – Nationally Endangered	Very High	Very High	Affecting about 20% of local population of a species known to be very rare and at high risk in Otago. At a national scale the species is present at a number of sites on protected land where there are few threats.
Wetland daisy (<i>Lagenophora barkeri</i>)	Coronation Mining Area	Threatened – Regionally Endangered	At Risk – Declining	Very High	Low	Only a small area affected relative to the number of sites where plants of this form is known in the local area, but given its Regionally Endangered status an elevated magnitude of effects is given. At a national scale it is known at a number of sites, many in protected areas with few threats.
<i>Lobelia ionantha</i>	Frasers / Innes Mills	Threatened – Regionally Endangered	At Risk - Declining	Very High	High	Two sites impacted, out of approximately 30 known within Macraes. A species with reasonably specific habitat requirements which are now very rare. Known to have been lost to sites in the ED due to weed invasion and requires relatively intact ephemeral wetland vegetation. Loss is a high proportion of the secure populations of this species in the ED.
<i>Leptinella pusilla</i>	Coronation Mining Area	Threatened – Regionally Endangered	At Risk – Declining	Very High	Moderate	Only a single plant affected relative to the number of sites where plants of this form is known in the local area, but given its Regionally Endangered status an elevated magnitude of effects is given. At a national scale it is known at a number of sites, many in protected areas with few threats.
<i>Rytidosperma thomsonii</i>	Coronation Mining Area, Golden Bar	Threatened – Regionally Endangered	At Risk – Declining	Very High	Very High	A species only known from two sites at Macraes, so the project at Coronation will result in a 50% loss of the known populations. At a national scale this species is sparsely distributed in dry dryland habitats, but at the sites where it occurs there can be 100's of plants. Macraes is at the periphery of the range of this species.
<i>Sonchus novae-zelandiae</i>	Coronation Mining Area	Threatened – Regionally Endangered	Threatened – Nationally Endangered	Very High	Very High	A species known from few sites at Macraes and with few plants at each. Nationally it is widely distributed and can be frequently encountered at some sites, but appears to be less common than previously, even in suitable habitat and there is concern for its status. May be a species that is affected by a changing climate.
<i>Acaena buchananii</i>	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	High	Loss of one of seven sites locally. Each site likely to be represented by 1-3 individuals. Species is more common in Central Otago and Mackenzie Basin so impact at a national level is negligible.
Narrow-leaved speargrass (<i>Aciphylla subflabellata</i>)	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	Low	Loss of one plant from a local population likely to number in the 100's across 58 known sites would warrant Negligible, but the estimated total population size and predicted rate of loss in Otago means any loss of plants is an elevated risk hence the slightly higher magnitude of Low. This species appears to be more common in the northern part of its range and therefore impact at a national scale is Negligible.

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect	Rationale
Tufted hair grass (<i>Deschampsia cespitosa</i>)	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	Very High	The project will affect the largest known population in the Macraes area and since the species is assessed as Regionally Vulnerable due to the limited extent and predicted rate of loss of its wetland habitat. At a national scale the species has some very large populations (1000's of plants) at some sites (especially in Southland), many of which are on Conservation Lands hence the Negligible magnitude of effects at a national scale.
<i>Epilobium insulare</i>	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	Low	A species that is widely distributed in wet gully bottoms in the Macraes area. Nationally it is widely but sparsely distributed that is likely to occupy a number of higher latitude gully bottom wetland sites.
<i>Euchiton polylepis</i>	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	High	A rare species at Macraes that is classified as Threatened in Otago. However, only one plant is affected, hence the High (rather than Very High) magnitude of effect at a local scale. Nationally seems to be infrequently recorded, but it has wide distributional range. Likely to be a Negligible level of effects at a national scale as only one plant affected.
<i>Juncus pusillus</i>	Frasers / Innes Mills	Threatened – Regionally Vulnerable	At Risk – Naturally Uncommon	Very High	Moderate	A species that is probably widely distributes through the area, but in scattered and usually small populations. May tolerate some artificial habitats.
<i>Lobelia perpusilla</i>	Frasers / Innes Mills	Threatened – Regionally Vulnerable	Not Threatened	Very High	High	A species of specific habitat needs (intact ephemeral wetlands, which are now rare) and known to have been lost to some sites due to weed invasion. The loss from MP4 is a high proportion of the secure populations of this species in the ED.
Dwarf greenhood orchid (<i>Pterostylis tristis</i>)	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	Moderate	Large footprint of Coronation Mining Area means it may affect a moderate proportion of the local population and because of this and its Regionally Vulnerable threat status a precautionary approach has been applied. Nationally it has a wide distribution and appears more common in the northern part of its range.
Delicate bluegrass (<i>Anthosachne falcis</i>)	Coronation Mining Area, Frasers / Innes Mills	Regionally Declining	At Risk – Declining	High	Low	Low level of effects at a local scale is solely due to the size of the project footprint. Stronghold of this species is in the Mackenzie Basin and inland Canterbury where there are likely to be large populations of plants in some areas so magnitude of effect is Negligible at a national scale.
Desert broom (<i>Carmichaelia petriei</i>)	Coronation Mining Area, Golden Bar, Golden Bar Haul Road, Frasers / Innes Mills	Regionally Declining	At Risk – Declining	High	Low	Despite the number of plants present in the footprint this species is represented by 1000's of individuals in the local area and so the magnitude of effects is considered Low. It is a widespread species in the south-eastern South Island and can be common in some areas, and is also present on Stewart Island, hence the Negligible magnitude of effect at the national scale.
<i>Colobanthus strictus</i>	Coronation North	Regionally Declining	Not Threatened	High	Moderate	A small, inconspicuous species that is easily missed during surveys. This means the size of the affected populations is not properly known and therefore the impact at the ecological district is uncertain.
<i>Juncus distegus</i>	Coronation Mining Area, Frasers / Innes Mills	Regionally Declining	Not Threatened	High	Low	Only a small number affected relative to the other sites where it has been recorded in the local area, however it is likely to be declining in Otago due to habitat loss (hence the elevation from Negligible to Low). At a national scale it has proved to be more common than previously supposed and shifted from At Risk - declining to Not Threatened nationally.

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect	Rationale
New Zealand mint / hioi (<i>Mentha cunninghamii</i>)	Coronation Mining Area	Regionally Declining	At Risk – Declining	High	Low	<i>Mentha cunninghamii</i> is a species that is common enough in the Macraes E.D. that it is not often recorded as point data (hence the low number of recorded sites). At a national scale it is present at a large number of sites where it can be very common at some.
<i>Rytidosperma buchananii</i>	Coronation Mining Area	Regionally Declining	At Risk – Declining	High	Moderate	Only 3 plants affected. A species that is rarely recorded at Macraes where it appears to be genuinely rare. At a national scale this species is widely distributed with large populations at some sites but populations in some areas are at risk of short tussock grassland habitat loss.
Wetland grass (<i>Agrostis pallescens</i>)	Coronation Mining Area	Regionally Naturally Uncommon	At Risk – Naturally Uncommon	Moderate	High	Species only definitely known at a few sites (but with very low certainty due to identification challenges) in the Macraes area and the sites being lost have a good coverage by the species, hence it could be that c. 33% of the known local population would be lost. At a national level it is thought to be a component of higher altitude wetland vegetation (grass flora) and hence is considered Regionally Naturally Uncommon.
<i>Brachyscome longiscapa</i>	Coronation Mining Area	Regionally Naturally Uncommon	At Risk – Naturally Uncommon	Moderate	Negligible	While it is probable that a number of individuals of this species are present in the footprint, it is a species that is frequently observed in moderate elevation open tussock grassland at Macraes and so points of occurrence are usually not recorded. Even given the large size of the project footprint it is highly unlikely that this represents more than an extremely small proportion of the local population. This species is more common at higher elevation sites and so the impact at a national scale is Negligible.
Hooker's mountain daisy (<i>Celmisia hookeri</i>)	Coronation Mining Area, Golden Bar	Regionally Naturally Uncommon	At Risk – Naturally Uncommon	Moderate	Negligible	Despite the number of plants present in the footprint this species is represented by many 1000's of individuals at multiple sites in the local area and so the magnitude of effects is considered Negligible. As the Macraes area probably represents the majority of the national population the magnitude of effect at the national scale is the same as at the local scale.
<i>Lagenophora pinnatifida</i>	Coronation North	Regionally Naturally Uncommon	Not Threatened	Moderate	Moderate	Although only a small number of plants thought to be impacted, a magnitude of Moderate has been given at the ED scale to reflect the uncertainty around the actual distribution of this species in the area and wetland environments in which it lives. A taxonomically difficult species which is morphologically variable and easily confused with other species.
<i>Poa pusilla</i>	Coronation Mining Area	Regionally Naturally Uncommon	Not Threatened	Moderate	Moderate	A species of restricted distribution at Macraes. Has a wide national distribution and occurs in a range of habitats.
<i>Shawia bullata</i> (formerly <i>Olearia bullata</i>)	Coronation Mining Area, Frasers / Innes Mills	Regionally Naturally Uncommon	Not Threatened	Moderate	Low	A species that is present in most gully heads at Macraes and also in Otago. A Low score is given because of the large size of the impact area.
<i>Oxalis rubens</i>	Coronation Mining Area	Regionally Data Deficient	Not Threatened	Moderate	Low	A species that appears to be sparsely but widely distributed in rocky sites in dry open short grassland at Macraes. Nationally it occurs at a number of sites and occupies a number of different habitats.
Porcupine shrub	Golden Bar	Regionally Data Deficient	Data Deficient	Moderate	High	A poorly known species with little information on its distinguishing characters. Plants at Macraes presumed to be this taxon as visually differs from the other forms of <i>M. alpinus</i> in the Macraes area and based on visual comparison with a photo of CHR 54568 on SCD database. Can be difficult to distinguish from other <i>Melicytus alpinus</i> segregates with which

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect	Rationale
(<i>Melicytus</i> aff. <i>alpinus</i> 'Otago')						it co-occurs. Distribution in Otago largely unknown however is the subject of a current survey programme.

6.4.1.3 Indirect Effects

Indirect effects are generally those effects that will occur beyond the direct loss footprint. For example, creation of new vegetation edges adjacent to mining infrastructure may alter environmental conditions in retained vegetation through:

- increased weed invasion;
- altered microclimatic conditions;
- increased dust deposition;
- changes in soil moisture;
- increased exposure to disturbance.

These indirect effects are briefly discussed below.

6.4.1.3.1 Dust deposition

Dust generated during earthworks, haulage and mining operations may accumulate on adjacent vegetation.

Potential effects include:

- reduced photosynthetic performance;
- reduced plant vigour;
- altered species composition;
- increased susceptibility to drought stress.

These effects are expected to be localised and managed to **low magnitude** effect through standard dust suppression measures.

6.4.1.3.2 Weed Invasion

Disturbance associated with vegetation clearance and soil exposure may facilitate the establishment and spread of exotic plant species.

Weed invasion may reduce indigenous vegetation condition by:

- competing for resources;
- suppressing indigenous regeneration;
- altering vegetation structure and composition.

Edge tussock plots (undertaken at 5-10 m from existing infrastructure edges) undertaken at Coronation Mining Area indicate a comparatively high indigenous plant species richness when compared with other tussock plots throughout the wider landscape and therefore weed invasion is considered to be no more than **low magnitude** of effect, if noticeable.

6.4.1.3.3 *Sedimentation and surface water effects*

Sediment runoff from disturbed areas may affect adjacent vegetation communities through:

- soil burial;
- altered substrate conditions;
- reduced vegetation health and recruitment.

These effects are expected to be managed through erosion and sediment control measures; however, it is acknowledged that some spillover or control measure may fail, resulting in direct loss. Such effects are considered unlikely, and localised if at all, representing a **low magnitude**.

6.4.1.3.4 *Cumulative Effects*

The Macraes landscape has experienced extensive historical modification through pastoral development, mining activities, vegetation clearance, oversowing and grazing. Remaining indigenous vegetation communities are therefore already substantially reduced (and in some instances, functionally extinct, such as podocarp forest) and fragmented relative to their historical extent.

Cumulative effects on indigenous vegetation may arise through:

- incremental loss of tussock grassland;
- ongoing fragmentation of shrubland remnants;
- progressive reduction in habitat quality;
- continued pressure from weeds and land-use change.

The Macraes ED provides an appropriate landscape-scale context for assessing cumulative effects because it encompasses the wider indigenous vegetation resource potentially affected by the Project.

6.4.1.3.5 *Dewatering GPUG extension*

Underground dewatering is confined to the GPUG extension works which may result in groundwater drawdown and subsidence. Any resulting hydrological changes are expected to primarily affect vegetation communities associated with gullies, valley floors, seepages, and other areas reliant on shallow groundwater or elevated soil moisture. Potential ecological effects of groundwater drawdown include:

- Physiological water stress, resulting in reduced photosynthesis, plant health;
- Increased susceptibility to drought, pests, and disease, potentially leading to plant mortality;
- Changes in plant community composition, with drought-tolerant species replacing more moisture-dependent species.

Although many of the dominant shrubland species are adapted to relatively dry inland Otago conditions, prolonged groundwater decline may alter vegetation composition in moisture-dependent areas and reduce habitat quality for indigenous fauna that rely on structurally diverse shrubland habitat.

Subsidence associated with underground mining may also affect terrestrial vegetation by:

- Altering surface topography;
- Drainage patterns;
- Soil structure; and
- Create localised depressions, cracking, or changes in slope gradients.

This can cause localised waterlogging in some areas and increased drying in others, affecting vegetation health and potentially altering plant community composition over time. Where these physical changes occur in conjunction with groundwater drawdown, the cumulative effects on vegetation condition and habitat quality may be greater than either stressor acting independently.

While the extent and magnitude of groundwater level changes remain uncertain, preliminary hydrogeological investigations undertaken by PSM indicate that dewatering may result in localised subsidence and reductions in groundwater availability, including potential dewatering of Deepdell Creek and its associated wetland systems (PSM 2026).

However, the anticipated reduction in groundwater levels is currently considered likely to be low, as operation of the existing GPUG has not resulted in any discernible dewatering of Deepdell Creek to date (GHD 2026). Nevertheless, the extent of groundwater drawdown and its potential ecological consequences remain subject to confirmation through the final hydrogeological report. Indirect effects on wetlands are discussed separately in Section 6.4.6.3.

In consideration of the above, such effects are anticipated to be minimal and are therefore considered to represent a **low** magnitude of ecological effect, however this is subject to confirmation through the final hydrogeological report.

6.4.1.4 Summary of Effects and Magnitude

Actual and potential effects are conservatively assessed as having potential to occur up to 20 m from the direct loss footprint, and the extent of this is quantified in Table 6-21 below. The rationale for this extent being considered conservative, is based on four tussock plots undertaken at 5 – 10 m from the existing pit and rock stack edges at Coronation Mining Area, which do not indicate any degradation with respect to measures of tussock structure, integrity and plant diversity (Table 6-22).

A summary of the terrestrial ecosystem values and magnitudes per project area is provided in Table 6-23.

Table 6-21. Extent of potential edge effect (up to 20 m from direct loss footprint) of MP4 on terrestrial ecosystems per project area

Ecosystem	Coronation Mining Area	Central	Golden Bar / Haul Road	Edge Area (ha)
Dry shrubland	0.67	0.0	0.17	0.84
Tall Tussock	7.83	0.77	5.99	14.59
Rock	0.04	0.00	0.06	0.10

Table 6-22. Edge effects for tussock plots taken 5-10 m from existing pits, rock stacks.

Tussock Vegetation Plots	% cover	Average canopy height	Native spp. Richness	% Indigenous Richness
Median value for Edge Plots (n = 4)	62.5	70	13.5	58
Median value for all Plots (n= 31)	46.7	85.0	5.0	40.0
Highest recorded plot value (n = 31)	99.0	170.0	16	61

Table 6-23. Summary of value and magnitude of effect on terrestrial vegetation per project component (prior to mitigation).

Location	Vegetation system / ecosystem	Value	Magnitude
Coronation Mining Area	Tussock grassland	Very High	High
	Dry Shrubland	Moderate	Low
	Rock	Very High	Low
GPUG Extension	All vegetation	Very High	Low
Central Mining Area	Tussock grassland	Low	Low
	Dry Shrubland	Low	Negligible
	Rock	N/A	N/A
Golden Bar Haul Road and Mining Area	Tussock grassland	Low	High
	Dry Shrubland	Moderate	Low
	Rock habitat	High	Low

6.4.1.5 Avoidance and minimisation

Vegetation avoidance has been incorporated into project design and footprint refinement wherever practicable. Of note, existing consents associated with BRWRS and the high ecological values within this area will be surrendered as part of MP4. Complete avoidance of vegetation effects is not practicable in all cases, particularly where the Project requires access to fixed ore bodies.

Management measures to minimise indirect effects on terrestrial vegetation will include clear delineation of work areas, protection of retained vegetation, staged vegetation clearance where practicable, dust suppression, erosion and sediment controls, weed hygiene and control, and restrictions on vehicle and stock access. These measures are intended to minimise accidental vegetation disturbance, reduce degradation of retained habitats, and limit the spread of weeds into indigenous vegetation.

Direct vegetation management measures will be set out in set out in the Vegetation and TAR Flora Management Plan and implemented under supervision of the Project Botanist to minimise adverse effects on indigenous vegetation communities and Threatened and At Risk (TAR) flora. These measures include targeted salvage and relocation of salvageable TAR plant species, with priority given to species that are regionally or nationally Threatened or At Risk, taoka species listed in Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998, and indigenous plant species that function as host plants for Threatened and At-Risk invertebrates.

Approximately 10% of tussock vegetation within each major Project area will also be salvaged and relocated, with salvage focused on areas supporting relatively high indigenous plant diversity and concentrations of TAR flora and invertebrate host plants. Salvaged vegetation will be used for direct transfer or establishment within restoration and enhancement areas, with a focus on Murphys ecological enhancement area.

In addition, almost all TAR plant species identified within the Project area will be incorporated into wetland, tussock grassland, and dry shrubland planting schedules to maximise their representation within restoration areas. Where species are amenable to salvage, propagation, and successful establishment, these measures are expected to substantially reduce adverse effects on TAR flora by retaining individuals, increasing representation within restored habitats, and maintaining populations within the wider Macraes landscape.

These measures will also provide complementary benefits for associated indigenous invertebrates through the retention and establishment of important host plant species. TAR flora management and restoration measures are set out in the Vegetation and TAR Flora Management Plan, with associated invertebrate host plant salvage described in the Invertebrate Management Plan.

Further, management measures would include monitoring and triggered management for TAR plant species that are known to occur within the 20 m indirect edge zone, direct vegetation transfer (salvage of plants and vegetation), seed collection, propagation, translocation, and post-transfer monitoring.

Recipient sites will require ongoing monitoring and active management, including stock exclusion and pest plant and animal control.

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For rock habitats, management will focus on identifying and protecting retained rock outcrops, preventing accidental disturbance, and avoiding unnecessary removal or burial of rocky features. Where impacts cannot be avoided, salvage or direct transfer of associated vegetation and substrate will form part of the Vegetation and TAR Flora Management Plan.

These measures will substantially reduce the extent and severity of direct and indirect vegetation effects on most TAR flora to low level effects, however it is acknowledged that some TAR flora management will have uncertain outcomes.

Minimisation measures are proposed as described in Table 6-24 below.

Table 6-24. Avoidance and minimisation measures for terrestrial vegetation.

Effect pathway	Management measure
Vegetation clearance	Clearly demarcate works boundaries before clearance, retain vegetation outside the approved footprint where practicable, and undertake pre-clearance checks for Threatened, At Risk, Data Deficient and locally uncommon plant records.
Loss of Threatened, At Risk, Data Deficient or locally uncommon plants	Manage affected plants through the Vegetation and TAR Flora Management Plan, which includes vegetation direct transfer, seed collection, propagation, salvage, translocation, recipient-site preparation and post-transfer monitoring.
Loss of high-value indigenous vegetation communities	Avoid retained areas of High and Very High value vegetation where practicable through final set-out, exclusion fencing and construction controls. Where loss cannot be avoided, address residual effects through the residual effects management package (document E13, Bioresearches 2026l).
Disturbance of retained rock habitat	Demarcate retained rock outcrops and rocky habitats, avoid unnecessary stripping or burial of rock features, and consider salvage or direct transfer of associated plants and substrate where feasible.
Dust deposition	Implement dust suppression measures, including watering, stabilisation of exposed surfaces and management of haul roads, to reduce dust deposition on adjacent retained vegetation.
Weed invasion and edge effects	Implement weed hygiene, weed control and progressive rehabilitation measures to reduce weed establishment in disturbed margins and retained indigenous vegetation.
Hydrological change affecting moisture-sensitive vegetation	Maintain hydrological inputs to retained seepage, riparian and wetland vegetation where practicable, manage road drainage and runoff, and monitor retained sensitive vegetation where hydrological effects are possible.

Effect pathway	Management measure
Sedimentation of retained wetland or riparian vegetation	Apply erosion and sediment controls to prevent sediment discharge to retained damp gullies, seepages, wetlands and riparian margins.
Accidental encroachment into retained vegetation	Use exclusion fencing, flagging, site inductions and construction drawings showing no-go areas to prevent accidental disturbance outside the approved works footprint.
Stock browsing and pest impacts at transfer or recipient sites	Provide stock exclusion and pest plant or pest animal control at transfer or recipient sites where required to support the establishment and survival of managed plants.

6.4.1.6 Level of residual effect

Residual effects on terrestrial vegetation vary between ecosystem types and Project areas. The greatest residual effect is associated with the loss of high-value tussock grassland at Coronation Mining Area, where a **Very High** residual level of effect remains due to the large extent of habitat affected (noting that the proportional loss within the OGNZL landholdings is low (less than 5%).

Elsewhere, residual effects are substantially lower. Dry shrubland is predicted to experience **Very Low to Low** residual effects across all Project areas, reflecting its lower ecological value and relatively limited extent of loss.

Residual effects on rock habitats are assessed as **Moderate** at Coronation Mining Area, where high-value schist outcrops are affected, and **Low** within the Golden Bar area. The Golden Point Underground extension is predicted to result in a **Very Low** residual level of effect because direct vegetation loss is **negligible**.

Overall, the highest residual effects are confined to Coronation Mining Area, while vegetation losses in the remaining Project areas are generally expected to result in Low or Very Low residual effects.

Table 6-25. Indigenous vegetation or habitat cover with corresponding magnitude and assessed residual level of effect (following implementation of management) .

Location	Vegetation system / ecosystem	Value	Magnitude prior to mitigation	Magnitude post mitigation	Residual Level of Effect
Coronation Mining Area	Tussock grassland	High	High	High	Very High
	Dry Shrubland	Moderate	Low	Low	Low
	Rock	Very High	Low	Low	Moderate

Location	Vegetation system / ecosystem	Value	Magnitude prior to mitigation	Magnitude post mitigation	Residual Level of Effect
GPUG Extension	All vegetation	High	Low	Low	Low
Central Mining Area	Tussock grassland	Low	Low	Low	Very Low
	Dry Shrubland	Low	Negligible	Negligible	Very Low
	Rock	N/A	N/A	N/A	N/A
Golden Bar Haul Road and Mining Area	Tussock grassland	Low	High	High	Low
	Dry Shrubland	Moderate	Low	Low	Low
	Rock habitat	High	Low	Low	Low

6.4.1.7 TAR flora level of effect

Following consideration of the proposed salvage, propagation, translocation and planting measures, the residual level of effect is assessed as:

- **Very High** for seven species,
- **High** for five species,
- **Moderate** for eight species,
- **Low** for four species and
- **Very Low**, or, **Negligible** for five species.

High confidence in management resulted in a lower residual level of effect for nine species. The level of effect reduced from Very High to High for *Acaena buechananii*, from Moderate to Low for *Epilobium insulare*, from High to Low for *Rytidosperma buechananii*, and from Low to Very Low for *Anthosachne falcis*, *Juncus distegus*, *Mentha cunninghamii* and *Oxalis rubens*. For *Rytidosperma thomsonii*, High confidence in management reduced the magnitude from Very High to High, although the residual level of effect remained Very High because of the species' Very High ecological value. The residual level of effect for *Celmisia hookeri* also remained Very Low because its pre-management magnitude was already Negligible. Where confidence in management success was Moderate or Low, no reduction in magnitude or level of effect was applied, reflecting uncertainty associated with salvage survival,

propagation, recipient habitat suitability, establishment and longer-term maintenance. A detailed analysis for each TAR species is provided below in Table 6-26.

Table 6-26. Threatened and At-Risk plant species within the direct loss footprint, and assessment of Residual level of effect, following analysis of management and confidence

Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect (ED)	Level of Effect	Management and confidence in success	Magnitude of Effect (Post management)	Residual Level of Effect
Dwarf broom (<i>Carmichaelia corrugata</i>)	Coronation Mining Area	Threatened – Regionally Critical	Threatened – Nationally Vulnerable	Very High	Very High	Very High	Management: Salvage from Coronation, propagation from seed, in-situ monitoring of Coal Creek population, post-salvage monitoring and management. <i>Carmichaelia corrugata</i> is expected to be moderately successful to cultivate and plant. However, the species can be difficult to establish and has specific habitat requirements, which may be challenging, including browsing to maintain open, bare ground and deep nurse soils. <i>C. corrugata</i> is susceptible to weed competition. Confidence in management success is moderate.	Very High	Very High
Indigenous St John's wort (<i>Hypericum rubicundulum</i>)	Coronation Mining Area	Threatened – Regionally Critical	Threatened – Nationally Endangered	Very High	Very High	Very High	Management: Salvage of plants from Coronation, propagation from seed and plant divisions, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance. Cultivation of <i>Hypericum rubicundulum</i> is anticipated to be straight forward, however finding appropriate habitat and success in planting out are both expected to be challenging. Plants in Macraes show distinctive habitat requirements that can differ from those in other regions and imply that there may be a genetically unique population present, if not a new plant entity. Plants are vulnerable to competition from taller vegetation and may require grazing, however this is not confirmed and plants may need to be planted in both grazed and ungrazed areas, increasing uncertainty for management of the species. Confidence of management success for this species is low.	Very High	Very High
Wetland daisy (<i>Lagenophora barkeri</i>)	Coronation Mining Area	Threatened – Regionally Endangered	At Risk – Declining	Very High	Low	Moderate	Management: Salvage from Coronation and Coal Creek, propagation from plant divisions and seed (if possible), in-situ monitoring, post-salvage monitoring and maintenance. This small daisy can be hard to identify, which poses challenges for accurate surveying and salvage. It requires open damp ground on stream and wetland margins to grow and this habitat can be difficult to find due to competition from taller plants. Grazing may be required, although this is uncertain. Seed production for this species is unreliable and seed collection may be difficult.	Low	Moderate

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect (ED)	Level of Effect	Management and confidence in success	Magnitude of Effect (Post management)	Residual Level of Effect
							<i>Lagenophora barkeri</i> is expected to grow well in propagation and when planted if suitable habitat is found. Confidence in management success is moderate.		
<i>Lobelia ionantha</i>	Central Mining Area	Threatened – Regionally Endangered	At Risk - Declining	Very High	High	Very High	Management: Salvage from Central Mining area, propagation from plant division and seed, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance. This ephemeral wetland plant may sulk in cultivation. It is sensitive to competition from taller plants and requires open habitat. Planting areas may be in ephemeral wetlands and planted pond edges. Grazing may be required. Confidence in management success is moderate.	High	Very High
<i>Leptinella pusilla</i>	Coronation Mining Area	Threatened – Regionally Endangered	At Risk – Declining	Very High	Moderate	High	Management: Salvage from Coronation, propagation from seed and plant division, post-salvage monitoring. This species is anticipated to be easy to grow and transfer and suitable habitat is available in shady areas (around rock bases and in shrublands). Competition from taller vegetation is expected to be the primary challenge for <i>Leptinella pusilla</i>, which may need to be resolved through grazing. Confidence in management success is moderate.	Moderate	High
<i>Rytidosperma thompsonii</i>	Coronation Mining Area, Golden Bar	Threatened – Regionally Endangered	At Risk – Declining	Very High	Very High	Very High	Management: Salvage from Golden Bar and Coronation, propagation from seed and plant division, post-salvage monitoring and maintenance. <i>Rytidosperma thompsonii</i> can be challenging to identify, and requires flowers or seed to be present. The species requires open ground and limited competition, which may need to be achieved through grazing. Prefers similar habitat to <i>C. corrugata</i> with deep soils. Is expected to grow easily in cultivation and translocation. Confidence in management success is high.	High	Very High
<i>Sonchus</i> aff. <i>novae-zelandiae</i> (a)	Coronation Mining Area	Threatened – Regionally Endangered	Threatened – Nationally Endangered	Very High	Very High	Very High	Management: Salvage from Coronation, propagation from seed, post-salvage monitoring and maintenance.	Very High	Very High

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect (ED)	Level of Effect	Management and confidence in success	Magnitude of Effect (Post management)	Residual Level of Effect
(CHR 517718; "grassland")							A very difficult species to grow, with limited seed production and low seed viability, very rare in the local environment, intolerant of competition, potential for root damage during salvage. Hard to plant out successfully. The species is also facing challenges due to climate change, which adds additional levels of uncertainty and risk to management. Grazing may be useful to limit competition. Confidence in management success is low .		
<i>Acaena buchananii</i>	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	High	Very High	Management: Salvage of plants from Coronation, propagation from both seed and plant divisions and post-salvage monitoring and management. This species requires a grazed environment to manage competition from weeds and other plants and maintain open ground. The species is expected to transfer well, propagate easily and appropriate habitat is available within the landholdings. Confidence in management success for <i>Acaena buchananii</i> is high .	Moderate	High
Narrow-leaved speargrass (<i>Aciphylla subflabellata</i>)	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	Low	Moderate	Management: Salvage from Coronation and survey of Central area to check no plants are present here and also require salvage, propagation from seed, monitoring of in-situ plants in buffer areas, post-salvage monitoring and maintenance. This speargrass species grows well from seed and is expected to establish well if planted into suitable habitat. Plants need deep nurse soils that are seasonably damp, which may be challenging to locate. There is a risk of damage to plant tap roots during salvage. Herbivory is a challenge for this species. Confidence in management success is moderate .	Low	Moderate
Tufted hair grass (<i>Deschampsia cespitosa</i>)	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	Very High	Very High	Management: Salvage from Coronation, propagation from seed and plant divisions, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance. A large impact on a significant population of this species is anticipated from this project, amplifying any risks. There may be difficulties in finding suitable habitat to replicate the ecosystem dynamics to be lost. <i>Deschampsia cespitosa</i> is expected to be easy to cultivate and plant out. Confidence in management success is moderate .	Very High	Very High

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect (ED)	Level of Effect	Management and confidence in success	Magnitude of Effect (Post management)	Residual Level of Effect
<i>Epilobium insulare</i>	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	Low	Moderate	Management: Salvage from Coronation and Coal Creek, propagation from seed and plant division, in-situ monitoring in buffer areas, post-salvage monitoring and management. Expected to be easy to grow and plant out, although challenges from fungal infections during cultivation are possible. Suitable wetland habitat available. Is vulnerable to competition from taller vegetation, which will require management. Confidence in management success is high.	Negligible	Low
<i>Euchiton polylepis</i>	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	High	Very High	Management: Salvage from Coronation, propagation from seed and plant divisions, post-salvage monitoring and maintenance. A species that is rarely grown and little is known about success in propagation. Challenges are expected from competition from exotic weeds and very particular and narrow habitat requirements (damp rock faces). Confidence in management success is low.	Very High	Very High
<i>Juncus pusillus</i>	Central Mining Area	Threatened – Regionally Vulnerable	At Risk – Naturally Uncommon	Very High	Moderate	High	Management: Salvage from Central Mining Area, propagation from division of plants and seed, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance. A small rush of damp ground and ephemeral wetlands. This species is expected to cultivate and plant out well. It requires open habitat with little competition from other plants, but tolerates modified environments such as track edges. Confidence in management success is high.	Moderate	Moderate
<i>Lobelia perpusilla</i>	Central Mining Area	Threatened – Regionally Vulnerable	Not Threatened	Very High	High	Very High	Management actions: Salvage from Central Mining Area, propagation from division of plants and seed, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance.	Moderate	High

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect (ED)	Level of Effect	Management and confidence in success	Magnitude of Effect (Post management)	Residual Level of Effect
							A creeping herb of open damp ground, lake margins and ephemeral wetlands. This species suffers from competition from taller vegetation. It is expected to cultivate and plant out well. Suitable habitat is anticipated around constructed ephemeral wetlands and graded pond margins. Confidence in management success is high.		
Dwarf greenhood orchid (<i>Pterostylis tristis</i>)	Coronation Mining Area	Threatened – Regionally Vulnerable	At Risk – Declining	Very High	Moderate	High	Management: Salvage from Coronation, vegetation direct transfer from Coronation, post-salvage monitoring and maintenance. This species is very difficult to manage due to the short window of time it is above ground, the cryptic nature of plants, the reliance of soil-based fungal symbionts for survival, challenges in cultivating orchids, specific habitat requirements and dislike of competition from taller vegetation. There is a risk that VDT and salvage may cause damage to bulbs. There is much uncertainty around the ability to grow and translocate this species. Confidence in management success for <i>Pterostylis tristis</i> is low.	Moderate	High
Delicate bluegrass (<i>Anthosachne falcis</i>)	Coronation Mining Area, Frasers / Innes Mills	Regionally Declining	At Risk – Declining	High	Low	Low	Management: Salvage from Coronation and Central areas, propagation from seed and plant divisions, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance. This grass is expected to grow well in propagation and establish well from translocation and planting. It is hoped that management approaches will help develop a better understanding of what makes this species flourish. Expectation of management success is high.	Negligible	Very Low
Desert broom (<i>Carmichaelia petriei</i>)	Coronation Mining Area, Golden Bar, Golden Bar Haul Road, Frasers / Innes Mills	Regionally Declining	At Risk – Declining	High	Low	Low	Management: Salvage of plants from Coronation and Golden Bar, propagation from seed, in-situ monitoring of plants in buffers, post-salvage monitoring and maintenance. This species is known to suffer from recruitment failure. Herbivory is also an issue. There is a risk of root damage during salvage of plants. There is ample appropriate habitat and the species is widespread within the landholdings. Confidence in management success is moderate.	Low	Low

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect (ED)	Level of Effect	Management and confidence in success	Magnitude of Effect (Post management)	Residual Level of Effect
<i>Colobanthus strictus</i>	Coronation	Regionally Declining	Not Threatened	High	Moderate	High	Management: Salvage of plants from Coronation North, propagation from seed, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance. An inconspicuous species that may be challenging to cultivate. Vulnerable to weed invasion. Confidence in management success is moderate.	Moderate	High
<i>Juncus distegus</i>	Coronation Mining Area, Frasers / Innes Mills	Regionally Declining	Not Threatened	High	Low	Low	Management: Salvage from Coronation and Central areas, propagation from seed and plant division, in-situ monitoring of plants in buffers, post-salvage monitoring and maintenance. A rush species that is expected to grow and translocate well. Appropriate habitat is available and will be increased through construction of wetlands. Confidence in management success is high.	Negligible	Very Low
New Zealand mint / hioi (<i>Mentha cunninghamii</i>)	Coronation Mining Area	Regionally Declining	At Risk – Declining	High	Low	Low	Management: Salvage from Coronation, propagation from seed and plant division, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance. Some uncertainty about how this plant will take in cultivation, but reasonably high confidence. <i>Mentha cunninghamii</i> has particular habitat requirements, preferring damp, shaded areas with little competition. Grazing may be required to keep other vegetation low. Confidence in management success is high.	Negligible	Very Low
<i>Rytidosperma buehnanii</i>	Coronation Mining Area	Regionally Declining	At Risk – Declining	High	Moderate	High	Management: Salvage from Coronation, propagation from seed and plant division, post-salvage monitoring and maintenance. A species that is expected to be easy to grow and survive salvage well. However there are challenges in identifying plants and low vegetation is needed (grazing is a possible solution to this). Expectation of management success is high.	Moderate	Moderate
Wetland grass	Coronation Mining Area	Regionally Naturally Uncommon	At Risk – Naturally Uncommon	Moderate	High	Moderate	Management: Salvage from Coronation, propagation from seed and plant division, post-salvage monitoring and maintenance.	Moderate	Moderate

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect (ED)	Level of Effect	Management and confidence in success	Magnitude of Effect (Post management)	Residual Level of Effect
<i>(Agrostis pallescens)</i>							<i>Agrostis pallescens</i> requires ephemeral wetland habitat with limited competition from taller vegetation. This may be difficult to find. It is expected to grow well in propagation and survive salvage if adequate habitat is found. Confidence in management success is moderate .		
<i>Brachyscome longiscapa</i>	Coronation Mining Area	Regionally Naturally Uncommon	At Risk – Naturally Uncommon	Moderate	Negligible	Low	Management: Salvage from Coronation, propagation from seed, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance. This daisy is expected to be difficult to propagate, in part because of difficulties in sourcing seed. Plants require cool, shaded open ground. Grazing may be required to manage competition from taller plants. Confidence in management success is moderate .	Negligible	Low
Hooker's mountain daisy (<i>Celmisia hookeri</i>)	Coronation Mining Area, Golden Bar	Regionally Naturally Uncommon	At Risk – Naturally Uncommon	Moderate	Negligible	Very Low	Management: Salvage of seedlings from Coronation, Golden Bar, Coal and Camp Creeks, propagation from seed, direct scattering of seed, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance of salvaged plants. A difficult species to cultivate. Larger plants are unlikely to survive salvage due to root damage and challenges in finding suitable deep rock crevices to plant into. Weed competition an issue. Herbivory also a challenge in open habitat. Seed scattering expected to be successful. Translocations of seedlings also expected to be successful. There are large populations in wider landholdings and the species is expected to recolonise habitat if browsing and weed competition managed. Expectation of management success high .	Negligible	Negligible
<i>Lagenophora pinnatifida</i>	Coronation North	Regionally Naturally Uncommon	Not Threatened	Moderate	Moderate	Moderate	Management: Salvage from Coronation, propagation from seed and plant division, post-salvage monitoring. This species may be difficult to cultivate from seed. Suitable damp and open habitat may be hard to find and weed incursion may be an issue. Confidence in management success is moderate .	Low	Moderate

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Species	Locations in footprint	Regional threat status	National threat status	Ecological Value	Magnitude of effect (ED)	Level of Effect	Management and confidence in success	Magnitude of Effect (Post management)	Residual Level of Effect
<i>Poa pusilla</i>	Coronation Mining Area	Regionally Naturally Uncommon	Not Threatened	Moderate	Moderate	Moderate	Management: Salvage from Coronation, propagation from seed and plant divisions, post-salvage monitoring and maintenance. This species is expected to propagate and translocate well. Finding suitable habitat is biggest challenge. Planting will need to be into rock environments, which poses difficulties. Confidence in management success is moderate.	Low	Moderate
<i>Shawia bullata</i> (formerly <i>Olearia bullata</i>)	Coronation Mining Area, Frasers / Innes Mills	Regionally Naturally Uncommon	Not Threatened	Moderate	Low	Low	Management: Salvage from Coronation, Central, Coal and Camp Creeks, propagation from seed and cuttings, post-salvage monitoring and maintenance. A shrubby daisy species that can be challenging to cultivate. Woody roots may also be sensitive to damage during salvage. Adequate suitable habitat is found at gully heads and in riparian margins. The species is common in the local landscape. Confidence in management success is moderate.	Low	Low
<i>Oxalis rubens</i>	Coronation Mining Area	Regionally Data Deficient	Not Threatened	Moderate	Low	Low	Management: Salvage from Coronation, propagation from seed and plant divisions, post-salvage monitoring and maintenance. <i>Oxalis rubens</i> is expected to be easy to grow and plant, and to survive translocation. Appropriate habitat is available around the constructed tors, and in rocky, dry vegetation up to 1m tall. The species resents competition from weeds. Confidence in management success is high.	Low	Very Low
Porcupine shrub (<i>Melicytus</i> aff. <i>alpinus</i> 'Otago')	Golden Bar	Regionally Data Deficient	Data Deficient	Moderate	High	Moderate	Management: Salvage from Golden Bar, propagation from seed, in-situ monitoring of plants in buffer areas, post-salvage monitoring and maintenance. A very slow growing shrub, which requires further study to determine if this is distinct from <i>Melicytus alpinus</i>. Faces risks from herbivory of seedlings and damage to roots during salvage. No obvious habitat is available for replanting this species/tag entity, which requires areas of rock break-down. Artificial tors may provide this. Confidence in management success is moderate.	High	Moderate

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6.4.2 Invertebrates

The Project has the potential to result in a range of direct and indirect adverse effects on invertebrate populations through the clearance, modification, degradation, and fragmentation of habitat, particularly tussock grasslands, shrublands, rocky outcrops, wetlands, and gully systems. These habitats provide important ecological functions for invertebrates, including refuge, foraging opportunities, breeding habitat, and dispersal pathways.

The invertebrate community within the Project area is diverse and representative of the diversity found in modified dryland environments within the local (OGNZL landholdings) and surrounding (Macraes ED) landscapes. Several notable taxa, including one 'Nationally Vulnerable', ten 'At Risk', three Data Deficient', and three other large-bodied taxa are present (Grainger *et al.* 2018; Hoare *et al.* 2026).

The nature and significance of potential effects vary among taxa according to their habitat requirements, mobility, population status, and ecological resilience. Invertebrates with strict host plant relationships will be more susceptible to impacts where their host plants are impacted, compared to more generalist invertebrates where resources are more plentiful in the surrounding landscape.

6.4.2.1 Potential direct effects

Potential direct effects on approximately 325 ha of suitable invertebrate habitat and thousands of individual invertebrates within the MP4 Project area (i.e., impact footprint plus 20 m buffer) are anticipated.

The Project will result in direct and indirect effects on terrestrial invertebrate communities associated with vegetation clearance, soil disturbance, and ongoing mining activities. Effects will be most relevant within tussock grassland habitats, which support the highest diversity of indigenous invertebrates and include habitat for conservation-listed Lepidoptera.

6.4.2.1.1 Permanent loss of habitat.

The Project will result in the removal and modification of a range of habitats utilised by indigenous invertebrates, including tussock grassland, shrubland, and rock tor habitats within the Project footprint. These habitats provide important ecological functions, including refuge, breeding sites, foraging resources, and dispersal pathways for a diverse range of invertebrate taxa.

The removal of tussock grassland and shrubland vegetation will reduce both habitat availability and structural complexity, potentially affecting the abundance and diversity of invertebrate communities. This is particularly significant for species with specialised habitat requirements, including those whose larvae depend on native tussocks, speargrasses, or other host plants to complete their life cycles.

Habitat modification associated with the Project, including changes to vegetation composition, ground cover, and microclimatic conditions, may also reduce habitat suitability in areas immediately adjacent to the disturbance footprint. Consequently, effects may extend beyond the area of direct habitat loss through the degradation of remaining habitat and the disruption of ecological processes that support indigenous invertebrate populations.

6.4.2.1.2 Injury or mortality of invertebrates during vegetation and habitat removal.

Vegetation clearance, topsoil stripping, and excavation activities will result in injury or mortality of invertebrates, including 'At Risk' species potentially, within the impact footprint. Mortality risk is highest for species with low mobility and strong site fidelity (e.g., non- or poorly flighted species, larvae, and eggs or ootheca).

6.4.2.1.3 Habitat fragmentation and loss of ecological connectivity.

Habitat fragmentation will occur as a result of vegetation clearance and the development of infrastructure, reducing connectivity between habitat patches. This may isolate local populations, particularly for species with limited dispersal ability.

6.4.2.1.4 Creation of habitat edge effects,

Creation of new habitat edges may alter the composition and degrade the integrity of adjacent vegetation affecting habitat suitability for invertebrates. Edge effects may alter microclimatic conditions, including temperature and moisture regimes, and increase exposure to predators.

6.4.2.1.5 Displacement of resident invertebrates

Displacement of invertebrates into adjacent habitats where habitat quality may be lower or already support populations at, or near, carrying capacity, potentially resulting in increased competition, reduced resource availability, and declines in individual fitness and population performance.

6.4.2.2 Potential indirect effects

Potential indirect effects on invertebrate communities and species could occur within approximately 198 ha of suitable habitat in the wider surrounding (80 m) buffer zone, though their extent and severity are uncertain. However, such effects are not expected to result in measurable impacts, because much of the landscape is already subject to mining activity and may already be experiencing indirect effects as a result and because many of the species recorded during the Project were themselves found within 80 m of existing or historical mining activity. A precautionary approach that accounts for the potential range of indirect effects has nonetheless been taken when assigning magnitude of effect ratings for invertebrate communities and species.

6.4.2.2.1 Disturbance and indirect alterations to adjacent habitat quality

Disturbance-related effects may arise through indirect changes to the quality and suitability of habitats adjacent to the Project footprint. These effects may include changes to hydrology, habitat structure, vegetation composition, dust deposition, artificial lighting, noise, and vibration.

Potential changes to local hydrology resulting from drainage (loss of surface water interaction) or dewatering (loss of groundwater interaction) could affect habitat suitability for some invertebrate taxa. Species associated with damper habitats, or with host plants that require damper soils, could be indirectly affected by changes in moisture regimes, which may alter vegetation composition and reduce habitat quality. However, surface water contributions (from rainfall) are likely to maintain shallow ground moisture to a large extent. Furthermore, any potential drainage of areas surrounding the mining activities will be minimised through construction design and mitigated through the

implementation of Sediment Retention Ponds (SRPs) and discharging equivalent catchment volumes back into the wider contributing catchment. Accordingly, indirect effects from drainage are not considered likely to impact invertebrate communities or their habitat beyond the impact area and 20 m precautionary buffer.

Ground subsidence, and associated changes to habitat structure, stability, and hydrology from underground mining, is not expected to materially affect invertebrate populations. In rocky habitats, subsidence could potentially alter the configuration of crevices within rock outcrops that provide refuge and breeding sites for some invertebrates. However, on balance subtle changes in crevice structure are unlikely to adversely affect rock-dwelling invertebrates given that any potential changes in structure could equally improve crevice habitat for invertebrates (e.g., widening or narrowing or crevices). Subsidence could influence surface drainage patterns, soil moisture, and vegetation composition, potentially affecting habitat suitability. These effects may be experienced in Deepdell Creek as a result of the underground mining expansion of GPUG. It is understood that further investigations are to be undertaken on the degree of subsidence in this area, but any potential effects will be minimised and/ or mitigated through management actions and the implementation of "orange no-go zones" where subsidence is expected to be greatest.

Dust deposition has the potential to reduce habitat quality by affecting vegetation health and structure, with consequential effects on shelter availability, host plants, and prey resources. However, these effects are expected to be localised and appropriately managed through standard dust suppression measures.

Artificial lighting associated with Project infrastructure or nocturnal mining activities may affect the behaviour of nocturnal invertebrates. Increased illumination has the potential to alter activity patterns and attract invertebrates towards lit areas, where they may be exposed to increased predation risk or mortality. These effects are expected to be greatest in areas immediately adjacent to lit infrastructure and within or along pit margins. However, for flighted invertebrates, effects may extend more widely if individuals are attracted from the surrounding landscape to artificial lights at night.

The potential impacts of noise and vibration on terrestrial invertebrates are not well studied. Many invertebrates rely on sensory receptors and mechanoreceptors that detect particle motion; therefore, it cannot be dismissed that blasting or heavy machinery vibration may cause disturbance responses in some taxa. Notwithstanding this, the diversity and abundance of invertebrates persisting immediately adjacent to, and within, existing mining disturbance areas suggests that at least some taxa exhibit a degree of tolerance to these disturbances.

Overall, while some short-term behavioural responses to disturbance may occur, long-term population-level effects on invertebrates are not anticipated.

6.4.2.2.2 *Sediment runoff*

Sediment runoff from disturbed areas has the potential to affect adjacent habitats through increased sediment deposition and changes to water quality. Such effects may alter vegetation composition, reduce habitat quality. However, these effects are expected to be localised and managed through standard erosion and sediment control measures.

6.4.2.2.3 *Facilitation or exacerbation of the spread of exotic/ invasive plants or animals through the landscape.*

Mining activities may facilitate the establishment and spread of invasive plant and animal species through increased habitat disturbance, vehicle movements, and the creation of dispersal corridors. Invasive species can potentially reduce habitat quality for some invertebrates by altering vegetation structure (e.g., outcompeting and replacing important host plants), degrading refuge sites, and increasing predation pressure. However, the lizard species present within the Project area are generally adaptable and are known to persist in modified and exotic-dominated habitats, suggesting any effects are likely to be limited and localised.

6.4.2.3 Cumulative effects

The staged development of the Macraes Operation has, to date, affected more than 2,000 ha of land, an unknown proportion of which is likely to have previously supported indigenous vegetation and lizard habitat. Effects management has been undertaken for each project stage; however, cumulative effects can arise where multiple individually minor, unaccounted for, or incompletely mitigated effects accumulate over time to produce a greater overall impact than anticipated at any single stage. Non-project effects, including surrounding pastoral land use such as the conversion of tussock grassland to pasture, may also interact with mining-related effects and contribute to long-term ecological change.

Cumulative effects are often difficult to measure and may not be fully captured in project-specific assessments. Nevertheless, it is important to consider the proposed activity in the context of past, present, and reasonably foreseeable future activities, after accounting for avoidance, remediation, and mitigation. For invertebrates, cumulative effects may include incremental habitat loss, degradation, and fragmentation, as well as reduced connectivity, declining habitat quality, and increasing pressure from pests and weeds.

For the Project, an appropriate temporal scale for considering cumulative effects on invertebrates extends from the period prior to establishment of the mine in 1990 through to the current proposed life of mine. The Macraes ED provides an appropriate spatial scale, as it captures both the Project area and the wider landscape context for invertebrate populations and habitat availability. Future staged mine development, ongoing agricultural pressures, and wider habitat degradation are expected to continue influencing the availability and quality of invertebrate habitat across this landscape.

Several invertebrate species are in population decline. Extensive areas of high-quality invertebrate habitat, including complex tussockland, shrubland, and riparian habitats, have also been cleared, modified, or fragmented over time through mining and agricultural activities. These historical effects, in combination with effects anticipated from the Project, have the potential to contribute to long-term adverse outcomes for invertebrate populations if not appropriately managed.

Given the complexity and uncertainty associated with cumulative effects assessment for invertebrates, no attempt has been made to quantify cumulative impacts directly. However, historical habitat loss, ongoing landscape modification, and predicted or known population declines (inferred based on conservation status assignments) have been considered when assigning the magnitude of effects for invertebrate species (Table 6-28).

6.4.2.4 Conservation status, spatial scale, duration, and ecosystem role

Several factors were considered when assigning the magnitude of effects, including conservation status, species distribution, spatial scale, duration, and ecosystem role, to provide an informed and proportionate assessment of potential impacts.

- Greater weight was given to species with higher levels of conservation concern, as populations of more threatened species are generally less resilient to disturbance, habitat loss, and population declines than widespread or 'Not Threatened' species.
- The magnitude of effect was assessed with reference to the known distribution of each species, recognising that habitat loss or degradation affecting a geographically restricted taxon may represent a disproportionately large impact on its overall population viability compared with effects on widespread species.
- Spatial scale was considered, with regard given to the extent of suitable habitat affected at both the local (OGNZL landholdings; approximately 13,063 ha) and ED (Macraes ED; approximately 113,818 ha) scales.
 - Population estimates for invertebrates were not available for either the local or ED scales.
 - Estimates of suitable habitat extent for each invertebrate species are not available at either the local scale or the Macraes ED scale. Accordingly, a precautionary approach was adopted. For commoner invertebrate taxa that are not known to have host-specific associations, and for which information on relative abundance in the surrounding landscape is available, it was assumed that suitable habitat comprises 20% of the land area at both scales. This assumption is considered conservative based on the apparent broad distribution of these taxa and the likely availability of suitable habitat across both OGNZL landholdings and the wider Macraes ED. Consequently, the proportion of suitable habitat affected by the Project is likely to be overestimated, resulting in a precautionary assessment of effect magnitude.
 - For more habitat-specific taxa, such as species associated with tussock grassland or shrubland, the mapped extent of the relevant habitat type within OGNZL landholdings and the Macraes ED was used to estimate proportional habitat loss. These estimates are also considered conservative because mapped habitat extents are likely to underestimate the actual occurrence of these habitat types across both OGNZL landholdings and the wider Macraes ED.

Table 6-27 Table 6-31 presents the assumed extents of suitable invertebrate habitat (all habitats and tussock and shrubland specifically) at both the local (OGNZL landholdings) and ED scales, providing the baseline context for invertebrates and information considered as part of the magnitude of effects assessment.

- The duration of effects recognises that short-term or temporary effects are generally less consequential than long-term or permanent effects. Effects resulting in temporary disturbance or habitat modification were assigned a lower magnitude than those causing prolonged reductions in habitat availability, population size, or ecological function.
- Ecosystem role refers to the function a species performs within its environment, including its interactions with other species and contribution to ecological processes. The assessment considers both the ecological function of the species and its assumed importance to the wider ecosystem.

Table 6-27. Assumed extent of suitable invertebrate habitat (all habitats and tussock and shrubland specifically) at both the local (OGNZL landholdings) and ED scales.

Taxonomic unit	Local – OGNZL landholdings			Macraes ED		
	Suitable invertebrate habitat (ha)	Tussock	Shrubland	Suitable invertebrate habitat (ha)	Tussock	Shrubland
Invertebrate community	2,613	1,913	1,294	22,764	14,503	3,532

6.4.2.5 Taoka/ Taonga species

Taoka, or taonga, species are indigenous species recognised as having cultural significance. No invertebrates are listed in Schedule 97 of the Ngai Tahu Claims Settlement Act 1998, and the cultural values of invertebrates have not previously been highlighted on similar large scale mining projects (e.g., Statement of Evidence of Jade Watkin (Ecology and Kāi Tahu)). However, since invertebrates hold significance not only for biodiversity and ecosystem functioning, but also within te ao Māori, where all living things are connected through whakapapa and contribute to the health and mauri of ecosystems, their significance has been considered in assigning magnitude of effect and mitigation measures to reduce severity of effects as far as practicable.

6.4.2.6 Magnitude of effect on invertebrates

To ensure a comprehensive assessment of magnitude, effects on the invertebrate communities overall (across all project areas) and each of the notable species within each Project area have been assessed (Table 6-28). This provides a transparent approach to highlight where magnitude is placed and also provides a clear outline of where residual effects remain, to guide residual effects management. However, it is noted that community level assessment is less sensitive and should be taken as a broad assessment to assist with guiding residual effects.

Table 6-28 Magnitude of effect assessment for invertebrates, presented as community and by individual notable species collectively for the entire MP4 Project.

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
Invertebrate community (Project wide)	High	Direct effects: • Injury or permanent loss of potentially several thousand individuals. • Permanent loss of 325 ha of potentially suitable habitat, approximating: ○ 12.4% of the estimated suitable habitat on OGNZL landholdings. ○ 1.4% of the estimated suitable habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider 198 ha buffer may be subject to potential ongoing disturbance effects, including: ○ Habitat degradation on the edges of the impact footprint. ○ Localised hydrological changes affecting moisture-dependent habitats. ○ Dust deposition affecting vegetation and host-plant quality on the periphery of the impact footprint. ○ Artificial lighting potentially altering nocturnal invertebrate behaviour and increasing predation risk. ○ Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. ○ Reduced habitat connectivity and dispersal opportunities for flightless invertebrates. ○ Increased weed invasion and vegetation change along habitat edges (only relevant to invertebrates with strong native habitat associations). Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally.	High

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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.	
<i>Orocrambus sophistes</i>	Very high	Single specimen found in Coronation in 2022 and not been seen since despite high search effort. Not regionally endemic but confined to the inland drier Mackenzie and Central Otago areas of the South Island. Direct effects: • Injury or permanent loss of few, if any, individuals. • Permanent loss of 90 ha of suitable tussock habitat, approximating: ○ 4.7% of the estimated tussock habitat on OGNZL landholdings. ○ 0.6% of the estimated tussock habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha, of which much less is tussock habitat) subject to ongoing disturbance effects as per those outlined under Invertebrate community (Project wide) above. Cumulative loss of potentially some individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		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	
<i>Agrotis admirationis</i>	High	Recorded at Coronation and outside the impact footprint in covenanted areas on OGNZL landholdings. Widely but patchily distributed throughout both the North and South Islands. Direct effects: • Injury or permanent loss of potentially tens to hundreds of individuals. • Permanent loss of 325 ha of potentially suitable habitat, approximating: ○ 12.4% of the estimated suitable habitat on OGNZL landholdings. ○ 1.4% of the estimated suitable habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
<i>Asaphodes recta</i>	High	One individual collected at Coronation and several seen in Murphys Creek catchment outside of impact footprint and within the Project mitigation site. Widespread distribution in Canterbury, Otago, and Southland tussockland. Direct effects: • Injury or permanent loss of potentially tens to hundreds of individuals. • Permanent loss of 90 ha of suitable tussock habitat, approximating: ○ 4.7% of the estimated tussock habitat on OGNZL landholdings. ○ 0.6% of the estimated tussock habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha, of which much less is tussock habitat) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of potentially some individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
<i>Dasyuris partheniata</i>	High	Single individual (larva) found in Coronation in 2014 but not recorded since. Widespread occurrence across South Island and lower North Island. Direct effects: • Injury or permanent loss of potentially tens to hundreds of individuals. • Permanent loss of 90 ha of suitable tussock habitat, approximating: ○ 4.7% of the estimated tussock habitat on OGNZL landholdings. ○ 0.6% of the estimated tussock habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha, of which much less is tussock habitat) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of potentially some individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	Moderate
<i>Nyctemera annulata</i>	High	Widespread across OGNZL landholdings and widely distributed across all of New Zealand. Direct effects:	Low

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		- Injury or permanent loss of potentially hundreds of individuals. - Permanent loss of 325 ha of suitable habitat, approximating: 12.4% of the estimated suitable habitat on OGNZL landholdings. 1.4% of the estimated suitable habitat in the Macraes ED. Indirect effects: - Individuals occupying the wider buffer (198 ha) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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.	
<i>Orthodera novaezealandiae</i>	High	Likely widespread in suitable shrubland habitats on OGNZL landholdings and widely distributed across all of New Zealand. Direct effects: - Injury or permanent loss of potentially tens to hundreds of individuals. - Permanent loss of 325 ha of suitable habitat, approximating: 12.4% of the estimated suitable habitat on OGNZL landholdings. 1.4% of the estimated suitable habitat in the Macraes ED.	Low

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		Indirect effects: Individuals occupying the wider buffer (198 ha) subject to ongoing disturbance effects as per those outlined under "Invertebrate community (Project wide)" above. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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.	
<i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia")	High	Recorded at Golden Bar and outside the impact footprint at BRWRS, and Cranky Jim's and Redbank Covenant. Widespread but patchy distribution across both the North and South Islands. Direct effects: - Injury or permanent loss of potentially tens to hundreds of individuals. - Permanent loss of 3.1 ha of suitable shrubland habitat, approximating: 0.2% of the estimated shrubland habitat on OGNZL landholdings. 0.1% of the estimated shrubland habitat in the Macraes ED. Indirect effects:	Low

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		Individuals occupying the wider buffer (198 ha, of which much less is shrubland habitat) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of potentially some individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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.	
<i>Patagoniodes farinaria</i>	High	Recorded in Coronation, Central Mining Area and Golden Bar, and outside the impact footprint at BRWRS, Cranky Jims, MEEA, and Redbank Covenant. Relatively common in the wider surrounding landscape and widespread across both North and South Islands. Also occurs in Australia. Direct effects: - Injury or permanent loss of potentially tens to hundreds of individuals. - Permanent loss of 325 ha of suitable habitat, approximating: 12.4% of the estimated suitable habitat on OGNZL landholdings. 1.4% of the estimated suitable habitat in the Macraes ED. Indirect effects:	Low

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		Individuals occupying the wider buffer (198 ha) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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.	
<i>Samana acutata</i>	High	Recorded in Central Mining Area and outside the impact footprint, elsewhere on OGNZL landholdings (e.g., BRWRS). Widespread occurrence in the lower South Island, but not locally common. Direct effects: - Injury or permanent loss of potentially tens to hundreds of individuals. - Permanent loss of 3.1 ha of suitable shrubland habitat, approximating: 0.2% of the estimated shrubland habitat on OGNZL landholdings. 0.1% of the estimated shrubland habitat in the Macraes ED. Indirect effects: - Individuals occupying the wider buffer (198 ha, of which much less is shrubland habitat) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		Cumulative loss of potentially some individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	
<i>Theoxena scissaria</i>	High	Single individual recorded outside of impact area in BRWRS. Widely distributed through mid-Canterbury, Otago Lakes, South Canterbury, Mackenzie, and Central Otago, but locally rare. Direct effects: • Injury or permanent loss of potentially single to tens of individuals, if any. • Permanent loss of 3.1 ha of suitable shrubland habitat, approximating: ○ 0.2% of the estimated shrubland habitat on OGNZL landholdings. ○ 0.1% of the estimated shrubland habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha, of which much less is shrubland habitat) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of potentially some individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	
<i>Bityla sericea</i>	Moderate	Recorded at Golden Bar, and outside the impact footprint at BRWRS, Murphys Creek, and Redbank Covenant. Widespread across Otago but not found in large numbers. Direct effects: • Injury or permanent loss of potentially tens to hundreds of individuals. • Permanent loss of 325 ha of suitable habitat, approximating: ○ 12.4% of the estimated suitable habitat on OGNZL landholdings. ○ 1.4% of the estimated suitable habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		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	
<i>Wiseana fuliginea</i>	Moderate•	Only eDNA recorded at Coronation. Poorly known species with distribution restricted to southern South Island. Considered elusive. Direct effects: • Injury or permanent loss of potentially tens of individuals, due to elusiveness. • Permanent loss of 325 ha of suitable habitat, approximating: ○ 12.4% of the estimated suitable habitat on OGNZL landholdings. ○ 1.4% of the estimated suitable habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
<i>Wiseana mimica</i>	Moderate•	Single individual collected in Murphys Creek catchment, outside of the impact footprint and inside Project mitigation area. Widespread in open country east of Fiordland and the Southern Alps. Direct effects: • Injury or permanent loss of potentially tens to hundreds of individuals. • Permanent loss of 325 ha of suitable habitat, approximating: ○ 12.4% of the estimated suitable habitat on OGNZL landholdings. ○ 1.4% of the estimated suitable habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
<i>Zelandobius uniramus</i>	Moderate•	eDNA recorded at several sites outside of the impact footprint (Highlay, Camp Creek, Cranky Jims, Murphys Creek, and Coal Creek). Distribution includes southern regions of the South Island and Stewart Island. Direct effects: • Injury or permanent loss of potentially tens to hundreds of individuals. • Permanent loss of 325 ha of suitable habitat, approximating: ○ 12.4% of the estimated suitable habitat on OGNZL landholdings. ○ 1.4% of the estimated suitable habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	Moderate
<i>Hemiandrus maia</i>	Low	Abundant in areas of tussock and shrubland both inside the impact area (Coronation, Golden Bar) and outside (Murphys Creek catchment). Widespread occurrence across Otago and Southland.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		Direct effects: • Injury or permanent loss of potentially hundreds of individuals. • Permanent loss of 93.1 ha of suitable tussock/ shrubland habitat, approximating: ○ 2.9% of the estimated tussock/ shrubland habitat on OGNZL landholdings. ○ 0.5% of the estimated tussock/ shrubland habitat in the Macraes ED. Indirect effects: • Individuals occupying the wider buffer (198 ha, of which much less is tussock/ shrubland habitat) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of potentially some individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	
<i>Mecodema</i> sp. “Oamaru”	Moderate•	Single observation in Central Mining Area. Poorly known but thought to occur throughout the wider Oamaru area (Dr D. Seldon, pers. comm.). Direct effects:	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		- Injury or permanent loss of potentially tens to hundreds of individuals. - Permanent loss of 325 ha of suitable habitat, approximating: 12.4% of the estimated suitable habitat on OGNZL landholdings. 1.4% of the estimated suitable habitat in the Macraes ED. Indirect effects: - Individuals occupying the wider buffer (198 ha) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	
<i>Orocrambus cf. cyclopicus</i>	Moderate•	Recorded at Golden Bar. Poorly known but possibly endemic to inland Otago drylands (Dr. R. Hoare, pers. comm. 2025). Direct effects: - Injury or permanent loss of few, if any, individuals. - Permanent loss of 90 ha of suitable tussock habitat, approximating: 12.4% of the estimated tussock habitat on OGNZL landholdings. 1.4% of the estimated tussock habitat in the Macraes ED. Indirect effects:	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		Individuals occupying the wider buffer (198 ha, of which much less is tussock habitat) subject to ongoing disturbance effects as per those outlined under “Invertebrate community (Project wide)” above. Cumulative loss of potentially some individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. Loss of invertebrates that contribute to local biodiversity and ecosystem functions, and to the health and mauri of ecosystems. 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	

- Moderate value, based on the presence of species assumed to be locally uncommon at the ED scale.

6.4.2.7 Effects avoidance, minimisation/ mitigation, and remediation

Management of effects on invertebrates associated with the proposed mining activities has been developed in accordance with the effects management hierarchy.

Complete avoidance of effects on invertebrates is not practicable because the Project involves extensions to existing fixed-location mining infrastructure and ore bodies. Consequently, adverse effects on invertebrates occurring within the Project footprint and associated 20 m buffer are considered unavoidable but will be minimised and mitigated through targeted management measures and operational controls.

Management actions will be implemented through the Invertebrate Management and Monitoring Plan (IMMP; Bioresearches 2026i), which includes measures such as invertebrate salvage and relocation, host-plant salvage and relocation, habitat protection and enhancement, habitat creation, and monitoring. These actions will be supported by standard environmental management practices designed to minimise indirect effects on adjacent habitats, including the management of dust, erosion, sediment, and other construction-related disturbances.

While these measures are expected to reduce the extent and severity of some adverse effects, uncertainty remains regarding the effectiveness of certain mitigation techniques, particularly for less well-known taxa. As a result, mitigation may not fully address the permanent loss of individuals and habitat within the Project footprint. Nevertheless, the proposed management package represents a comprehensive and practicable approach to reducing adverse effects to the greatest extent achievable.

Several notable invertebrate species recorded within the MP4 Project area are poorly known and may be more sensitive to habitat loss and modification than common and widespread taxa. These species require specific consideration through targeted management actions, including host-plant salvage and relocation, species-specific surveys, and habitat management. Accordingly, the IMP includes a range of measures such as pre-clearance surveys, staged vegetation clearance, invertebrate salvage and relocation, host-plant salvage and relocation, habitat enhancement, and habitat protection. Table 6-29 outlines the proposed management measures for each notable invertebrate species identified within the Project area. Collectively, these measures are intended to reduce adverse effects and support the persistence of local populations.

Overall, while the MP4 Project will result in unavoidable adverse effects on indigenous invertebrates, most affected species are expected to remain widespread within the Macraes' ED. The combination of mitigation, compensation, and long-term management measures is expected to maintain local population viability and contribute to positive biodiversity outcomes beyond the Project footprint.

6.4.2.7.1 Avoidance measures

Opportunities to avoid effects on invertebrates were considered during Project planning. However, due to the fixed location of the ore resource and associated mining infrastructure, complete avoidance of habitat loss within the Project footprint is not practicable. As a result, management has focussed on minimising and mitigating adverse effects where they cannot reasonably be avoided.

6.4.2.7.2 *Minimisation/ mitigation measures*

- Implement standard operational controls to limit disturbances. These will include:
 - Erosion and sediment controls to prevent sediment discharge to retained damp gullies, seepages, wetlands and riparian margins.
 - Dust suppression measures, including watering, stabilisation of exposed surfaces and management of haul roads, to reduce dust deposition and maintain existing habitat quality for invertebrates in adjacent land areas.
 - Lighting controls to limit light spill.
- Implement weed hygiene, weed control and progressive rehabilitation measures to reduce weed establishment in disturbed margins and retained indigenous vegetation.
- Minimise accidental encroachment into retained vegetation using exclusion fencing, flagging, site inductions, and/ or construction drawings showing no-go areas to prevent accidental disturbance outside the approved works footprint.
- Maintain hydrological inputs to retained seepage, riparian and wetland vegetation where practicable, manage road drainage and runoff, and monitor retained sensitive vegetation where hydrological effects are possible to reduced hydrological change affecting moisture-sensitive vegetation utilised by some invertebrate species.
- Implement salvage and relocation of invertebrates from impact areas prior to and during vegetation clearance. Detailed methods and procedures for invertebrate capture, handling, relocation, and post-release monitoring are outlined in the IMP but will generally include:
 - Capture of terrestrial and flighted invertebrates prior to and during vegetation clearance activities.
 - Relocation of individuals to suitable receiving sites with appropriate habitat characteristics.
 - Staged and progressive vegetation clearance where practicable to allow natural dispersal of invertebrates outwards towards adjacent unaffected habitats.
 - Enhancement of habitat at the relocation site(s) to maintain habitat availability and support-term population persistence. This will include measures such permanent protection of tussock grassland and shrub vegetation.

6.4.2.7.3 *Remediation*

Remediation and rehabilitation of disturbed mining areas will be undertaken in accordance with the Rehabilitation Management Plan (Boffa Miskell 2026) and Mine Closure Plan (Boffa Miskell 2026). Details of the location, extent, and type of rehabilitation are provided in these documents and are expected to include the re-establishment of indigenous vegetation communities and the restoration or creation of habitats suitable for invertebrates such as areas of replanted tussock. The extent of the native vegetation rehabilitation will be at least the amount, likely more, that has been lost from the impact area.

While rehabilitation will not immediately replace the ecological values lost through habitat clearance, it is expected to progressively improve (to some degree) habitat conditions over time. As vegetation establishes and habitat complexity increases, rehabilitated areas are likely to be naturally recolonised by some invertebrates from adjacent habitats. Furthermore, the addition of rocky features will provide

refugia habitat for invertebrates. Consequently, rehabilitation has the potential to provide longer-term benefits for local invertebrate populations through increased habitat availability, improved connectivity, and the restoration of ecological function.

However, the extent, timing, and effectiveness of these benefits are inherently uncertain and cannot be quantified with confidence at this stage. Accordingly, any potential gains associated with rehabilitation have not been relied upon to reduce the assessed severity of adverse effects resulting from habitat loss and modification. Rather, any future ecological benefits arising from rehabilitation are considered additional to the measures required to avoid, remedy, mitigate, offset, or compensate for Project-related effects on invertebrates.

6.4.2.8 Efficacy of avoidance, minimisation/ mitigation, and remediation measures

Despite applying these mitigation measures, it is inevitable that some invertebrates will not be detected or captured during salvage operations and may therefore be incidentally injured or killed during vegetation clearance and construction activities. Consequently, some residual adverse effects on invertebrate populations are expected to remain.

For the purposes of this ecological effects assessment, salvage and relocation has been assumed to materially reduce the magnitude of effects on invertebrates. This assumption is considered reasonable because there is currently no evidence to suggest that such measures are ineffective, and salvage and relocation has previously been accepted by regulatory authorities as an appropriate means of reducing adverse effects on invertebrates associated with mining activities (e.g., Waitaki District Council Land-use consent – 201.2023.2302/3 (condition 16)). Furthermore, large-scale salvage and relocation programmes undertaken for the Coronation North 5 and Continuity Consents Project Stage 2 have demonstrated that these measures can be successfully implemented in the field (Bioresearches 2025; 2026q).

While the effectiveness of salvage and relocation is likely to vary among species and cannot be quantified with certainty, these measures are expected to reduce direct mortality, retain individuals within the wider landscape, and increase the likelihood of local population persistence following disturbance. Accordingly, salvage and relocation are anticipated to provide positive benefits and contribute to reducing the overall adverse effects of the Project on invertebrates.

Table 6-29. Summary of the effects management measures proposed for invertebrates (including 'Threatened', 'At Risk', 'Data Deficient', and other notable species) present in the MP4 Project area.

Species	Magnitude of effect (prior to mitigation)	Effects management measures	Magnitude of residual effect
<i>Invertebrate community (Project wide)</i>	High	- Salvage and relocation of terrestrial and flighted invertebrates. - Salvage of various species of host plants (e.g., <i>Chionochloa</i>, <i>Senecio</i>, <i>Ranunculus</i>, <i>Aciphylla</i>, <i>Carmichaelia</i>) and larvae associated with these plants for relocation to areas of protected and enhanced habitat elsewhere on the landholdings (e.g., MEEA, compensation wetland areas). - Vegetation direct transfer (VDT) of invertebrate host plants to the Mt Highlay Station). - Anticipated benefits from protection of 200 ha of tussock in the Murphys Connection and 252 ha of habitat within the predator-exclusion fence at MEEA. - Anticipated benefits from 0.17 ha of protected ephemeral wetland at Murphys Connection. - Replanting host plants as part of the 175 ha of tussock planting at Mt Highlay Station and Cranky Jims Link	Moderate
<i>Orocrambus sophistes</i>	High	- Salvage, using moth traps, and relocation of flighted adults. - Salvage of host plants (<i>Chionochloa rigida</i> subsp. <i>rigida</i>) and larvae associated with these plants and relocation to nearby protected areas (e.g., Murphys Connection, MEEA fence, My Highlay Station). - Replanting host plants (<i>Chionochloa rigida</i> subsp. <i>rigida</i>) in the 175 ha tussock planting area at Mt Highlay Station and Cranky Jims Link. - Anticipated benefits from protection of 200 ha of tussock in the Murphys Connection and 252 ha of habitat within the predator-exclusion fence at MEEA.	Moderate

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Species	Magnitude of effect (prior to mitigation)	Effects management measures	Magnitude of residual effect
<i>Agrotis admirationis</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Host plant unknown but thought to be polyphagous and feed on herbs. - Anticipated benefits from protection of 200 ha of tussock in the Murphys Connection and 252 ha of habitat within the predator-exclusion fence at MEEA.	Moderate
<i>Asaphodes recta</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Salvage and relocation of host plants (<i>Senecio glomeratus</i> Poir. subsp. <i>glomeratus</i>, <i>Ranunculus</i> spp.) and larvae associated with these plants. <i>Senecio glomeratus</i> Poir. subsp. <i>glomeratus</i> growing in the Central Mining Area is proposed to be vegetation direct transferred (VDT) to the Mt Highlay Station (see vegetation management report), which will result in the relocation of <i>Asaphodes recta</i> larvae. - Replanting host plants (<i>Senecio dunedinensis</i>) in tor buffer planting areas in (e.g., MEEA, Mt Highlay Station) and <i>Ranunculus amphitrichus</i> and <i>R. ternatifolius</i> in ephemeral wetland protection areas. - Other hosts plants such as <i>Bellis</i> sp. are considered environmental weeds in New Zealand and thus, will not be relocated. - Anticipated benefits from 0.17 ha of protected ephemeral wetland at Murphys Connection.	Moderate
<i>Dasyuris partheniata</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Salvage and relocation of host plants (<i>Aciphylla subflabellata</i>) and larvae associated with these plants. Plants to be relocated to nearby protected areas (e.g., Murphys Connection, MEEA fence, My Highlay Station). - Replanting host plants (<i>Aciphylla subflabellata</i>) as part of the 175 ha of tussock planting at Mt Highlay Station and Cranky Jims Link, protection of 200 ha of tussock at Murphys Connection, and 252 ha of habitat within the predator-exclusion fence at MEEA.	Moderate

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Species	Magnitude of effect (prior to mitigation)	Effects management measures	Magnitude of residual effect
<i>Nyctemera annulata</i>	Low	- Salvage, using moth traps, and relocation of flighted adults. - Salvage and relocation of host plants (<i>Senecio</i> spp.) and larvae associated with these plants. Salvaged <i>Senecio</i> spp. to be relocated to nearby protected areas (e.g., Murphys Connection, MEEA fence, Mt Highlay Station). - Replanting host plants (<i>Senecio dunedinensis</i>) within Murphys Connection and as part of the rock tor buffer enhancement and rock outcrop creation/ replacement (See Lizard Management Plan for details). - Other hosts plants (e.g., Cineraria, groundsel, ragwort) are naturally abundant in the local landscape, where they will be protected (e.g., Murphys Connection, MEEA fence, Cranky Jims Link, Mt Highlay Station).	Low
<i>Orthodera novaezealandiae</i>	Low	- Salvage and relocation of adults, juveniles, and ootheca (egg cases) as encountered during lizard salvage and vegetation transfer operations. - Anticipated benefits from 175 ha of tussock and 50 ha of shrubland enhancement planting at Mt Highlay Station and Cranky Jims Link, respectively, protection of 200 ha of tussock and 80 ha of shrubland at Murphys Connection, and 252 ha of habitat within the predator-exclusion fence at MEEA.	Low
<i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia")	Low	- Salvage, using moth traps, and relocation of flighted adults. - Salvage and relocation of host plants (<i>Carmichaelia crassicaulis</i> subsp. <i>crassicaulis</i>; <i>Carmichaelia petriei</i>; <i>Carmichaelia corrugata</i>, <i>Carmichaelia kirkii</i>) and larvae associated with these plants. Salvaged plants to be relocated to Murphys Connection, the MEEA fence, and/ or Cranky Jims Link. - Replanting host plants (<i>Carmichaelia crassicaulis</i> subsp. <i>crassicaulis</i>; <i>Carmichaelia corrugata</i>, <i>Carmichaelia petriei</i>) as part of the 50 ha of shrubland and 175 ha of tussock enhancement planting at Cranky Jims Link and Mt Highlay Station, respectively. - Anticipated benefits from protection of 200 ha of tussock in the Murphys Connection and 252 ha of habitat within the predator-exclusion fence at MEEA.	Low

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Species	Magnitude of effect (prior to mitigation)	Effects management measures	Magnitude of residual effect
<i>Patagoniodes farinaria</i>	Low	- Salvage, using moth traps, and relocation of flighted adults. - Host plants (e.g., shore groundsel, ragwort) are common in the landscape and will not be salvaged or relocated. - Anticipated benefits from protection of 200 ha of tussock in the Murphys Connection and 252 ha of habitat within the predator-exclusion fence at MEEA.	Low
<i>Samana acutata</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Salvage and relocation of host plants (<i>Carmichaelia crassicaulis</i> subsp. <i>crassicaulis</i>; <i>Carmichaelia petriei</i>; <i>Carmichaelia corrugata</i>, <i>Carmichaelia kirkii</i>) and larvae associated with these plants. Salvaged plants to be relocated to Murphys Connection, the MEEA fence, and/ or Cranky Jims Link. - Replanting host plants (<i>Carmichaelia crassicaulis</i> subsp. <i>crassicaulis</i>; <i>Carmichaelia corrugata</i>, <i>Carmichaelia petriei</i>) as part of the 50 ha of shrubland and 175 ha of tussock enhancement planting at Cranky Jims Link and Mt Highlay Station, respectively. - Anticipated benefits from protection of 200 ha of tussock in the Murphys Connection and 252 ha of habitat within the predator-exclusion fence at MEEA.	Moderate

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Species	Magnitude of effect (prior to mitigation)	Effects management measures	Magnitude of residual effect
<i>Theoxena scissaria</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Salvage and relocation of host plants (<i>Carmichaelia crassicaulis</i> subsp. <i>crassicaulis</i>; <i>Carmichaelia petriei</i>; <i>Carmichaelia corrugata</i>, <i>Carmichaelia kirkii</i>), as well as larvae and flightless females associated with these plants. Salvaged plants to be relocated to Murphys Connection, the MEEA fence, and/ or Cranky Jims Link. - Replanting host plants (<i>Carmichaelia crassicaulis</i> subsp. <i>crassicaulis</i>; <i>Carmichaelia corrugata</i>, <i>Carmichaelia petriei</i>) as part of the 50 ha of shrubland and 175 ha of tussock enhancement planting at Cranky Jims Link and Mt Highlay Station, respectively. - Anticipated benefits from protection of 200 ha of tussock in the Murphys Connection and 252 ha of habitat within the predator-exclusion fence at MEEA.	Moderate
<i>Bityla sericea</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Host plant thought to be <i>Muehlenbeckia</i>, which is abundant in the surrounding landscape and will not be salvaged or relocated. - Replanting host plants (<i>Muehlenbeckia</i>) as part of the rock outcrop creation/ replacement in MEEA (See Lizard Management Plan for details). - Anticipated benefits from protection of 200 ha of tussock in the Murphys Connection and 252 ha of habitat within the predator-exclusion fence at MEEA, both areas of which support <i>Muehlenbeckia</i> host plants.	Moderate
<i>Wiseana fuliginea</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Host plant unknown but larvae are thought to feed on pasture grasses, which are abundant in the local landscape so will not be relocated.	Moderate

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Species	Magnitude of effect (prior to mitigation)	Effects management measures	Magnitude of residual effect
<i>Wiseana mimica</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Host plant unknown but larvae are thought to feed on pasture grasses, which are abundant in the local landscape so will not be relocated.	Moderate
<i>Zelandobius uniramus</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Larvae are aquatic and therefore, protection of freshwater (stream) habitats are expected to provide benefits for this species (see Stream Compensation Plan, Viridis 2026). - Anticipated benefits from stream habitat protection within the 268 ha Murphys Connection and 252 ha predator-exclusion fence at MEEA.	Moderate
<i>Hemiandrus maia</i>	Moderate	- Salvage of adults during lizard salvage operation and relocation to MEEA. This species is readily caught in lizard pitfall traps and found beneath rocks. - Anticipated benefits from habitat protection within the 268 ha Murphys Connection, 50 ha of Cranky Jims Link, and 252 ha predator-exclusion fence at MEEA.	Moderate
<i>Mecodema</i> sp. "Oamaru"	Moderate	- Salvage of adults during lizard salvage operation and relocation to MEEA. This species is readily caught in lizard pitfall traps and found beneath rocks. - Anticipated benefits from habitat protection within the 268 ha Murphys Connection, 50 ha of Cranky Jims Link, and 252 ha predator-exclusion fence at MEEA.	Moderate

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Species	Magnitude of effect (prior to mitigation)	Effects management measures	Magnitude of residual effect
<i>Orocrambus</i> cf. <i>cyclopicus</i>	Moderate	- Salvage, using moth traps, and relocation of flighted adults. - Salvage and relocation of host plants (<i>Chionochloa rigida</i> subsp. <i>rigida</i>) and larvae associated with these plants. - Replanting host plants (<i>Chionochloa rigida</i> subsp. <i>rigida</i>) at Mt Highlay Station. - Anticipated benefits from 175 ha of tussock enhancement planting at Mt Highlay Station, protection of 200 ha of tussock in the Murphys Connection, and 252 ha of habitat within the predator-exclusion fence at MEEA.	Moderate

- Moderate value, based on the presence of species assumed to be locally uncommon at the ED scale.

6.4.2.9 Level of residual effect

The level of residual effect on invertebrates has been determined by combining ecological value with the assessed magnitude of effect following implementation of the mitigation measures outlined above. The resulting residual effects assessment is presented in Table 6-30, with a summary provided below.

At the Project-wide scale, the residual level of effect on the invertebrate community is assessed as High. This reflects the expectation that the proposed mitigation package, including salvage and relocation, host-plant management, habitat protection, habitat enhancement, and monitoring, will reduce the adverse effects of habitat loss and construction activities, although uncertainty remains regarding the effectiveness of some measures. The assessment is intentionally precautionary, reflecting this uncertainty. Notwithstanding, the majority of the affected invertebrate community comprises species that are widespread throughout the Macraes ED and are expected to remain well represented in the surrounding landscape following Project implementation. Consequently, residual effects are expected to be largely confined to localised habitat loss within the Project footprint and unavoidable mortality of a relatively small number of individuals during construction.

For notable invertebrate species, residual levels of effect range from Low to High (Table 6-30). The Moderate and High residual effects are primarily driven by the species' High or Very High ecological values combined with a precautionary Moderate residual magnitude of effect. Although the proposed mitigation measures, including species-specific management such as host-plant salvage and relocation, targeted surveys, habitat enhancement, habitat protection, and monitoring, are expected to reduce the magnitude of effects, the extent of this reduction cannot be quantified with confidence. Most notable species are considered to have relatively widespread distributions and large populations within the Macraes' ED (with the possible exception of *Theoxena scissaria*), and survey results indicate that only a small number of individuals of any particular species are likely to be affected within the Project footprint. Importantly, available information indicates that very few, if any, individuals of *Orocrambus sophistes* are likely to occur within the Project footprint. Accordingly, the residual effects assessment should not be interpreted as indicating that adverse effects on this species cannot be appropriately managed but rather reflects the application of a precautionary assessment framework in the face of uncertainty.

Overall, the residual effects assessment indicates that the proposed mitigation measures are expected to contribute to a reduction in Project-related effects on invertebrates, although residual effects will remain. Extensive areas of suitable habitat will continue to occur both within OGNZL landholdings and throughout the wider Macraes ED, and affected species are expected to remain widespread in the landscape following Project implementation. Nevertheless, because residual effects remain after mitigation, additional residual effects management is required to address these effects. This is considered in the Terrestrial Residual Effects Analysis report (E13; Bioresearches 2026I).

Table 6-30. Level of residual effect on invertebrates (i.e., level of effect after mitigation).

Species	Ecological value	Magnitude of effect (after mitigation)	Level of residual effect
Invertebrate community (Project wide)	High	Moderate	High
<i>Orocrambus sophistes</i>	Very high	Moderate	High
<i>Agrotis admirationis</i>	High	Moderate	High
<i>Asaphodes recta</i>	High	Moderate	High
<i>Dasyuris partheniata</i>	High	Moderate	High
<i>Nyctemera annulata</i>	High	Low	Low
<i>Orthodera novaezealandiae</i>	High	Low	Low
<i>Pasiphila</i> sp. A (NZAC 04285480 "Carmichaelia")	High	Low	Low
<i>Patagoniodes farinaria</i>	High	Low	Low
<i>Samana acutata</i>	High	Moderate	High
<i>Theoxena scissaria</i>	High	Moderate	High
<i>Bityla sericea</i>	Moderate	Moderate	Moderate
<i>Wiseana fuliginea</i>	Moderate	Moderate	Moderate
<i>Wiseana mimica</i>	Moderate	Low	Low
<i>Zelandobius uniramus</i>	Moderate	Moderate	Moderate
<i>Hemiandrus maia</i>	Low	Moderate	Low
<i>Mecodema</i> sp. "Oamaru"	Moderate	Moderate	Moderate
<i>Orocrambus</i> cf. <i>cyclopicus</i>	Moderate	Moderate	Moderate

6.4.3 Lizards

The Project has the potential to result in a range of direct and indirect adverse effects on lizard populations through the clearance, modification, degradation, and fragmentation of habitat, including tussock grassland, shrubland, and schist rock outcrops.

These habitats provide important ecological functions for lizards, including refuge, basking sites, foraging opportunities, breeding habitat, and dispersal pathways. The lizard community within the Project area comprises three indigenous species, including two species classified as 'At Risk' under the NZTCS (Hitchmough *et al.* 2026) and RTCS (Jarvie *et al.* 2025a).

The nature and significance of potential effects vary among species according to their habitat requirements, mobility, population status, and ecological resilience. Species with a strong dependence on schist rock habitats are likely to be most susceptible to permanent habitat loss and fragmentation, while shrubland or grassland-associated species tend to be more widespread and more tolerant of habitat modification, although localised adverse effects on individuals and habitat are still anticipated.

6.4.3.1 Potential direct effects

Potential direct effects on approximately 238.7 ha of suitable lizard habitat and 155,564 individual lizards within the MP4 Project area (i.e., impact footprint plus 20 m buffer) are anticipated.

6.4.3.1.1 *Permanent loss of habitat that supports protected and 'At Risk' lizards.*

The Project will result in removal and modification of tussock grassland, shrubland, and rock tor habitats within the footprint. These habitats provide essential ecological functions for lizards, including refuge, basking sites, and foraging areas. Loss of rock tor habitats represents the most significant direct effect, as these features support high-value, habitat-specialist species (e.g., kōrero gecko) and are not readily replaceable. Removal of shrubland and tussock vegetation will reduce habitat availability and structural complexity for geckos and grassland-associated skinks. Habitat modification, including changes to ground cover and vegetation composition, may further reduce habitat suitability in areas adjacent to the Project footprint.

6.4.3.1.2 *Injury or mortality of lizards during vegetation and habitat removal.*

Vegetation clearance, topsoil stripping, and excavation activities will result in injury or mortality of lizards, including 'At Risk' species, within the impact footprint. Mortality risk is highest for species with low mobility and strong site fidelity, particularly those associated with rock habitats and dense vegetation.

6.4.3.1.3 *Habitat fragmentation and loss of ecological connectivity.*

Habitat fragmentation will occur as a result of vegetation clearance and the development of infrastructure, reducing connectivity between habitat patches. This may isolate local populations, particularly for species with limited dispersal ability.

6.4.3.1.4 *Creation of habitat edge effects,*

Creation of new habitat edges may alter the composition and degrade the integrity of adjacent vegetation affecting habitat suitability for lizards. Edge effects may alter microclimatic conditions, including temperature and moisture regimes, and increase exposure to predators.

6.4.3.1.5 *Displacement of resident lizards*

Displacement of lizards into adjacent habitats where habitat quality may be lower or already support populations at, or near, carrying capacity, potentially resulting in increased competition, reduced resource availability, and declines in individual fitness and population performance.

6.4.3.2 *Potential indirect effects*

Potential indirect effects are anticipated within approximately 180.8 ha of suitable lizard habitat within the buffer zone. The magnitude of these effects has been assessed using a precautionary approach, recognising the uncertainty associated with indirect effects and the inherent challenges in accurately quantifying their extent and severity.

Potential indirect effects on lizard communities and species could occur within approximately 180.8 ha of suitable habitat in the wider surrounding (80 m) buffer zone, though their extent and severity are uncertain. However, such effects are not expected to result in measurable impacts, because much of the landscape is already subject to mining activity and may already be experiencing indirect effects as a result and because many of the species recorded during the Project were themselves found well within 80 m of existing or historical mining activity. A precautionary approach that accounts for the potential range of indirect effects has nonetheless been taken when assigning magnitude of effect ratings for lizard communities and species.

6.4.3.2.1 *Disturbance and indirect alterations to adjacent habitat quality*

Disturbance related effects may arise through alterations to the quality and suitability of adjacent habitats. Noise and vibration associated with blasting and heavy machinery have the potential to disturb lizards, displace individuals from refuges, and reduce habitat quality in areas surrounding active operations. These effects are likely to be most pronounced in rock habitats, where vibration could alter the stability or suitability of refuge sites.

Changes to local hydrology resulting from drainage (loss of surface water interaction) or dewatering (loss of groundwater interaction) could potentially affect habitat suitability for some lizard taxa. Species associated with damper habitats (e.g., southern grass skink) could be indirectly affected by changes in moisture regimes, which may alter vegetation composition and reduce habitat quality. However, because surface water contributions (from rainfall) are likely to maintain shallow ground moisture and lizards are mobile and will move to find preferred habitats, potential impacts are not likely to materially influence the species presence or population viability. Furthermore, any potential drainage of areas surrounding the mining activities will be minimised through construction design and

mitigated through the implementation of Sediment Retention Ponds (SRPs) and discharging equivalent catchment volumes back into the wider contributing catchment. Accordingly, indirect effects from drainage are not considered likely to impact lizard communities or their habitat beyond the impact area and 20 m precautionary buffer.

Ground subsidence, and associated changes to habitat structure, stability, and hydrology from underground mining, is not expected to materially affect lizard populations. In rocky habitats, subsidence could potentially alter the configuration of crevices within rock outcrops that provide refuge sites for lizards. However, on balance subtle changes in crevice structure are unlikely to adversely affect rock-dwelling lizards given that any potential changes in structure could equally improve crevice habitat for lizards (e.g., widening or narrowing of crevices). Subsidence could influence surface drainage patterns, soil moisture, and vegetation composition, potentially affecting habitat suitability. These effects may be experienced in Deepdell Creek as a result of the underground mining expansion of GPUG. It is understood that further investigations are to be undertaken on the degree of subsidence in this area, but any potential effects will be minimised and/ or mitigated through management actions and the implementation of "orange no-go zones" where subsidence is expected to be greatest.

Dust deposition may further reduce habitat quality by affecting vegetation health and structure, with consequent effects on shelter availability and invertebrate prey resources. Dust accumulation may also influence thermoregulation by altering the thermal properties of basking substrates. However, these effects are expected to be localised and managed through standard dust suppression measures.

Artificial lighting associated with Project infrastructure or nocturnal mining activities may affect lizard behaviour, particularly for nocturnal kōrero geckos. Increased illumination has the potential to alter activity patterns, reduce foraging opportunities, and increase exposure to predators. Such effects are expected to be largely confined to areas immediately adjacent to lit infrastructure and within or on the edges of pits and are unlikely to extend across the wider landscape.

While some short-term behavioural responses to disturbances may be anticipated, any long-term population-level effects are expected to be restricted to habitats in immediately adjacent to active mining operations.

6.4.3.2.2 *Sediment runoff*

Sediment runoff from disturbed areas has the potential to affect adjacent habitats through increased sediment deposition and changes to water quality. Such effects may alter vegetation composition, reduce habitat quality, and affect invertebrate prey availability for lizards. However, these effects are expected to be localised and managed through standard erosion and sediment control measures.

6.4.3.2.3 *Facilitation or exacerbation of the spread of exotic/ invasive plants or animals through the landscape.*

Mining activities may facilitate the establishment and spread of invasive plant and animal species through increased habitat disturbance, vehicle movements, and the creation of dispersal corridors. Invasive species can potentially reduce habitat quality for lizards by altering vegetation structure,

degrading refuge sites, and increasing predation pressure. However, the lizard species present within the Project area are generally adaptable and are known to persist in modified and exotic-dominated habitats, suggesting any effects are likely to be limited and localised.

6.4.3.3 Cumulative effects

The staged development of the Macraes Operation has, to date, affected more than 2,000 ha of land, an unknown proportion of which is likely to have previously supported indigenous vegetation and lizard habitat. Effects management has been undertaken for each project stage; however, cumulative effects can arise where multiple individually minor, unaccounted for, or incompletely mitigated effects accumulate over time to produce a greater overall impact than anticipated at any single stage. Non-project effects, including surrounding pastoral land use such as the conversion of tussockland to pasture, may also interact with mining-related effects and contribute to long-term ecological change.

Cumulative effects are often difficult to measure and may not be fully captured in project-specific assessments. Nevertheless, it is important to consider the proposed activity in the context of past, present, and reasonably foreseeable future activities, after accounting for avoidance, remediation, and mitigation. For native lizards, cumulative effects may include incremental habitat loss, degradation, and fragmentation, as well as reduced connectivity, declining habitat quality, and increasing pressure from pests and weeds.

For the Project, an appropriate temporal scale for considering cumulative effects on lizards extends from the period prior to establishment of the mine in 1990 through to the current proposed life of mine. The Macraes ED provides an appropriate spatial scale, as it captures both the Project area and the wider landscape context for lizard populations and habitat availability. Future staged mine development, ongoing agricultural pressures, and wider habitat degradation are expected to continue influencing the availability and quality of lizard habitat across this landscape.

Several lizard species previously reported from OGNZL Macraes landholdings, including herffield skink, Otago skink, grand skink, and Otago green skink, have declined markedly in recent decades. In addition, all but one of the lizard species recorded within the Project area are in population decline. Extensive areas of high-quality lizard habitat, including complex schist tors, native tussockland, shrubland, and riparian habitats, have also been cleared, modified, or fragmented over time through mining and agricultural activities. These historical effects, in combination with effects anticipated from the Project, have the potential to contribute to long-term adverse outcomes for native lizard populations if not appropriately managed.

Given the complexity and uncertainty associated with cumulative effects assessment for lizards, no attempt has been made to quantify cumulative impacts directly. However, historical habitat loss, ongoing landscape modification, and known population declines have been considered when assigning the magnitude of effects for lizard species (Table 6-32).

6.4.3.4 Conservation status, spatial scale, duration, and ecosystem role

Several factors were considered when assigning the magnitude of effects, including conservation status, spatial scale, duration, and ecosystem role, to provide an informed and proportionate assessment of potential impacts.

- Greater weight was given to species with higher levels of conservation concern, as populations of more threatened species are generally less resilient to disturbance, habitat loss, and population declines than widespread or 'Not Threatened' species.
- Spatial scale was considered, with regard given to the extent of suitable habitat and proportion of the population affected at both the local (OGNZL landholdings; approximately 13,063 ha) and ED (Macraes ED; approximately 113,818 ha) scales.
 - Reliable estimates of the total extent of suitable habitat for McCann's skink, southern grass skink, and kōrero gecko are not currently available at either the OGNZL landholding or Macraes' ED scales. Accordingly, a precautionary assumption was adopted that suitable habitat comprises 10% of the land area at both scales. This assumption is considered conservative based on the perceived widespread distribution of these species and the apparent availability of suitable habitat across both the OGNZL landholdings and the wider Macraes' ED. Consequently, the proportion of available habitat affected by the Project is likely to be overestimated, resulting in a precautionary assessment of effect magnitude.
 - Population estimates for these species at the local and ED scales are also unavailable. Therefore, precautionary population estimates were derived by extrapolating species-specific density estimates generated from baseline monitoring data (see Section 3.6.3 of the Lizard Values Report; Bioresearches 2026c) across the assumed extent of suitable habitat (10% of the land area) at both the local and ED scales. The resulting estimates are intended solely to provide context for assessing the relative magnitude of effects and should not be interpreted as actual population estimates (see Appendix E for calculations).
- The duration of effects recognises that short-term or temporary effects are generally less consequential than long-term or permanent effects. Effects resulting in temporary disturbance or habitat modification were assigned a lower magnitude than those causing prolonged reductions in habitat availability, population size, or ecological function.
- Ecosystem role refers to the function a species performs within its environment, including its interactions with other species and contribution to ecological processes. The assessment considers both the ecological function of the species and its assumed importance to the wider ecosystem.

Table 6-31 summarises the baseline context for each lizard species and provides the information considered as part of the magnitude of effects assessment.

6.4.3.5 Taoka/ Taonga species

Taoka, or taonga, species are indigenous species recognised as having cultural significance. While no lizards are listed in Schedule 97 of the Ngai Tahu Claims Settlement Act 1998, the April 2026 Statement of Evidence of Jade Watkin (Ecology and Kāi Tahu) affirms the cultural value of kārara/ lizards (including tussock skink, McCann’s skink, and Kawarau gecko—a close relative of the kōrero gecko) as “spiritual guardians of wāhi tapu and urupā, are respected kaitiaki, and are part of the whakapapa of Kāi Tahu”. Accordingly, the significance of these species has been considered in assigning magnitude of effect and mitigation measures to reduce severity of effects as far as practicable.

Table 6-31. Baseline ecological context for each lizard species, including conservation status, ecosystem role, estimated population size, and extent of suitable habitat at both the local (OGNZL landholdings) and ED scales. Also see Appendix E.

Species	NZTCS Status	Regional status	Ecosystem Role	Local – OGNZL landholdings		Macraes ED	
				Population estimate	Suitable habitat (ha)	Population estimate	Suitable habitat (ha)
McCann's skink	Not Threatened	Regionally Not Threatened	Small, skink, diurnal heliothermic, predator of invertebrates, prey for native birds, seed disperser and potential pollinator.	> 1 million	1,306	> 10 million	11,382
Southern grass skink	At Risk – Declining	Regionally Declining	Diurnal heliothermic skink, predator of invertebrates, prey for native birds, seed disperser and potential pollinator.	> 500,000	1,306	> 5 million	11,382
Kōrero gecko	At Risk – Declining	Regionally Declining	Nocturnal gecko, predator of invertebrates, prey for native birds, seed disperser and potential pollinator.	> 50,000	1,306	> 400,000	11,382

6.4.3.6 Magnitude of effects on lizards

To ensure a comprehensive assessment of magnitude, effects on each species within each Project area have been assessed (Table 6-32). This provides a transparent approach to highlight where magnitude is placed and also provides a clear outline of where residual effects remain, to guide residual effects management.

A summary of the overall magnitude on lizards across the entire Project area is also provided but is considered less sensitive and should be taken as a broad assessment and not replace the more specific Project area assessments.

Table 6-32. Magnitude of effect assessment for indigenous lizards, presented by individual MP4 Project area and collectively for the entire MP4 Project.

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
Coronation Mining Area			
McCann's skink	Low	Direct effects: • Injury or permanent loss of 22,452 individuals, approximating: ○ 1.6% of the estimated population on OGNZL landholdings. ○ 0.2% of the estimated population in the Macraes ED. • Permanent loss of 83.1 ha of suitable habitat, approximating: ○ 6.4% of the estimated suitable habitat on OGNZL landholdings. ○ 0.7% of the estimated suitable habitat in the Macraes ED. • Permanent loss of 48 rock outcrops (total extent: 0.167 ha). Indirect effects: • Individuals occupying the wider buffer (9.3 ha of suitable lizard habitat) subject to ongoing disturbance effects, including: ○ Habitat degradation on the edges of the impact footprint. ○ Localised hydrological changes potentially affecting moisture-dependent habitats. ○ Dust deposition affecting vegetation quality on the periphery of the impact footprint. ○ Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk. ○ Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. ○ Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. ○ Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		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	
Southern grass skink	High	Direct effects: - Injury or permanent loss of 30,277 individuals, approximating: 3.7% of the estimated population on OGNZL landholdings. 0.4% of the estimated population in the Macraes ED. - Permanent loss of 83.1 ha of suitable habitat, approximating: 6.4% of the estimated suitable habitat on OGNZL landholdings. 0.7% of the estimated suitable habitat in the Macraes ED Indirect effects: - Individuals occupying the wider buffer (9.3 ha) subject to ongoing disturbance effects, including: - Habitat degradation on the edges of the impact footprint. - Localised hydrological changes potentially affecting moisture-dependent habitats. - Dust deposition affecting vegetation quality on the periphery of the impact footprint. - Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk. - Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. - Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. - Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		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	
Kōrero gecko	High	Direct effects: - Injury or permanent loss of 2,050 individuals, approximating: 3.1% of the estimated population on OGNZL landholdings. 0.7% of the estimated population in the Macraes ED. - Permanent loss of 83.1 ha of suitable habitat, approximating: 6.4% of the estimated suitable habitat on OGNZL landholdings. 0.7% of the estimated suitable habitat in the Macraes ED - Permanent loss of 48 rock outcrops (total extent: 0.167 ha). Indirect effects: - Individuals occupying the wider buffer (9.3 ha) subject to ongoing disturbance effects, including: - Habitat degradation on the edges of the impact footprint. - Localised hydrological changes potentially affecting moisture-dependent habitats. - Dust deposition affecting vegetation quality on the periphery of the impact footprint. - Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk. - Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. - Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. - Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		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	
GPUG			
McCann's skink	Low	No direct effects are anticipated. Potential indirect effects associated with hydrological changes and/ or subsidence due to underground mining. No cumulative effects are anticipated. The species is culturally important to Kāi Tahu and holds a recognised cultural status.	Negligible
Southern grass skink	High	No direct effects are anticipated. Potential indirect effects associated with hydrological changes and/ or subsidence due to underground mining. No cumulative effects are anticipated. The species is culturally important to Kāi Tahu and holds a recognised cultural status.	Negligible
Kōrero gecko	High	No direct effects are anticipated. Potential indirect effects associated with hydrological changes and/ or subsidence due to underground mining. No cumulative effects are anticipated. The species is culturally important to Kāi Tahu and holds a recognised cultural status.	Negligible

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
Central Mining Area			
McCann's skink	Low	Direct effects: - Injury or permanent loss of 12,434 individuals, approximating: 2.9% of the estimated population on OGNZL landholdings. 0.3% of the estimated population in the Macraes ED. - Permanent loss of 49.9 ha of estimated suitable habitat, approximating: 3.8% of the estimated suitable habitat on OGNZL landholdings. 0.4% of the estimated suitable habitat in the Macraes ED Indirect effects: - Individuals occupying the wider buffer (8.6 ha) subject to ongoing disturbance effects, including: - Habitat degradation on the edges of the impact footprint. - Localised hydrological changes potentially affecting moisture-dependent habitats. - Dust deposition affecting vegetation quality on the periphery of the impact footprint. - Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk. - Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. - Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. - Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
Southern grass skink	High	Direct effects: - Injury or permanent loss of 18,107 individuals, approximating: 2.0% of the estimated population on OGNZL landholdings. 0.2% of the estimated population in the Macraes ED. - Permanent loss of 49.9 ha of suitable habitat, approximating: 3.8% of the estimated suitable habitat on OGNZL landholdings. 0.4% of the estimated suitable habitat in the Macraes ED Indirect effects: - Individuals occupying the wider buffer (8.6 ha) subject to ongoing disturbance effects, including: - Habitat degradation on the edges of the impact footprint. - Localised hydrological changes potentially affecting moisture-dependent habitats. - Dust deposition affecting vegetation quality on the periphery of the impact footprint. - Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk. - Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. - Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. - Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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	Moderate
Kōrero gecko	High	Direct effects:	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		- Injury or permanent loss of 1,213 individuals, approximating: 2.4% of the estimated population on OGNZL landholdings. 0.5% of the estimated population in the Macraes ED. - Permanent loss of 49.9 ha of suitable habitat, approximating: 3.8% of the estimated suitable habitat on OGNZL landholdings. 0.4% of the estimated suitable habitat in the Macraes ED Indirect effects: - Individuals occupying the wider buffer (8.6 ha) subject to ongoing disturbance effects, including: - Habitat degradation on the edges of the impact footprint. - Localised hydrological changes potentially affecting moisture-dependent habitats. - Dust deposition affecting vegetation quality on the periphery of the impact footprint. - Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk. - Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. - Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. - Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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	
FWFD			
McCann's skink	Low	Direct effects:	Low

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		- Injury or permanent loss of 1,474 individuals, approximating: 0.1% of the estimated population on OGNZL landholdings. 0.01% of the estimated population in the Macraes ED. - Permanent loss of 5.5 ha of suitable habitat, approximating: 0.4% of the estimated suitable habitat on OGNZL landholdings. 0.05% of the estimated suitable habitat in the Macraes ED No indirect effects anticipated because of the small scale and temporary nature of the works. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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.	
Southern grass skink	High	Direct effects: - Injury or permanent loss of 2,134 individuals, approximating: 0.3% of the estimated population on OGNZL landholdings. 0.03% of the estimated population in the Macraes ED. - Permanent loss of 5.5 ha of suitable habitat, approximating: 0.4% of the estimated suitable habitat on OGNZL landholdings. 0.05% of the estimated suitable habitat in the Macraes ED No indirect effects anticipated because of the small scale and temporary nature of the works. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally.	Low

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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.	
Kōrero gecko	-•	No direct effects are anticipated, as the species is not present. No indirect effects are anticipated, as the species is not present. No cumulative effects are anticipated, as the species is not present.	Negligible
Golden Bar Haul Road			
McCann's skink	Low	Direct effects: - Injury or permanent loss of 6,728 individuals, approximating: 0.5% of the estimated population on OGNZL landholdings. 0.2% of the estimated population in the Macraes ED. - Permanent loss of 26.4 ha of suitable habitat, approximating: 2.0% of the estimated suitable habitat on OGNZL landholdings. 0.2% of the estimated suitable habitat in the Macraes ED - Permanent loss of 2 rock outcrops (total extent: 0.015 ha). Indirect effects: - Individuals occupying the wider buffer (20.9 ha) subject to ongoing disturbance effects, including: - Habitat degradation on the edges of the impact footprint. - Localised hydrological changes potentially affecting moisture-dependent habitats. - Dust deposition affecting vegetation quality on the periphery of the impact footprint. - Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk.	Moderate

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		○ Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. ○ Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. ○ Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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	
Southern grass skink	High	Direct effects: • Injury or permanent loss of 9,834 individuals, approximating: ○ 1.2% of the estimated population on OGNZL landholdings. ○ 0.4% of the estimated population in the Macraes ED. • Permanent loss of 26.4 ha of suitable habitat, approximating: ○ 2.0% of the estimated suitable habitat on OGNZL landholdings. ○ 0.2% of the estimated suitable habitat in the Macraes ED Indirect effects: • Individuals occupying the wider buffer (20.9 ha) subject to ongoing disturbance effects, including: ○ Habitat degradation on the edges of the impact footprint. ○ Localised hydrological changes potentially affecting moisture-dependent habitats. ○ Dust deposition affecting vegetation quality on the periphery of the impact footprint. ○ Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		○ Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. ○ Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. ○ Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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	
Kōrero gecko	High	Direct effects: • Injury or permanent loss of 656 individuals, approximating: ○ 1.0% of the estimated population on OGNZL landholdings. ○ 0.6% of the estimated population in the Macraes ED. • Permanent loss of 26.4 ha of suitable habitat, approximating: ○ 2.0% of the estimated suitable habitat on OGNZL landholdings. ○ 0.2% of the estimated suitable habitat in the Macraes ED • Permanent loss of 2 rock outcrops (total extent: 0.015 ha). Indirect effects: • Individuals occupying the wider buffer (20.9 ha) subject to ongoing disturbance effects, including: ○ Habitat degradation on the edges of the impact footprint. ○ Localised hydrological changes potentially affecting moisture-dependent habitats. ○ Dust deposition affecting vegetation quality on the periphery of the impact footprint. ○ Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		○ Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. ○ Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. ○ Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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	
Golden Bar			
McCann's skink	Low	Direct effects: • Injury or permanent loss of 18,909 individuals, approximating: ○ 1.3% of the estimated population on OGNZL landholdings. ○ 0.15% of the estimated population in the Macraes ED. • Permanent loss of 73.8 ha of suitable habitat, approximating: ○ 5.7% of the estimated suitable habitat on OGNZL landholdings. ○ 0.2% of the estimated suitable habitat in the Macraes ED. • Permanent loss of 14 rock outcrops (total extent: 0.118 ha). Indirect effects: • Individuals occupying the wider buffer (11.1 ha) subject to ongoing disturbance effects, including: ○ Habitat degradation on the edges of the impact footprint. ○ Localised hydrological changes potentially affecting moisture-dependent habitats. ○ Dust deposition affecting vegetation quality on the periphery of the impact footprint.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		- Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk. - Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. - Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. - Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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	
Southern grass skink	High	Direct effects: - Injury or permanent loss of 27,461 individuals, approximating: 3.4% of the estimated population on OGNZL landholdings. 0.4% of the estimated population in the Macraes ED. - Permanent loss of 73.8 ha of suitable habitat, approximating: 5.7% of the estimated suitable habitat on OGNZL landholdings. 0.2% of the estimated suitable habitat in the Macraes ED Indirect effects: - Individuals occupying the wider buffer (11.1 ha) subject to ongoing disturbance effects, including: - Habitat degradation on the edges of the impact footprint. - Localised hydrological changes potentially affecting moisture-dependent habitats. - Dust deposition affecting vegetation quality on the periphery of the impact footprint. - Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk.	Moderate

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Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		○ Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. ○ Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. ○ Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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	
Kōrero gecko	High	Direct effects: • Injury or permanent loss of 1,835 individuals, approximating: ○ 2.8% of the estimated population on OGNZL landholdings. ○ 0.6% of the estimated population in the Macraes ED. • Permanent loss of 73.8 ha of suitable habitat, approximating: ○ 5.7% of the estimated suitable habitat on OGNZL landholdings. ○ 0.2% of the estimated suitable habitat in the Macraes ED. • Permanent loss of 14 rock outcrops (total extent: 0.118 ha). Indirect effects: • Individuals occupying the wider buffer (11.1 ha) subject to ongoing disturbance effects, including: ○ Habitat degradation on the edges of the impact footprint. ○ Localised hydrological changes potentially affecting moisture-dependent habitats. ○ Dust deposition affecting vegetation quality on the periphery of the impact footprint. ○ Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk.	Moderate

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		○ Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. ○ Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. ○ Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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	
MP4 Project overall			
McCann's skink	Low	Direct effects: • Injury or permanent loss of approximately 62,000 individuals, approximating: ○ 4.29% of the estimated population on OGNZL landholdings. ○ 0.5% of the estimated population in the Macraes ED. • Permanent loss of 238.7 ha of suitable habitat, approximating: ○ 18.3% of the estimated suitable habitat on OGNZL landholdings. ○ 2.1% of the estimated suitable habitat in the Macraes ED. • Permanent loss of 64 rock outcrops (total extent: 0.26 ha). Indirect effects: • Individuals occupying the wider buffer (180.8 ha) subject to ongoing disturbance effects, including: ○ Habitat degradation on the edges of the impact footprint. ○ Localised hydrological changes potentially affecting moisture-dependent habitats. ○ Dust deposition affecting vegetation quality on the periphery of the impact footprint.	High

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Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		- Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk. - Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. - Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. - Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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.	
Southern grass skink	High	Direct effects: - Injury or permanent loss of approximately 88,000 individuals, approximating: 10.7% of the estimated population on OGNZL landholdings. 1.2% of the estimated population in the Macraes ED. - Permanent loss of 238.7 ha of suitable habitat, approximating: 18.3% of the estimated suitable habitat on OGNZL landholdings. 2.1% of the estimated suitable habitat in the Macraes ED. Indirect effects: - Individuals occupying the wider buffer (180.8 ha) subject to ongoing disturbance effects, including: - Habitat degradation on the edges of the impact footprint. - Localised hydrological changes potentially affecting moisture-dependent habitats. - Dust deposition affecting vegetation quality on the periphery of the impact footprint. - Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk.	High

Macraes Phase 4 - Fast-track

Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		○ Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. ○ Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. ○ Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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.	
Kōrero gecko	High	Direct effects: • Injury or permanent loss of approximately 6,000 individuals, approximating: ○ 2.8% of the estimated population on OGNZL landholdings. ○ 0.6% of the estimated population in the Macraes ED. • Permanent loss of 238.7 ha of habitat (not all of which is suitable for kōrero gecko), approximating: ○ 18.3% of the estimated habitat on OGNZL landholdings. ○ 2.1% of the estimated habitat in the Macraes ED. • Permanent loss of 64 rock outcrops (total extent: 0.26 ha). Indirect effects: • Individuals occupying the wider buffer (180.8 ha) subject to ongoing disturbance effects, including: ○ Habitat degradation on the edges of the impact footprint. ○ Localised hydrological changes potentially affecting moisture-dependent habitats. ○ Dust deposition affecting vegetation quality on the periphery of the impact footprint. ○ Artificial lighting potentially altering nocturnal lizard behaviour and increasing predation risk.	High

Macraes Phase 4 - Fast-track

Ecological Impact Assessment for Terrestrial and Wetland Ecology Values

Species	Ecological value	Factors considered	Magnitude of effect (prior to mitigation)
		○ Vibration, and possibly noise, disturbance from blasting and mining activities. Not likely to extend beyond the periphery of the impact footprint. ○ Reduced habitat connectivity and dispersal opportunities for terrestrial lizards. ○ Increased weed invasion and vegetation change along habitat edges. Cumulative loss of individuals and habitat contributing to the historical loss of these features from OGNZL landholdings, Macraes ED, and nationally. The species is culturally important to Kāi Tahu and holds a recognised cultural status. 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.	

- Species is not present

6.4.3.7 Effects avoidance, minimisation/ mitigation, and remediation

Effects management for lizards associated with the proposed mining activities has been developed in accordance with the effects management hierarchy.

Complete avoidance of effects on lizards is not practicable across most Project areas, as the Project involves extensions to existing fixed-location mining infrastructure and ore bodies. Accordingly, effects on lizards occurring within the impact footprint and 20 m buffer are assumed to be unable to be avoided. Where avoidance is not practicable, effects will be minimised and managed through operational controls and targeted lizard salvage and relocation.

Lizard management will be implemented through the Lizard Management and Monitoring Plan (LMMP; Bioresearches 2026j), which will include salvage and relocation, habitat protection and enhancement, habitat creation, and population monitoring. These measures will be supported by standard environmental controls to reduce indirect effects on adjacent habitats as far as practicable.

The management approach also reflects the objectives of the OceanaGold Lizard Management Strategy (OceanaGold 2026), which provides a broader framework for the holistic management of lizard populations across OGNZL landholdings.

While these measures are expected to reduce the extent and severity of some direct and indirect effects, they will not fully mitigate the permanent loss of lizards and lizard habitat within the Project footprint. Any residual adverse effects on lizard communities will therefore be carried forward into the residual effects analysis and management package.

Four lizard species (herbfield skink, Otago green skink, Otago skink, and grand skink) known from the wider Macraes ED have not been assessed individually for the Project because extensive field investigations undertaken since 2022 have not detected them within the Project area, indicating that their presence is highly unlikely. Nevertheless, a precautionary approach will be adopted, and Project management measures will apply to any indigenous lizard species incidentally discovered during construction or operation. Further detail on the management of incidentally discovered species will be provided in the LMMP (Bioresearches 2026j).

6.4.3.7.1 Avoidance measures

Opportunities to avoid effects on lizards were considered during Project planning. However, given the fixed location of the ore resource and associated mining infrastructure, complete avoidance of habitat loss within the Project footprint is not practicable.

Where avoidance is possible, it will be achieved by scheduling vegetation and habitat clearance outside May to August — the period of lowest lizard activity — unless lizard salvage activities set out in the LMMP have already been completed for the area concerned. Beyond this, management of effects on lizards has focused primarily on minimising and mitigating adverse effects where avoidance is not reasonably achievable.

6.4.3.7.2 *Minimisation/ mitigation measures*

- Implement standard operational controls to limit disturbances. These will include:
 - Erosion and sediment controls to prevent sediment discharge to retained damp gullies, seepages, wetlands and riparian margins.
 - Dust suppression measures, including watering, stabilisation of exposed surfaces and management of haul roads, to reduce dust deposition and maintain existing habitat quality for lizards in adjacent land areas.
 - Lighting controls to limit light spill.
- Implement weed hygiene, weed control and progressive rehabilitation measures to reduce weed establishment in disturbed margins and retained indigenous vegetation.
- Minimise accidental encroachment into retained vegetation using exclusion fencing, flagging, site inductions, and/ or construction drawings showing no-go areas to prevent accidental disturbance outside the approved works footprint.
- Maintain hydrological inputs to retained seepage, riparian and wetland vegetation where practicable, manage road drainage and runoff, and monitor retained sensitive vegetation where hydrological effects are possible to reduced hydrological change affecting moisture-sensitive vegetation utilised by some lizard species.
- For higher value habitat in the 80 m buffer areas (e.g., the large complex rock outcrops in the Golden Bar buffer), minimisation will focus on physically demarcating retained rock outcrops, preventing accidental disturbance, and monitoring habitat quality and lizard populations through mining.
- Implement salvage and relocation of lizards from impact areas prior to and during vegetation clearance. Detailed methods and procedures for lizard capture, handling, relocation, and post-release monitoring are outlined in the LMMP but will generally include:
 - Capture of lizards prior to and during vegetation clearance activities.
 - Relocation of individuals to suitable receiving sites with appropriate habitat characteristics.
 - Staged and progressive vegetation clearance where practicable to allow natural dispersal of lizards outwards towards adjacent unaffected habitats.
 - Enhancement of habitat at the relocation site(s) to maintain habitat availability and support -term population persistence. This will include measures such as construction of rock piles to provide artificial refuges and permanent protection of tussock grassland and shrub vegetation.

6.4.3.7.3 *Remediation*

Remediation and rehabilitation of disturbed mining areas will be undertaken in accordance with the Rehabilitation Management Plan (Boffa Miskell 2026) and Mine Closure Plan (Boffa Miskell 2026). Details of the location, extent, and type of rehabilitation are provided in these documents and are expected to include the re-establishment of indigenous vegetation communities and the restoration or creation of habitats suitable for indigenous lizards (including rocky habitats). The extent of the native vegetation rehabilitation will be at least the amount, likely more, that has been lost from the impact area.

While rehabilitation will not immediately replace the ecological values lost through habitat clearance, it is expected to progressively improve (to some degree) habitat conditions over time. As vegetation establishes and habitat complexity increases, rehabilitated areas are likely to be naturally recolonised by lizards from adjacent habitats. Furthermore, the addition of rocky features will provide refugia habitat for lizards. Evidence of recolonisation of rehabilitated areas by lizards is evident in area such as the Golden Bar WRS (Bioresearches 2026c). Consequently, rehabilitation has the potential to provide longer-term benefits for local lizard populations through increased habitat availability, improved connectivity, and the restoration of ecological function.

However, the extent, timing, and effectiveness of these benefits are inherently uncertain and cannot be quantified with confidence at this stage. Accordingly, any potential gains associated with rehabilitation have not been relied upon to reduce the assessed severity of adverse effects resulting from habitat loss and modification. Rather, any future ecological benefits arising from rehabilitation are considered additional to the measures required to avoid, remedy, mitigate, offset, or compensate for Project-related effects on lizards.

6.4.3.8 Efficacy of avoidance, minimisation/ mitigation, and remediation measures

Notwithstanding these measures, it is inevitable that some lizards will not be detected or captured during salvage operations and may therefore be incidentally injured or killed during construction activities. As a result, residual adverse effects on lizard populations will remain.

For the purposes of this ecological effects assessment, salvage and relocation have not been assumed to materially reduce the magnitude of effects. This reflects the likelihood that only a proportion of affected individuals will be captured, together with the inherent uncertainty surrounding the long-term outcomes of lizard translocation and relocation programmes. Accordingly, the adequacy of the overall ecological effects management package does not rely on the success of salvage and relocation alone. Nevertheless, these measures are expected to provide conservation benefits by reducing direct mortality, retaining individuals within the wider landscape, and contributing to the persistence of lizard populations affected by the Project.

6.4.3.9 Level of residual effect

The level of residual effect on each lizard species within each Project area has been determined by combining ecological value with the assessed magnitude of effect. The assessment also considers conservation status, spatial scale, duration of effect, ecosystem role, and cultural value to provide an informed and proportionate assessment of potential impacts.

It is important to note that the assessed magnitude of effect on lizards remains unchanged before and after mitigation. This is because the assessment does not rely on mitigation measures, such as salvage and relocation, to reduce the magnitude of effect, due to uncertainty regarding relocation outcomes.

The assessment is presented in Table 6-33, with a summary provided below.

At the scale of individual Mining Areas:

- McCann's skink is expected to experience Very low to Low levels of residual effect. This reflects that the species is abundant and widespread in the landscape, relatively tolerant of habitat disturbance and modification, and will remain common in immediately surrounding environments following implementation of the MP4 Project. Field investigations have shown that McCann's skinks persist in highly modified habitats, including artificial habitats associated with mining, such as rock accumulations in windrows. Effects are therefore, largely confined to localised habitat loss and potential mortality during construction activities.
- Southern grass skink and kōrero geckos are expected to experience Very Low to High levels of residual effect. This reflects that both species are in decline and are more habitat-specific than McCann's skink. Southern grass skinks are most abundant in tussock grassland and damper vegetation environments, while kōrero geckos are primarily, though not exclusively, associated with complex rock outcrops and shrubland. Although both species will remain present in high numbers in the surrounding landscape, with suitable habitat remaining widely available, the loss of habitat and potential loss of individuals will contribute to ongoing declines. Accordingly, residual effects are assessed as higher than for the 'Not Threatened' McCann's skink.

At the scale of the entire MP4 Project:

- McCann's skink is expected to experience an overall Moderate level of residual effect. This reflects the combined effects of all Project mining areas and components, which necessitates an increased magnitude rating and corresponding increase in the assessed residual effect. The rating is primarily driven by the high number of McCann's skinks potentially affected, estimated at approximately 62,000 individuals, and the large area of habitat to be lost, estimated at approximately 238.7 ha. Although these impacts represent less than 5% of the estimated population and less than 20% of available habitat on OGNZL landholdings for this 'Not Threatened' species, a precautionary High magnitude rating has been applied. This results in a Moderate overall level of residual effect. Notwithstanding this rating, McCann's skink is abundant and widespread, relatively tolerant of habitat disturbance, and will remain common in the surrounding landscape following implementation of the MP4 Project.
- Southern grass skink and kōrero gecko are expected to experience overall Very high levels of residual effect. This reflects the combined effects of all Project mining areas and components, including the high number of southern grass skinks and kōrero geckos potentially affected, estimated at approximately 88,000 and 6,000 individuals respectively, and the large area of habitat to be lost, estimated at approximately 238.7 ha. These impacts represent less than 10% of the estimated populations and less than 20% of available habitat on OGNZL landholdings for these species. The assessed level of residual effect is higher than for McCann's skink because southern grass skinks and kōrero geckos are classified as 'At Risk' and are more habitat

specific. Despite these impacts, both species are expected to remain abundant in the surrounding landscape after the Project has been delivered.

The Moderate overall residual effect assessed for McCann's skink and the Very high overall residual effects assessed for southern grass skink and kōrero gecko reflect the precautionary and conservative nature of the assessment, rather than an expectation of population-level decline or loss of species viability. These ratings are driven primarily by the large absolute number of individuals and extent of habitat affected when impacts are aggregated across all Project components, despite these impacts representing less than 10% of the estimated populations and less than 20% of available habitat on OGNZL landholdings for these species.

Importantly, McCann's skink, southern grass skink, and kōrero gecko will remain widespread and abundant within the surrounding landscape following Project implementation, with extensive areas of suitable habitat remaining available. The assessment also does not rely on mitigation measures to reduce the magnitude of effect, resulting in a deliberately conservative residual effects assessment.

In this context, the Very high residual effect rating should not be interpreted as indicating that effects cannot be appropriately managed, mitigated, offset, or compensated. Rather, it reflects the precautionary approach adopted for the assessment. Consequently, biodiversity compensation is considered an appropriate response, as it can address residual effects through the delivery of measurable and enduring gains for lizard populations at a scale that is proportionate to, and intended to exceed, the localised impacts of the Project.

Table 6-33. Level of residual effect on lizards after mitigation measures. Note: mitigation measures have not reduced magnitude for reasons outlined in text.

Species	Ecological value	Magnitude of effect (after mitigation)	Level of residual effect
Coronation Mining Area			
McCann's skink	Low	Moderate	Low
Southern grass skink	High	Moderate	High
Kōrero gecko	High	Moderate	High
GPUG			
McCann's skink	Low	Negligible	Very low
Southern grass skink	High	Negligible	Very low
Kōrero gecko	High	Negligible	Very low
Central Mining Area			
McCann's skink	Low	Moderate	Low
Southern grass skink	High	Moderate	High
Kōrero gecko	High	Moderate	High
FWFD			
McCann's skink	Low	Low	Very low
Southern grass skink	High	Low	Low
Kōrero gecko	-	-	-
Golden Bar Haul Road			
McCann's skink	Low	Moderate	Low
Southern grass skink	High	Moderate	High
Kōrero gecko	High	Moderate	High
Golden Bar			
McCann's skink	Low	Moderate	Low
Southern grass skink	High	Moderate	High
Kōrero gecko	High	Moderate	High
MP4 Project overall			
McCann's skink	Low	High	Moderate
Southern grass skink	High	High	Very high
Kōrero gecko	High	High	Very high

6.4.4 Avifauna

6.4.4.1 Overview of avifauna effects assessment

This section assesses the potential effects of MP4 on indigenous birds and associated habitats within the Project Footprint and surrounding Zone of Influence. It draws on the avifauna values assessment, which describes the bird species recorded within the Project area, their conservation status, habitat associations, and ecological value.

The assessment focuses on indigenous bird species confirmed within, or likely to use, habitats affected by MP4. Particular attention is given to species of elevated ecological value due to being considered of Threatened or At Risk conservation status. Species value has been assigned in accordance with the EIANZ Ecological Impact Assessment Guidelines, using the higher of national or regional conservation status where relevant (Roper-Lindsay et al., 2018; Robertson et al., 2021; Jarvie et al., 2025).

The bird assemblage recorded within the Project area is characteristic of modified inland pastoral and mining landscapes in the Macraes' ED. Most species recorded are mobile and use a range of open-country, wetland, riparian, shrubland, pasture and mine-modified habitats. The assessment therefore distinguishes between effects on habitat availability and effects on individual birds, nests, eggs or chicks during sensitive periods such as breeding.

Potential effects on birds include permanent loss or modification of habitat, injury or mortality during vegetation and habitat removal, displacement from affected areas, habitat fragmentation, edge effects, and indirect disturbance or habitat degradation associated with mining activities. The magnitude and level of effect are assessed before and after implementation of avoidance, minimisation, mitigation and remediation measures, including the Avifauna Management Plan.

6.4.4.2 Baseline ecological context for affected bird species

The MP4 Project area supports an indigenous bird assemblage typical of modified inland pastoral and mining landscapes in Central Otago. Indigenous species recorded within the Project area include open-country, wetland-associated, riparian, shrubland-associated and generalist taxa. Overall indigenous bird diversity is low to moderate and reflects the modified character of the Project area, with higher diversity associated with ponds, wetlands, riparian gullies, shrubland and enhancement areas.

Seven species of elevated ecological value have been confirmed within the Project Footprint or wider MP4 assessment area: eastern falcon | kārearea, banded dotterel | pohowera, South Island pied oystercatcher | tōrea, New Zealand pipit | pīhoihoi, black shag | māpunga, fernbird | mātātā and silvereye | tauhou. Species value has been assigned using the higher of national or regional conservation status, consistent with the EIANZ EcIA framework (Roper-Lindsay et al., 2018; Robertson et al., 2021; Jarvie et al., 2025).

Table 6-34 provides the baseline ecological context for the principal indigenous bird species relevant to the effects assessment. The table focuses on species of elevated ecological value, together with lower-value indigenous species where their habitat use or nesting ecology is relevant to the assessment of direct and indirect effects.

Overall, the Project area provides functional habitat for several Threatened and At Risk open-country bird species within a predominantly modified mining and pastoral landscape. The most important avifauna values are associated with open-country habitats used by eastern falcon, banded dotterel,

South Island pied oystercatcher and New Zealand pipit, and with localised wetland, pond, riparian and shrubland habitats used by black shag, fernbird, silvereye and other indigenous species. The site does not support known breeding colonies of highly threatened taxa, but it provides foraging, movement and potential breeding habitat for several indigenous species of conservation concern.

6.4.4.3 Potential direct effects

Potential direct effects on birds are associated with the physical disturbance of habitat within the MP4 impact area. These effects may arise from vegetation clearance, overburden stripping, earthworks, pit development, waste rock placement, haul road construction, waterbody modification and other surface disturbance associated with mining activities.

For avifauna, the main direct effects are permanent loss or modification of habitat, injury or mortality of birds, eggs or chicks during vegetation and habitat removal, localised fragmentation of retained habitats, creation of new habitat edges, and displacement of birds from the direct impact area. These effects are most relevant to ground-nesting open-country species, particularly New Zealand pipit | pīhoihoi, banded dotterel | pohowera and South Island pied oystercatcher | tōrea.

The current assessment areas, based on the direct impact footprint plus a 20 m buffer, comprise approximately 319.76 ha across all the mining areas. The Frasers West French Drain is an additional impact area of 5.52 ha of predominantly exotic grassland. As this impact is from an approximately 2 m wide linear feature, it was not expected to remove complete bird territory or home range, and as such, these impacts were not carried forward. The impact areas include a high proportion of modified habitats, but also include pasture, tussock grassland, shrubland, wetland margins, riparian margins, ponds, gravel substrates, sparsely vegetated ground and mine-modified landforms that provide habitat for indigenous birds. The GPUG Extension is predominantly underground and is not expected to result in substantial direct surface habitat loss for avifauna. BRWRS has been removed from the active MP4 footprint and is therefore treated as an avoided area rather than an impact area.

6.4.4.3.1 Permanent loss of habitat that supports indigenous birds

MP4 will result in permanent loss or substantial modification of habitats that support indigenous birds. The affected habitats include open pasture, exotic grassland, tussock grassland, shrubland, riparian gullies, wetlands, ponds, mine-modified ground, road margins and sparsely vegetated substrates.

Direct habitat loss is most relevant to open-country species that use short vegetation, gravel, bare ground, rehabilitated mine landforms and disturbed substrates for foraging or breeding. These species include banded dotterel, South Island pied oystercatcher and New Zealand pipit. Habitat loss may also affect eastern falcon | kārearea through reduction in local foraging habitat, although this species is highly mobile, with large breeding and foraging territories. No nest sites have been identified within the impact area, but this cannot be excluded as a possibility.

Loss or modification of ponds, wetlands, riparian gullies and shrubland may reduce local habitat availability for black shag | māpunga, fernbird | māātātā, silvereye | tauhou and other indigenous wetland, riparian or shrubland-associated species. These effects are expected to be localised because similar or alternative habitat remains present within the surrounding landscape, but they remain relevant where affected habitats provide foraging, roosting, breeding or movement functions.

6.4.4.3.2 Injury or mortality of birds or their nests during vegetation and habitat removal

Vegetation clearance, earthworks, vehicle movements and ground disturbance may result in injury or mortality of indigenous birds if works occur where birds are nesting or where dependent young are present. The highest risk is to nests, eggs and chicks of ground-nesting species, as these can be cryptic, immobile and difficult to detect before machinery access.

Species most exposed to this risk include banded dotterel, South Island pied oystercatcher, pied stilt and New Zealand pipit. Other indigenous ground-nesting or wetland-associated species may also be affected where nests occur within the works area. Adult birds are generally mobile and are more likely to avoid active disturbance, but eggs, chicks and dependent fledglings have limited ability to avoid clearance, earthworks or vehicle movements.

Without management, nest loss or chick mortality could occur if vegetation clearance or earthworks take place within occupied breeding habitat. This effect is seasonal and is most relevant during the breeding periods identified in the Avifauna Management Plan (Bioresearches, 2026k).

6.4.4.3.3 Habitat fragmentation and loss of ecological connectivity

Direct habitat removal may reduce local habitat continuity between open-country, wetland, riparian and shrubland habitats. This may affect movement through the Project area where works remove vegetation or habitat features that provide shelter, foraging opportunities or movement pathways.

Fragmentation effects are expected to be limited for highly mobile species, including eastern falcon, black shag, South Island pied oystercatcher, banded dotterel and most wetland birds, because these species can move across open and modified landscapes. Fragmentation effects may be more relevant to smaller shrubland, wetland or riparian-associated species where retained habitat becomes more isolated or reduced in size.

Overall, habitat fragmentation is expected to be a localised effect within the Project area and is not expected to create a landscape-scale barrier to bird movement.

6.4.4.3.4 Creation of habitat edge effects

MP4 will create new edges between disturbed mining areas and retained habitats. Edge effects may include increased exposure, dust deposition, weed invasion, pest animal activity, light spill, noise, vibration and human disturbance at the interface between active works and retained habitat.

For most open-country species, edge effects are expected to be limited because these species already use open, exposed and modified habitats. Edge effects may be more relevant where works occur next to wetlands, shrubland, riparian gullies or denser vegetation used by fernbird, silvereye, grey warbler, fantail or other small indigenous birds that are resident within less open habitats.

The extent of edge effects will depend on the final works boundary, the condition of retained habitat, and the effectiveness of no-go areas, sediment controls, dust management, weed control and pest animal management.

6.4.4.3.5 Displacement of resident birds

Habitat removal and physical disturbance will displace birds from the direct impact area. Displacement may occur through removal of foraging habitat, breeding habitat, roosting areas or shelter, and through repeated disturbance from machinery, vehicles and human activity.

For common and mobile species, displacement is expected to occur at a local scale, with individuals likely to move into retained habitat within the surrounding pastoral, mining and open-country landscape. For Threatened and At Risk species, displacement is more relevant where affected habitat provides recurring foraging or breeding opportunities, particularly for New Zealand pipit, banded dotterel and South Island pied oystercatcher.

Displacement effects are likely to be greatest during the breeding season if birds are excluded from, or disturbed within, active breeding territories. Outside the breeding season, most displacement effects are expected to be lower because birds are more mobile and are not tied to nests or dependent young.

6.4.4.4 Potential indirect effects

Potential indirect effects on birds may occur where mining activities alter habitat quality or increase disturbance outside the direct impact footprint. These effects may arise through noise, vibration, lighting, dust deposition, sediment runoff, weed spread, pest animal activity, or accidental encroachment into retained habitats.

Indirect effects are expected to be most relevant where retained wetlands, ponds, riparian gullies, shrubland or open-country breeding habitat occur adjacent to active works. The scale of effect will depend on the proximity of retained habitat to the works area, the duration and intensity of disturbance, and the effectiveness of operational controls.

6.4.4.4.1 Disturbance and indirect alterations to adjacent habitat quality

Noise, vibration, blasting, vehicle movements, human activity, dust deposition and lighting may reduce the quality or use of retained habitat adjacent to active works. These effects may result in temporary avoidance of otherwise suitable habitat, reduced foraging use, or disturbance of breeding behaviour where works occur close to active nests.

Open-country species such as banded dotterel, South Island pied oystercatcher and New Zealand pipit may be affected if disturbance occurs near active breeding areas. Eastern falcon may also be sensitive to disturbance close to an active nest, although no nest sites have been identified within the impact area as yet. For most other mobile species, disturbance effects are expected to be localised and temporary.

Dust deposition may affect adjacent vegetation, invertebrate prey resources or habitat condition if unmanaged, particularly near shrubland, wetland or riparian margins. Lighting effects are expected to be limited and localised, but may alter habitat use near active work areas, haul routes or other lit infrastructure.

6.4.4.4.2 Sediment runoff

Sediment runoff may indirectly affect birds by reducing the quality of wetland, pond, riparian or open-water habitats. This pathway is most relevant to freshwater and wetland-associated species, including black shag, pūkeko, pied stilt, grey teal, Australasian shoveler, paradise shelduck, New Zealand scaup and white-faced heron.

Potential effects include reduced water clarity, smothering of wetland or riparian margins, and changes to aquatic prey availability. These effects are expected to be localised and manageable through erosion and sediment controls but remain relevant where works occur upslope of retained pond, wetland or riparian habitats.

6.4.4.4.3 Facilitation or exacerbation of the spread of exotic and invasive plants or animals through the landscape

Mining activities may facilitate the spread of exotic plants or pest animals through vegetation clearance, soil disturbance, vehicle movement, creation of new edges and increased access into retained habitats. These effects may reduce habitat quality for indigenous birds or increase predation pressure on eggs, chicks or adult birds.

The pest animal pathway is particularly relevant for ground-nesting species. Eggs and chicks of these species are vulnerable to mammalian predators such as rats, mice, mustelids, feral cats and hedgehogs. Increased pest animal activity near disturbed edges or retained breeding habitat could therefore increase breeding risk if unmanaged.

Exotic plant spread may alter the structure of retained open-country, wetland, riparian or shrubland habitats. This may reduce habitat suitability for species that rely on short, sparsely vegetated substrates or alter dense wetland and shrubland habitats used by smaller indigenous birds. Weed and pest animal management will therefore be relevant to maintaining habitat quality around retained habitats and residual effects management areas.

6.4.4.5 Cumulative effects

MP4 represents a continuation and extension of existing mining activities within the Macraes landscape. The cumulative effects on birds therefore need to be considered in the context of historic and ongoing habitat modification associated with mining, pastoral land use, habitat fragmentation, weed spread, pest animal pressure and previous vegetation clearance.

For birds, cumulative effects are primarily associated with the incremental loss or modification of open-country habitat, prolonged disturbance within an active mining landscape, and cumulative reduction in the availability of potential breeding and foraging habitat for indigenous species. These effects are most relevant to Threatened and At Risk open-country species that use short pasture, tussock grassland, sparsely vegetated ground, gravel substrates, rehabilitated mine landforms and disturbed mine surfaces. The main species for which cumulative effects are relevant are eastern falcon, banded dotterel, South Island pied oystercatcher and New Zealand pipit.

The MP4 impact area forms part of a wider highly modified pastoral and mining landscape. Similar open-country habitat remains widespread across OGNZL landholdings and the broader Macraes ED. Consequently, while MP4 will contribute to the cumulative loss of habitat used by indigenous birds, the proportional loss of broadly comparable open-country habitat is expected to be small at the ED scale (see Table 6-34). This is particularly relevant for mobile species that can forage or disperse across retained pasture, tussock grassland, mine-modified habitats and rehabilitated landforms.

Cumulative effects are likely to be more ecologically relevant at the local scale, where repeated loss or disturbance of suitable breeding habitat may reduce the availability of nesting opportunities within parts of the OGNZL landholdings. This is most relevant for ground-nesting species, particularly banded

dotterel, South Island pied oystercatcher and New Zealand pipit. However, these species also use modified and previously disturbed habitats, including mine-modified landforms, and habitat suitability may vary over time as mining, rehabilitation and pastoral management create or remove short, open substrates.

Eastern falcon is highly mobile and uses large territories. Cumulative effects on this species are therefore more likely to relate to broad changes in prey availability, foraging habitat and breeding success across the wider landscape, rather than loss of any single habitat patch. No falcon nest sites have been confirmed within the MP4 impact area as yet.

The assessment of cumulative effects should be read alongside the proportional habitat-loss assessment in Table 6-34. That table summarises the estimated extent of suitable habitat affected for each key bird species and the proportion of comparable habitat affected within OGNZL landholdings and the Macraes ED. Where the proportional loss is low, cumulative effects are expected to be localised and unlikely to affect the long-term viability of bird populations at the ED scale. Where residual effects remain for species of elevated ecological value, those effects are carried forward into the residual effects analysis and compensation package.

Overall, cumulative avifauna effects are expected to be greatest for open-country species that use affected habitats for breeding or foraging. For most species, the effect is expected to remain localised because comparable habitat remains available in the wider landscape. The main residual concern is the incremental loss of functional open-country habitat and potential breeding habitat for species of elevated ecological value, particularly where habitat loss occurs in combination with ongoing disturbance and predation pressure.

6.4.4.6 Conservation status, spatial scale, duration, and ecosystem role

The assessment of magnitude for birds considers conservation status, spatial scale, duration of effect and ecosystem role. These factors are relevant because the affected species differ in ecological value, habitat specificity, mobility, breeding ecology and reliance on habitats within the MP4 impact area.

- Greater weight was given to species with higher levels of conservation concern, as populations of more threatened species are generally less resilient to disturbance, habitat loss, and population declines than widespread or 'Not Threatened' species.
- Spatial scale was considered, with regard given to the extent of suitable habitat and proportion of the population affected at both the local (OGNZL landholdings; approximately 13,063 ha) and ED (Macraes ED; approximately 113,818 ha) scales.
 - Estimates of the extent of suitable habitat for each species at the local and ED scales are not available. Accordingly, a precautionary assumption was adopted that a given species would occupy all of a habitat if it is suitable. Suitable habitats were assigned based on species habitat descriptions (e.g. nzbirdsonline.org.nz; Table 6-35). Ecosystem types are based on those mapped by the New Zealand Landcover Database (LCDB6)³. It is also acknowledged that these ecosystem classifications and mapping may not be well refined at a small scale, but are generally adequate when looking at larger scales. Ecosystem extents have been classified in more detail within the MP4

³<https://iris.scinfo.org.nz/layer/123148-lcdb-v60-land-cover-database-version-60-mainland-new-zealand/attachments/22464/>

- footprint, but due to differences, they don't always match the LCDB classifications. As such, they have been cross-referenced to their most suitable congener (Table 6-35).
- Population estimates for these species are not available at the local and ED scales, but are available for the Otago Region, for Threatened and At Risk species (Jarvie, et al., 2025). These are provided as a guide for assigning magnitude, but it is acknowledged that detailed population estimates for each species at the local scale are not possible. Population estimates for these species are not available at the local or Macraes Ecological District scales. For species with Moderate residual effects, indicative estimates of the number of breeding territories or individuals potentially intersected by the Project have been developed from the survey results, habitat use and relevant species ecology. The basis for these estimates is described in the Avifauna Values Assessment (Bioresearches, 2026d), and the estimates are applied in the magnitude assessment below (Table 6-37).
 - The duration of effects recognises that short-term or temporary effects are generally less consequential than long-term or permanent effects. Effects resulting in temporary disturbance or habitat modification were assigned a lower magnitude than those causing prolonged reductions in habitat availability, population size, or ecological function.
 - Ecosystem role refers to the function a species performs within its environment, including its interactions with other species and its contribution to ecological processes. The assessment considers both the ecological function of the species and its assumed importance to the wider ecosystem.

Table 6-37 summarises the baseline context for each bird species and provides the information considered as part of the magnitude of effects assessment.

6.4.4.7 Toaka/ Taonga species

Schedule 97 of the Ngāi Tahu Claims Settlement Act 1998 identifies taoka species for which Ngāi Tahu has a recognised cultural association. Taoka bird species recorded or identified within the MP4 EclA and Avifauna Values Assessment include 15 species (Ngāi Tahu Claims Settlement Act 1998; see Appendix B).

Of these species, kārearea, pīhoihoi and kōau are also species of elevated ecological value due to their national or regional conservation status. Kārearea and pīhoihoi are the taoka bird species most relevant to the assessment of direct habitat loss and breeding-season effects, because they use open-country habitats that occur within the MP4 impact area. Kōau is primarily associated with ponds, riparian habitats and open water, and is more relevant to the assessment of indirect effects on freshwater-associated bird habitat.

Several other taoka bird species recorded within the Project area are nationally and regionally Not Threatened, but remain relevant to the assessment because of their recognised cultural status and their contribution to the indigenous bird assemblage. These species are generally mobile and use habitats that are widespread in the surrounding pastoral and mining landscape. Effects on these species are expected to be localised and are generally associated with habitat loss, disturbance, and potential nest loss where breeding occurs within affected habitats.

The identification of taoka bird species does not alter the EIANZ ecological value assigned to each species, which is based on ecological criteria and conservation status. However, taoka status is relevant to the interpretation of effects, the design of management responses, and the importance of continued engagement with mana whenua regarding residual effects management, restoration, monitoring and pest animal control. Where residual adverse effects remain for taoka bird species, these are considered through the residual effects analysis and associated compensation package.

Table 6-34. Baseline ecological context for each avifauna species, including conservation status, ecosystem role, estimated population size, and extent of suitable habitat at both the local (OGNZL landholdings) and ED scales.

Species	Project locations where recorded or considered present	NZTCS status	Otago regional status	Ecosystem role	Otago population estimate	Local – OGNZ landholdings			Macraes ED		Notes and uncertainty
						Estimated impacted habitat (ha)	Suitable habitat (ha)	% habitat Impacted	Suitable habitat (ha)	% habitat Impacted	
Eastern falcon / kārearea	Project-wide, including open-country and mine-modified mosaic	Nationally Vulnerable	Regionally Vulnerable	Mobile raptor using open country, shrubland margins, rock/gully systems and mining mosaic for hunting	1,000–5,000 mature individuals	231.9	11548	2.01%	53537	0.43%	Confirmed in the wider MP4 landscape. No nest identified within the impact footprint. Habitat extent includes broad open-country and shrubland/gully habitat, but not active mine-disturbed land as suitable habitat.
Banded dotterel / pohowera	Coronation Mining Area, Central Mining Area, Golden Bar, Golden Bar Haul Road	At Risk – Declining	Regionally Vulnerable	Open-country ground-nesting shorebird using short vegetation, gravel, sparsely vegetated ground, wet margins and rehabilitated mine surfaces	1,000–5,000 mature individuals	130.64	9645	1.35%	26580	0.49%	Suitable habitat includes short pasture, sparsely vegetated ground and rehabilitated mining areas. Active mine-disturbed areas should not be counted as suitable habitat.
South Island pied oystercatcher / tōrea	Coronation Mining Area, Central Mining Area, Golden Bar, Golden Bar Haul Road, BRWRS	At Risk – Declining	Regionally Vulnerable	Open-country ground-nesting and foraging wader using pasture, short grassland, wet margins and rehabilitated landforms	1,000–5,000 mature individuals	130.38	9645	1.35%	26545	0.49%	Suitable habitat remains widespread in the surrounding pastoral landscape. Macraes ED mapped natural ecosystem data will underestimate pasture / farmland habitat.
Black shag / kōau	Ponds, open water and riparian habitats within the wider MP4 assessment area	At Risk – Relict	Regionally Endangered	Pond, open-water and riparian predator, mainly foraging and loafing	250–1,000 mature individuals	0.35	152	0.23%	58185	0.00%	No breeding colony recorded. Effects are primarily related to foraging habitat.
New Zealand fernbird / mātātā	Coronation Mining Area, BRWRS / GPUG wetland area and nearby wetland habitats	At Risk – Declining	Regionally Declining	Wetland and dense riparian / shrubland passerine	5,000–20,000 mature individuals	8.58	977	0.88%	6421	0.13%	Low-frequency detections and anecdotal observations. Current evidence suggests intermittent or transient use rather than confirmed resident occupancy.
New Zealand pipit / pīhoihoi	Coronation Mining Area, Central Mining Area, Golden Bar, Golden Bar Haul Road, BRWRS and wider open-country areas	At Risk – Declining	Regionally Not Threatened	Open-country ground-nesting insectivore using pasture, tussock, short vegetation, gravel and rehabilitated landforms	Not quantified in regional table	226.19	10276	2.20%	27853	0.81%	Likely widespread in open-country habitat. Include rehabilitated mining areas where vegetated or sparsely vegetated; exclude active mine-disturbed land.
Silvereye / tauhou	Shrubland, gullies, pine margins, MEEA, Cranky	Not Threatened	Regionally Declining	Generalist shrubland / treeland passerine, insectivore and frugivore	20,000–100,000	11.25	1697	0.66%	25966	0.04%	Associated with structurally diverse woody vegetation and enhancement areas.

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	Jims and vegetated margins				mature individuals							
Australasian shoveler / kuruwhengi	Ponds and wetland-associated habitats	Not Threatened	Regionally Not Threatened	Pond and wetland waterfowl	Not available	4.67	194	2.40%	58620	0.01%	Habitat use limited to ponds and wetland features.	
Grey teal / tētē-moroiti	Ponds and wetland-associated habitats	Not Threatened	Regionally Not Threatened	Pond and wetland waterfowl	Not available	4.67	194	2.40%	58620	0.01%	Likely occasional or local use of ponds and wetland margins.	
Grey warbler / riroriro	Coronation Mining Area, BRWRS, MEEA, Cranky Jims, shrubland / riparian / woody margins	Not Threatened	Regionally Not Threatened	Shrubland and riparian insectivore	Not available	11.25	1683	0.67%	25948	0.04%	Widespread indigenous passerine associated with woody and riparian vegetation.	
Kererū / New Zealand pigeon	Woody vegetation, shelterbelts, shrubland and enhancement areas	Not Threatened	Regionally Not Threatened	Mobile frugivore / folivore using woody vegetation	Not available	4.77	1114	0.43%	24344	0.02%	Use likely occasional and associated with woody habitat.	
New Zealand scaup / pāpango	Ponds and open water	Not Threatened	Regionally Not Threatened	Diving waterfowl using ponds and open water	Not available	0.35	152	0.23%	57648	0.00%	Habitat restricted to open water features.	
Paradise shelduck / pūtangitangi	Open pasture, ponds, wetlands, rehabilitated landforms and gullies	Not Threatened	Regionally Not Threatened	Generalist open-country and wetland waterfowl	Not available	135.05	9840	1.37%	85172	0.16%	Widespread species using both aquatic and open-country habitats.	
Pied stilt / poaka	Ponds, wetland margins and wet open-country habitats	Not Threatened	Regionally Not Threatened	Wetland-margin wader, ground-nesting where conditions are suitable	Not available	135.31	9840	1.38%	85200	0.16%	Use likely associated with ponds, wet margins and ephemeral wetland habitats.	
Pūkeko	Wetlands, wet pasture, pond margins and vegetated wetland edges	Not Threatened	Regionally Not Threatened	Wetland-margin omnivore	Not available	134.81	9840	1.37%	84625	0.16%	Habitat use likely associated with wetland and pond-margin habitats.	
Sacred kingfisher / kōtare	Riparian margins, trees, poles, shelterbelts and open-country edges	Not Threatened	Regionally Not Threatened	Perch-hunting insectivore / small vertebrate predator using open-country edges	Not available	151.92	11343	1.34%	53068	0.29%	Likely occasional use of perches and riparian / edge habitats.	
South Island fantail / pīwakawaka	Shrubland, gullies, pine margins, Cranky Jims, MEEA and woody margins	Not Threatened	Regionally Not Threatened	Shrubland / riparian insectivore	Not available	11.25	1697	0.66%	25966	0.04%	Associated with structurally diverse woody vegetation.	
Southern black-backed gull / karoro	Open-country, ponds, wet margins, rehabilitated landforms and wider mining landscape	Not Threatened	Regionally Not Threatened	Generalist scavenger / predator and wetland-margin forager	Not available	145.84	9854	1.48%	85245	0.17%	Highly mobile and widespread. Not protected under the Wildlife Act according to AMP summary table.	
Spur-winged plover	Open pasture, short vegetation, wet margins and rehabilitated landforms	Not Threatened	Regionally Not Threatened	Open-country ground-nesting lapwing	Not available	145.49	10995	1.32%	28655	0.51%	Likely widespread in open-country habitats.	

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Swamp harrier / kāhu	Project-wide open-country, wetlands, shrubland margins and rehabilitated landforms	Not Threatened	Regionally Not Threatened	Mobile raptor and scavenger	Not available	234.77	11253	2.09%	34282	0.68%	Uses open-country and wetland habitats for hunting.
Tūi	Woody vegetation, shrubland, shelterbelts and enhancement areas	Not Threatened	Regionally Not Threatened	Mobile nectarivore / frugivore / insectivore using woody vegetation	Not available	5.45	1285	0.42%	25667	0.02%	Likely occasional use where suitable woody vegetation and food resources are present.
Welcome swallow / warou	Open-country, ponds, wetland margins, structures and mine-edge habitats	Not Threatened	Regionally Not Threatened	Aerial insectivore associated with open areas, water and structures	Not available	235.85	10073	2.34%	86254	0.27%	Mobile and widespread. May use structures or banks for nesting where present.
White-faced heron / matuku moana	Ponds, wetland margins, pasture and riparian habitats	Not Threatened	Regionally Not Threatened	Wetland and pasture forager	Not available	134.81	9840	1.37%	85172	0.16%	Uses ponds, wetlands, damp pasture and riparian habitats.

Note: Macraes ED mapped habitat extent should be treated as contextual only. ORC ecosystem mapping does not provide species-specific habitat modelling and is likely to underestimate habitat for species that use exotic grassland, farmland, road margins, rehabilitated mine surfaces or constructed ponds.

Table 6-35. Ecosystem types determined to be suitable as potential habitat for each avifauna species. Ecosystem types are based on the Landcover Database (LCDB6). These ecosystem associations have been used to calculate the area of suitable habitat within the local (OGNZL landholdings) and ED scales in Table 6-34.

Species	Broadleaved Indigenous Hardwoods	Built-up Area (settlement)	Deciduous Hardwoods	Depleted Grassland	Exotic Forest	Forest - Harvested	Gorse and/or Broom	Gravel and Rock	Herbaceous Freshwater Vegetation	High Producing Exotic Grassland	Indigenous Forest	Lake or Pond	Low Producing Grassland	Manuka and/or Kanuka	Matagouri or Grey Scrub	Mixed Exotic Shrubland	River	Short-rotation Cropland	Surface Mine or Dump	Tall Tussock Grassland	Transport Infrastructure
Eastern falcon / kārearea	✓	x	✓	✓	✓	✓	✓	✓	x	✓	✓	x	✓	✓	✓	✓	x	x	x	✓	x
Banded dotterel / pohowera	x	x	x	✓	x	x	x	✓	x	✓	x	x	✓	x	x	x	x	x	x	x	x
South Island pied oystercatcher / tōrea	x	x	x	✓	x	x	x	x	x	✓	x	x	✓	x	x	x	x	x	x	x	x
Black shag / kōau	x	x	x	x	x	x	x	x	x	x	x	✓	x	x	x	x	✓	x	x	x	x
New Zealand fernbird / mātātā	x	x	x	x	x	x	✓	x	✓	x	x	x	x	✓	✓	✓	✓	x	x	x	x
New Zealand pipit / pīhoihoi	x	x	x	✓	x	✓	x	x	x	✓	x	x	✓	x	x	x	x	x	x	✓	x
Silvereye / tauhou	✓	✓	✓	x	✓	✓	✓	x	x	x	✓	x	x	✓	✓	✓	x	x	x	x	x
Australasian shoveler / kuruwhegi	x	x	x	x	x	x	x	x	✓	x	x	✓	x	x	x	x	✓	x	x	x	x
Grey teal / tētē-moroiti	x	x	x	x	x	x	x	x	✓	x	x	✓	x	x	x	x	✓	x	x	x	x
Grey warbler / riroriro	✓	x	✓	x	✓	✓	✓	x	x	x	✓	x	x	✓	✓	✓	x	x	x	x	x
Kererū / New Zealand pigeon	✓	x	✓	x	✓	x	x	x	x	x	✓	x	x	✓	✓	x	x	x	x	x	x
New Zealand scaup / pāpango	x	x	x	x	x	x	x	x	x	x	x	✓	x	x	x	x	x	x	x	x	x
Paradise shelduck / pūtangitangi	x	x	x	✓	x	x	x	x	✓	✓	x	✓	✓	x	x	x	✓	✓	x	x	x
Pied stilt / poaka	x	x	x	✓	x	x	x	✓	✓	✓	x	✓	✓	x	x	x	✓	x	x	x	x
Pūkeko	x	x	x	x	x	x	x	x	✓	✓	x	✓	✓	x	x	x	x	x	x	x	x
Sacred kingfisher / kōtare	✓	✓	✓	✓	✓	✓	✓	x	x	✓	✓	x	✓	✓	✓	✓	✓	x	x	x	✓
South Island fantail / pīwakawaka	✓	✓	✓	x	✓	✓	✓	x	x	x	✓	x	x	✓	✓	✓	x	x	x	x	x
Southern black-backed gull / karoro	x	✓	x	✓	x	x	x	✓	✓	✓	x	✓	✓	x	x	x	✓	✓	x	x	✓
Spur-winged plover	x	x	x	✓	x	x	x	✓	✓	✓	x	x	✓	x	x	x	x	✓	✓	x	✓
Swamp harrier / kāhu	x	x	x	✓	x	✓	✓	x	✓	✓	x	x	✓	✓	✓	✓	✓	✓	x	✓	x
Tūi	✓	✓	✓	x	✓	x	✓	x	x	x	✓	x	x	✓	✓	✓	x	x	x	x	x
Welcome swallow / warou	x	✓	x	✓	x	x	x	✓	✓	✓	x	✓	✓	x	x	x	✓	✓	x	✓	✓
White-faced heron / matuku moana	x	x	x	✓	x	x	x	x	✓	✓	x	✓	✓	x	x	x	✓	✓	x	x	x

Table 6-36. Landcover names (from LCDB6) and their equivalent ecosystem type names used for MP4 impact areas. This was used to determine potential habitat for each avifauna species in Table 6-34.

LCDB 6 name	MP4 impact name
Built-up Area (settlement)	Built/Disturbed
Herbaceous Freshwater Vegetation	Ephemeral wetland
Depleted Grassland	Exotic Grassland
High Producing Exotic Grassland	Exotic Grassland
Low Producing Grassland	Exotic Grassland
Gorse and/or Broom	Gorse
Surface Mine or Dump	Mine - disturbed
Exotic Forest	Pine
Forest - Harvested	Pine forest (felled)
Lake or Pond	Pond
Rehabilitated mine workings	Rehabilitated mine workings
River	Riparian
Herbaceous Freshwater Vegetation	Riparian - Freshwater Herbaceous
Herbaceous Freshwater Vegetation	Riparian - Sedgeland
Matagouri or Grey Scrub	Riparian - Shrubland
Transport Infrastructure	Road
Gravel and Rock	Rock
Matagouri or Grey Scrub	Dry Shrubland
Tall Tussock Grassland	Tussock - Dense
Tall Tussock Grassland	Tussock - Moderately Dense
Herbaceous Freshwater Vegetation	Wetland - Freshwater Herbaceous
Herbaceous Freshwater Vegetation	Wetland - Sedgeland
Herbaceous Freshwater Vegetation	Wetland - Seepage
Matagouri or Grey Scrub	Wetland - Shrubland
Deciduous Hardwoods	Woody Exotic
Mixed Exotic Shrubland	Woody Exotic

6.4.4.8 Magnitude of Effect

The magnitude of the effect on birds before management has been assessed in relation to the extent and duration of habitat loss, the species affected, the likely function of the affected habitats, the availability of comparable habitats in the surrounding landscape, and the susceptibility of each species to breeding-season effects. The assessment applies the EIANZ magnitude framework and considers effects before implementation of the Avifauna Management Plan, but based on the current MP4 footprint, including areas already avoided through project design.

The principal effect pathway is permanent loss or substantial modification of habitat used by indigenous birds for foraging, movement and potential breeding. Localised indirect effects on retained pond, wetland, riparian and shrubland habitats are also relevant where those habitats occur adjacent to active works.

For most species, the magnitude of effect is moderated by their mobility and the availability of comparable habitat within the surrounding pastoral and mining landscape. The highest magnitude ratings apply to species that regularly use affected habitats, have elevated ecological value, and may be vulnerable to nest loss, chick mortality or breeding disturbance if works occur during the breeding season. Ground-nesting open-country species are therefore the primary receptors for unmanaged effects.

The magnitude assessment includes direct habitat loss, potential indirect habitat degradation, disturbance and displacement, breeding-season vulnerability, duration of effect, reversibility, proportional habitat loss, and the ecological function of the affected habitat for each species. It also considers the extent to which comparable habitat occurs within OGNZL landholdings and the Macraes ED. These factors are addressed in Table 6-37, which provides the detailed species-specific basis for the magnitude ratings.

The magnitude assessment does not include the effect of avoidance, minimisation, mitigation or remediation measures that will be implemented through the Avifauna Management Plan or other management plans. These measures are considered separately in the following sections. The magnitude assessment also does not include biodiversity offsetting or compensation, as those measures address residual effects after the effects management hierarchy has been applied.

The assessment has not been separated by mining area for each species but considers the effects of the MP4 project. Birds are mobile, and several key species utilise habitats across multiple parts of the Project area and wider OGNZL landholdings. Assigning separate magnitude ratings for each species within each mining area would therefore provide a false level of precision and would not reflect the way these species use the landscape. Instead, the assessment considers each species across the MP4 impact area, with reference to local and ED scale habitat availability where relevant. Commentary on where each species was recorded is provided in the baseline ecological context table for birds (Table 6-34) and in the Avifauna Values Assessment (Bioresearches, 2026d).

Before management, the magnitude of effect is assessed as Negligible-Low for most species. This largely reflects the small proportional loss of habitat, both at the local and ED scale. This approach has been used, as the potential magnitude based on areal loss of habitat would not be commensurate to the actual magnitude, for birds, due to their mobility and abundance of available habitats within the local landscape. The detailed rationale for each rating is provided in Table 6-37.

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Table 6-37. Magnitude of effect assessment for avifauna.

Species	Ecological value ⁴	Factors considered	Magnitude before management ⁵
Eastern falcon / kārearea	Very High	- Estimated suitable habitat affected within MP4 footprint: 231.90 ha. - Estimated number of birds potentially affected, conservatively estimated at 6 (3 pairs), based on territory size and distribution of impact areas. - This represents 2.01% of estimated suitable habitat within OGLNZL landholdings and 0.43% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Species is highly mobile and no nesting sites have been identified within the impact footprint. - Main risks relate to a reduction in foraging habitat and disturbance if breeding occurs close to works. - The affected habitat is broad potential foraging habitat rather than confirmed nesting habitat. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Low
Banded dotterel / pohowera	Very High	- Estimated suitable habitat affected within MP4 footprint: 130.64 ha. - The Avifauna Values Assessment identifies six occupied breeding-season survey locations within affected Project areas. These provide a conservative index of potential breeding territories but do not represent six confirmed nests or breeding pairs. - This represents 1.35% of estimated suitable habitat within OGLNZL landholdings and 0.49% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Habitat includes short open ground, sparsely vegetated surfaces, gravel, grassland and rehabilitated mine surfaces. - Direct effects include loss of potential breeding and foraging habitat and potential nest, egg or chick mortality if works occur during the breeding season. - Similar open-country habitat is widespread locally, but breeding birds are sensitive to disturbance and direct mortality.	Low
South Island pied oystercatcher / tōrea	Very High	- Estimated suitable habitat affected within MP4 footprint: 130.38 ha. - Estimated number of birds potentially affected, conservatively estimated at 27 (6 pairs), based on territory size and location of records from bird surveys. Predominantly recorded outside direct impact footprint, in rehabilitated mining areas and gravel/mine margins. - This represents 1.35% of estimated suitable habitat within OGLNZL landholdings and 0.49% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Habitat includes open pasture, short grassland and open-country foraging / breeding habitat. - Direct effects include loss of potential foraging and nesting habitat and potential nest, egg or chick mortality. - The affected habitat is a small proportion of available local and ED habitat, and surrounding farmland remains extensive.	Low
Black shag / kōau	Very High	- Estimated suitable habitat affected within MP4 footprint: 0.35 ha. - This represents 0.23% of estimated suitable habitat within OGLNZL landholdings and 0.001% within the Macraes ED. - The proportional loss threshold is Negligible (<1%) at both the local and ED scales. - Habitat affected is limited to pond / open-water habitat.	Negligible

⁴ Ecological value follows the EIANZ species-value approach used in the MP4 avifauna assessment, where the highest applicable national or regional conservation status informs species value. Nationally Threatened species are Very High, At Risk – Declining species are High unless regional status results in a higher value, and nationally / regionally common indigenous species are Low.

⁵ See section 5.2 for further explanation about assigning magnitude levels.

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		- No breeding colony has been recorded within the Project footprint. - Effects are primarily limited to localised loss or disturbance of foraging / loafing habitat. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	
New Zealand fernbird / mātātā	High	- Estimated suitable habitat affected within MP4 footprint: 8.58 ha. - This represents 0.88% of estimated suitable habitat within OGLNZL landholdings and 0.13% within the Macraes ED. - The proportional loss threshold is Negligible (<1%) at both the local and ED scales. - Habitat includes wetland, riparian and shrubland habitats, but not all mapped habitat will have dense structure suitable for fernbird. - Records indicate low-frequency or intermittent use, rather than confirmed resident occupancy. - Uncertainty remains regarding local occupancy and habitat quality.	Negligible
New Zealand pipit / pīhoihoi	High	- Estimated suitable habitat affected within MP4 footprint: 226.19 ha. - This represents 2.20% of estimated suitable habitat within OGLNZL landholdings and 0.81% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Species is likely widespread across open-country habitat, including pasture, tussock, gravel margins and rehabilitated mine surfaces. - Direct effects include loss of open-country habitat and potential nest, egg or chick mortality during breeding. - Cumulative loss across MP4 is relevant because the species may use multiple project areas. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Low
Silvereye / tauhou	High	- Estimated suitable habitat affected within MP4 footprint: 11.25 ha. - This represents 0.66% of estimated suitable habitat within OGLNZL landholdings and 0.04% within the Macraes ED. - The proportional loss threshold is Negligible (<1%) at both the local and ED scales. - Habitat affected includes woody, shrubby and exotic forest / scrub habitat. - Direct effects include localised clearance of woody vegetation and possible nest loss. - Species is regionally declining but remains mobile and uses a range of woody habitats.	Negligible
Australasian shoveler / kuruwhengi	Low	- Estimated suitable habitat affected within MP4 footprint: 4.67 ha. - This represents 2.40% of estimated suitable habitat within OGLNZL landholdings and 0.008% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Habitat affected includes ponds, wetlands and riparian freshwater herbaceous vegetation. - Species is mobile and effects are localised to aquatic / wetland habitats. - Habitat quality and regularity of use are not quantified. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Low
Grey teal / tētē-moroiti	Low	- Estimated suitable habitat affected within MP4 footprint: 4.67 ha. - This represents 2.40% of estimated suitable habitat within OGLNZL landholdings and 0.008% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Habitat affected includes river / riparian, ponds and wetland habitat. - Species is mobile and effects are localised to aquatic / wetland habitats. - Habitat quality and regularity of use are not quantified. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Low
Grey warbler / riroriro	Low	- Estimated suitable habitat affected within MP4 footprint: 11.25 ha. - This represents 0.67% of estimated suitable habitat within OGLNZL landholdings and 0.04% within the Macraes ED. - The proportional loss threshold is Negligible (<1%) at both the local and ED scales.	Negligible

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		- Habitat affected includes woody and shrubby vegetation. - Direct effects include localised vegetation clearance and potential nest loss. - Species is widespread and the affected habitat is a small proportion of available habitat at both scales. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	
Kererū / New Zealand pigeon	Low	- Estimated suitable habitat affected within MP4 footprint: 4.77 ha. - This represents 0.43% of estimated suitable habitat within OGLNZL landholdings and 0.02% within the Macraes ED. - The proportional loss threshold is Negligible (<1%) at both the local and ED scales. - Habitat affected is limited to woody vegetation. - Use within the MP4 area is likely occasional and associated with food resources in woody habitat. - No important feeding or breeding concentration has been identified. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Negligible
New Zealand scaup / pāpango	Low	- Estimated suitable habitat affected within MP4 footprint: 0.35 ha. - This represents 0.23% of estimated suitable habitat within OGLNZL landholdings and 0.001% within the Macraes ED. - The proportional loss threshold is Negligible (<1%) at both the local and ED scales. - Habitat affected is limited to pond / open-water habitat. - Species is mobile and habitat use is restricted to suitable waterbodies. - Actual suitable habitat is likely less than broad mapped aquatic habitat.	Negligible
Paradise shelduck / pūtangitangi	Low	- Estimated suitable habitat affected within MP4 footprint: 135.05 ha. - This represents 1.37% of estimated suitable habitat within OGLNZL landholdings and 0.16% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Species uses open-country, pasture, wetlands, ponds and rehabilitated landforms. - Direct effects include localised habitat loss and possible nest disturbance. - Species is mobile and widespread, with abundant surrounding habitat. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Low
Pied stilt / poaka	Low	- Estimated suitable habitat affected within MP4 footprint: 135.31 ha. - This represents 1.38% of estimated suitable habitat within OGLNZL landholdings and 0.16% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Habitat includes wetlands, pond margins, damp pasture, gravel and open-country habitat. - Breeding suitability is likely much more restricted than mapped potential habitat. - Direct effects include loss of wet-margin habitat and potential nest, egg or chick mortality if breeding occurs. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Low
Pūkeko	Low	- Estimated suitable habitat affected within MP4 footprint: 134.81 ha. - This represents 1.37% of estimated suitable habitat within OGLNZL landholdings and 0.16% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - The habitat estimate is broad and includes exotic grassland as potential habitat, which may overstate functional habitat. - Species is mobile and widespread. - Effects are likely concentrated around wetland margins and damp pasture rather than the full mapped potential habitat area. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Low
Sacred kingfisher / kōtare	Low	Estimated suitable habitat affected within MP4 footprint: 151.92 ha.	Low

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		- This represents 1.34% of estimated suitable habitat within OGLNZL landholdings and 0.29% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Broad habitat includes woody, riparian, edge, pasture and transport infrastructure habitats. - Direct effects include loss of perches, edge habitat or nesting substrate where present. - The estimate is likely to overstate breeding habitat because it includes broad edge / foraging habitat. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	
South Island fantail / pīwakawaka	Low	- Estimated suitable habitat affected within MP4 footprint: 11.25 ha. - This represents 0.66% of estimated suitable habitat within OGLNZL landholdings and 0.04% within the Macraes ED. - The proportional loss threshold is Negligible (<1%) at both the local and ED scales. - Habitat affected includes woody and shrubby vegetation. - Direct effects include localised clearance of woody / shrubby vegetation and possible nest loss. - Species is widespread and the affected habitat is a small proportion of available habitat. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Negligible
Southern black-backed gull / karoro	Low	- Estimated suitable habitat affected within MP4 footprint: 145.84 ha. - This represents 1.48% of estimated suitable habitat within OGLNZL landholdings and 0.17% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Broad habitat includes open-country, aquatic, gravel, road and modified edge habitats. - Species is highly mobile and widespread. - Direct effects are primarily the loss a breeding colony that is present within the existing Golden Bar pit. Additionally, loss of local foraging / loafing habitat. - It should be noted that this species is Not Threatened and is not a protected species under the Wildlife Act. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	High
Spur-winged plover	Low	- Estimated suitable habitat affected within MP4 footprint: 145.49 ha. - This represents 1.32% of estimated suitable habitat within OGLNZL landholdings and 0.51% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Habitat includes open pasture, depleted grassland, wet margins, gravel, road margins, cropland and rehabilitated mine workings. - Direct effects include localised habitat loss and possible nest disturbance. - It should be noted that this species is Not Threatened and is not a protected species under the wildlife act. - Species is widespread and uses modified habitats.	Low
Swamp harrier / kāhu	Low	- Estimated suitable habitat affected within MP4 footprint: 234.77 ha. - This represents 2.09% of estimated suitable habitat within OGLNZL landholdings and 0.68% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Species is a highly mobile raptor / scavenger using open-country, wetland, shrubland and tussock habitats. - Direct effects include loss of hunting habitat and possible nest disturbance if nesting occurs. - Broad affected habitat is unlikely to represent limiting habitat for the species. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	Low
Tūi	Low	- Estimated suitable habitat affected within MP4 footprint: 5.45 ha. - This represents 0.42% of estimated suitable habitat within OGLNZL landholdings and 0.02% within the Macraes ED. - The proportional loss threshold is Negligible (<1%) at both the local and ED scales.	Negligible

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		- Habitat affected is limited to woody and shrubby vegetation. - Use within the MP4 area is likely occasional and dependent on flowering / fruiting resources. - No important feeding or breeding concentration has been identified. - The species is considered a taoka species — culturally important to Kāi Tahu and holding a recognised cultural status.	
Welcome swallow / warou	Low	- Estimated suitable habitat affected within MP4 footprint: 235.85 ha. - This represents 2.34% of estimated suitable habitat within OGLNZL landholdings and 0.27% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Broad habitat includes open-country, wetland, pond, gravel, tussock, road and built / edge habitats. - Species is mobile and widespread; nesting habitat is much more restricted than the broad habitat estimate. - Direct effects mainly relate to local nesting sites, if present, and temporary displacement from foraging habitat.	Low
White-faced heron / matuku moana	Low	- Estimated suitable habitat affected within MP4 footprint: 134.81 ha. - This represents 1.37% of estimated suitable habitat within OGLNZL landholdings and 0.16% within the Macraes ED. - The proportional loss threshold is Low (1-5%) at the local scale and Negligible at the ED scale. - Broad habitat includes wetlands, ponds, rivers, pasture and damp open-country habitats. - Species is mobile and uses common wetland and pasture habitats. - Effects are expected to be concentrated around wetland / pond margins rather than the full mapped potential habitat area.	Low

6.4.4.9 Effects avoidance, minimisation/mitigation, and remediation measures

Management of potential adverse effects on avifauna associated with MP4 will follow the effects management hierarchy, prioritising avoidance where practicable, followed by minimisation/mitigation and remediation. These measures are intended to reduce the extent and severity of adverse effects on indigenous birds before residual effects are considered.

For birds, avoidance measures are primarily focused on preventing injury or mortality of birds, eggs and chicks during vegetation clearance, earthworks and habitat removal. This is particularly relevant for ground-nesting species, including banded dotterel | pohowera, South Island pied oystercatcher | tōrea and New Zealand pipit | pīhoihoi, which may nest in open pasture, tussock grassland, sparsely vegetated ground, road margins, rehabilitated mine landforms and other disturbed substrates within the MP4 impact area. Avoidance measures are also relevant to kārearea | eastern falcon, both within impact areas, and if they are found to be breeding near active works.

The Avifauna Management Plan (AMP; Bioresearches, 2026k) will provide the primary mechanism for avoiding or minimising direct effects on breeding birds. Operational controls will also be implemented to minimise indirect effects on retained bird habitat.

While these measures are expected to reduce the risk of direct mortality, nest loss, breeding disturbance and indirect habitat degradation, they will not fully address the permanent loss or modification of bird habitat within the Project footprint. Residual adverse effects on avifauna, will therefore be carried forward into the residual effects analysis and associated management package.

6.4.4.9.1 Avoidance

Avoidance measures are intended to prevent adverse effects on avifauna before they occur. For this project, avoidance will primarily be achieved through the implementation of an AMP (Table 2-2; Bioresearches, 2026k), which will set out procedures for identifying and protecting breeding birds within areas scheduled for disturbance.

The AMP will focus particularly on species known to utilise open-country habitats within the project area and that are sensitive to disturbance during the breeding season, including New Zealand falcon (kārearea), South Island pied oystercatcher (tōrea), banded dotterel (tūturiwhatu), and New Zealand pipit (pīhoihoi). These species nest on the ground or in open environments and may therefore be vulnerable to disturbance from vegetation clearance, earthworks, vehicle movements and blasting if breeding occurs within the project footprint.

The AMP will include the following avoidance measures:

- Pre-works nest surveys undertaken prior to vegetation clearance or earthworks during the breeding season to identify active nests within areas proposed for disturbance.
- Establishment of exclusion zones around any identified nests or breeding territories. Works within these areas will be delayed until nesting activity has concluded and chicks have fledged.
- Seasonal restrictions on vegetation clearance and earthworks, where practicable, to avoid the peak breeding period for ground-nesting species.
- Falcon management procedures, including protocols for identifying potential nest sites and establishing appropriate buffer distances should nesting activity be detected within or adjacent to the project footprint.

Through these measures, the potential for direct impacts on breeding birds, including nest destruction or the mortality of eggs or chicks, will be avoided.

6.4.4.9.2 *Minimisation/mitigation measures*

Where complete avoidance of effects on birds or bird habitat is not practicable, effects will be minimised and managed through operational controls and implementation of the Avifauna Management Plan (AMP). These measures are intended to reduce the risk of injury or mortality of birds, eggs and chicks, minimise disturbance to breeding birds, and reduce indirect effects on retained habitats adjacent to the works area.

Standard operational controls will be implemented to limit disturbance and protect retained habitats. These will include:

- Erosion and sediment controls to reduce sediment discharge to retained wetlands, ponds, riparian margins and drainage lines used by wetland and water-associated birds.
- Dust suppression measures, including watering, surface stabilisation and haul road management, to reduce dust deposition on retained vegetation and adjacent bird habitat.
- Lighting controls, where practicable, to limit light spill into retained wetland, riparian, shrubland and open-country habitats.
- Weed hygiene and weed control to reduce weed establishment in disturbed margins and retained indigenous vegetation.
- Demarcation of approved works areas using exclusion fencing, flagging, site inductions and construction drawings showing no-go areas, to reduce the risk of accidental encroachment into retained bird habitat.
- Management of road drainage, runoff and hydrological inputs where practicable, to reduce indirect effects on retained wetland, riparian and pond habitats used by indigenous birds.
- Progressive rehabilitation of disturbed areas where practicable, to restore some open-country habitat function over time.

Species-specific management will be implemented through the AMP. This will focus on breeding birds because eggs and chicks have limited capacity to avoid vegetation clearance, earthworks or vehicle movements. The AMP will include procedures for pre-works surveys, identification of active nests or breeding territories, establishment of appropriate exclusion zones, monitoring of active nests, and temporary modification or delay of works where required.

These measures are expected to reduce the risk of direct mortality and breeding disturbance, and to reduce indirect effects on retained bird habitat. They will not, however, fully mitigate the permanent loss or modification of habitat within the MP4 footprint. Residual effects associated with permanent habitat loss, particularly for open-country species of elevated ecological value, will therefore be carried forward into the residual effects analysis.

6.4.4.9.3 Remediation

Remediation and rehabilitation of disturbed mining areas will be undertaken in accordance with the Mine Closure Plan (Boffa Miskell, 2026). Details of the location, extent and type of rehabilitation are provided in that document and are expected to include landform stabilisation, replacement of suitable growth media where available, revegetation, erosion control and weed management.

For avifauna, rehabilitation is expected to restore some habitat function over time, particularly for open-country species that use short vegetation, sparsely vegetated ground, rehabilitated mine landforms and disturbed substrates. Species that may use rehabilitated areas include New Zealand pipit|pīhoihoi, banded dotterel|pohowera and South Island pied oystercatcher|tōrea, where suitable open habitat structure develops. This has already been observed with these species being recorded as present and breeding within previous rehabilitated mine habitats. Rehabilitated landforms may also provide foraging habitat for kārearea|eastern falcon and other mobile indigenous birds.

The value of rehabilitated habitat for birds will depend on the final landform, vegetation structure, cover of indigenous and exotic species, grazing regime, hydrology, weed control, predator pressure and the time taken for vegetation to establish. In the short term, some rehabilitated or disturbed surfaces may provide habitat for open-country birds that use bare or sparsely vegetated substrates. Over longer timeframes, revegetation may increase habitat complexity and provide foraging, shelter and nesting opportunities for a wider range of indigenous birds.

Rehabilitation will not immediately replace the ecological functions lost through permanent habitat clearance. It is also unlikely to fully replace all habitat values associated with mature tussock grassland, shrubland, wetland margins, riparian vegetation, ponds or structurally diverse habitat within the assessment timeframe. There will therefore be a time lag between habitat loss and any replacement habitat function provided by rehabilitated landforms.

For these reasons, remediation is expected to reduce some adverse effects on avifauna habitat over time, but it is not included in any residual effects analysis to offset/compensate for permanent habitat loss. Residual adverse effects on avifauna will therefore be carried forward into the terrestrial residual effects analysis (Bioresearches, 2026l) and associated residual effects management package (Bioresearches, 2026n).

6.4.4.10 Efficacy of avoidance, minimisation/mitigation and remediation measures

The avoidance, minimisation/mitigation and remediation measures described above are expected to reduce the severity of some effects on avifauna, particularly direct effects on breeding birds. Their efficacy will vary depending on the species affected, the timing of works, the detectability of nests or breeding behaviour, and the ability to modify works where breeding activity is identified.

The highest confidence applies to measures that avoid direct effects on active nests, eggs and dependent chicks. Pre-works checks, nest buffers, exclusion zones, timing controls and monitoring

under the Avifauna Management Plan are practical measures for reducing the risk of nest loss or chick mortality during vegetation clearance, earthworks and ground disturbance.

These measures are expected to reduce, but not eliminate, breeding-season risk. Some nests may be missed during pre-works checks, particularly where nests are cryptic, occur in dense or uneven ground cover, or are established shortly before works commence. This limitation is most relevant to ground-nesting species such as New Zealand pipit | pīhoihoi, banded dotterel | pohowera and South Island pied oystercatcher | tōrea. Pipit nests in particular can be difficult to detect because they are small, well-concealed and may occur in grassland, road margins, rehabilitated mine landforms or other open-country habitats.

Operational controls, including erosion and sediment controls, dust suppression, weed hygiene, lighting controls where practicable, and protection of retained habitats, are expected to reduce localised indirect effects on retained bird habitat. These measures are less able to address the broader disturbance associated with an active mining environment, including intermittent noise, vibration, vehicle movements and human activity.

Remediation and rehabilitation may provide some replacement habitat function over time, particularly for mobile open-country species that use short vegetation, sparsely vegetated ground and rehabilitated mine landforms. However, replacement habitat value will depend on landform design, vegetation establishment, grazing management, hydrology, weed control and predator pressure, and will be delayed relative to the timing of habitat loss.

Overall, the proposed measures are expected to reduce the likelihood of direct mortality and breeding disturbance but will not fully address the permanent loss or modification of bird habitat within the MP4 footprint. Residual adverse effects on avifauna will therefore be carried forward into the terrestrial residual effects analysis and associated residual effects management package.

6.4.4.11 Level of residual effect

The overall level of effect for each bird species has been assigned by combining the ecological value of the species with the magnitude of effect after avoidance, minimisation/mitigation and remediation measures have been applied. This assessment uses the EIANZ level of effect matrix and assumes implementation of the Avifauna Management Plan, including nest checks and associated breeding-bird management procedures.

For most species, the post-management magnitude of effect remains Low or Negligible, reflecting the mobility of birds, the localised nature of habitat loss relative to available habitat in the surrounding landscape, and the limited evidence of reliance on the MP4 impact area for breeding. The highest post-management level of effect is Moderate, which applies to eastern falcon | kārearea, banded dotterel | pohowera and South Island pied oystercatcher | tōrea due to their Very High ecological value, despite a Low magnitude of effect. For all other bird species assessed, the post-management level of effect is Low or Very Low, as summarised in Table 6-38.

Table 6-38. The magnitude of effect before and after management, and the overall level of effect.

Species	Ecological Value	Magnitude of effect (after mitigation)	Level of residual effect
Eastern falcon / kārearea	Very High	Low	Moderate
Banded dotterel / pohowera	Very High	Low	Moderate
South Island pied oystercatcher / tōrea	Very High	Low	Moderate
Black shag / kōau	Very High	Negligible	Low
New Zealand fernbird / mātātā	High	Negligible	Very Low
New Zealand pipit / pīhoihoi	High	Low	Low
Silvereye / tauhou	High	Negligible	Very Low
Australasian shoveler / kuruwhengi	Low	Low	Very Low
Grey teal / tētē-moroiti	Low	Low	Very Low
Grey warbler / riroriro	Low	Negligible	Very Low
Kererū / New Zealand pigeon	Low	Negligible	Very Low
New Zealand scaup / pāpango	Low	Negligible	Very Low
Paradise shelduck / pūtangitangi	Low	Low	Very Low
Pied stilt / poaka	Low	Low	Very Low
Pūkeko	Low	Low	Very Low
Sacred kingfisher / kōtare	Low	Low	Very Low
South Island fantail / pīwakawaka	Low	Negligible	Very Low
Southern black-backed gull / karoro	Low	High	Low
Spur-winged plover	Low	Low	Very Low
Swamp harrier / kāhu	Low	Low	Very Low
Tūī	Low	Negligible	Very Low
Welcome swallow / warou	Low	Low	Very Low
White-faced heron / matuku moana	Low	Low	Very Low

6.4.5 Bats

A targeted bat/ pekapeka assessment was undertaken to determine the presence and potential ecological values of bats within the Project area and its zone of influence. The assessment included a desktop review of available records and a landscape-scale acoustic survey using automatic bat monitors deployed across 28 locations for up to 20 nights during March 2026.

No bat detections were recorded during the acoustic survey despite coverage of a range of habitats considered most likely to support bat activity, including waterways, wetlands, forest edges, potential roost trees, and rock tors. Survey effort was consistent with accepted good practice for presence or

absence surveys and included a high number of valid recording nights under suitable weather conditions.

In combination with the absence of records in the Department of Conservation bat database within the surrounding region, the lack of suitable indigenous forest habitat for short-tailed bats, and the distance to the nearest known long-tailed bat populations, the survey results provide a high level of confidence that bats are not present within the Project area or its zone of influence.

On this basis, bats are considered absent from the site, and no ecological values or effects relating to bats are identified for the Project.

6.4.6 Natural Inland Wetlands

The Project will result in direct and indirect effects on wetland ecosystems through vegetation clearance, soil disturbance and earthworks, catchment alteration, groundwater drawdown and ongoing mining activities. The effects are mostly permanent (i.e. vegetation clearance); however, some are temporary in nature. These effects will be realised in six wetland ecosystem types which are present throughout the disturbance footprint and within the 100 m buffer zone, totalling 15.45 ha (Table 6-39). These wetland ecosystems are;

- Ephemeral wetlands, representative ecosystem WL14 Ephemeral herbfield;
- Sedgeland, representative ecosystem WL22 *Carex*, *Schoenus pauciflorus* sedgeland;
- Herbaceous wetlands, representative ecosystem WL16 Red tussock, *Schoenus pauciflorus* tussockland⁶;
- Shrubland wetlands, representative ecosystem WL23 *Oleria* Shrubland, developed by Wildlands (2020)
- Red tussock wetland, representative ecosystem WL16 Red tussock, *Schoenus pauciflorus* tussockland
- seepage wetland representative ecosystem. WL17 *Schoenus pauciflorus* sedgeland [alpine seepage].

Wetland and riparian vegetation communities are smaller in extent than the terrestrial vegetation communities (Section 6.2), but include communities of elevated ecological value because of rarity, localised occurrence, association with naturally uncommon ecosystems, or habitat value for Threatened, At Risk, Data Deficient or locally uncommon, plant species.

Table 6-39. Extent of wetland extent located within the impact zone and 100 m buffer of wetland ecosystems per project area

Ecosystem	Coronation Mining Area (ha)	Central Mining Area (ha)	Golden Bar / Haul Road (ha)	Frasers WRS (ha)	Total area (ha)
Ephemeral	0.39	3.26	1.23		4.88
Sedgeland	0.59	0.38	1.84		2.81
Freshwater herbaceous	1.89	0.09	1.02	0.97	3.97

⁶ This vegetation community does not have a recognised ecosystem type per Singers and Rodgers *et al* (2014), therefore the extent of loss has been compared to WL16 as Wildlands (2020) inferred most “freshwater herbaceous” wetlands mapped fell within WL16, WL17 and/or WL8 ecosystem categories.

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Shrubland wetland	0.01	-	0.02		0.03
Seepage	0.02	-	-		0.02
Copper tussock	0.076				0.076
Induced wetland	0.35			3.32	3.67
Total	3.32	3.73	4.11	4.29	15.45

6.4.6.1 Actual and Potential Effects

Potential ecological effects are primarily associated with:

- Reclamation and permanent loss of wetland extent and values.
- Earthworks and vegetation clearance within wetlands.
- Groundwater drawdown and lowered base flow resulting in the complete or partial dewatering of wetlands.
- Surface water flow reduction due to earthworks, resulting in the complete or partial drainage of wetlands.
- Damming and diversion of stormwater.
- Diversion of surface water flow towards wetlands, resulting in increases to the wetland water level.
- Sedimentation in un-reclaimed wetlands which has the potential for transportation to downstream receiving waterbodies or bury wetland vegetation.
- Changes to water quality within wetlands, either due to reduced hydrology or discharge of water utilised in mine operations.
- Loss of Threatened and At-Risk wetland plants (addressed in Section 6.3.1.1 of this EclA).

6.4.6.2 Direct Effects

6.4.6.2.1 Reclamation and permanent loss

The majority of wetlands within the disturbance footprint are freshwater herbaceous wetlands and sedgeland which are notably dominated by exotic species and low indigenous biodiversity. The identified wetland largely containing high invasion of exotic species with evidence of agricultural impacts, such as pugging and grazing, however, support a suite of TAR flora. The wetlands located within the direct project footprint have Low to Very High ecological values with respect to indigenous biodiversity, overall ecosystem function and threat status.

The proposed Project Area and disturbance footprint will result in the direct loss of a cumulative 4.17 ha of wetland extent (conservatively including those areas within the 20 m buffer) via direct reclamation. This will result in an overall reduction in wetland ecosystem extent on a local scale (within OGL Landholdings) and wider scale (Macraes ED). Table 6-40 and Table 6-41 summarise the extents (ha) of direct wetland loss, and potential edge effects on wetland ecosystems within the 20 m buffer which may be lost.

Table 6-40. Extent of direct loss of wetland ecosystems per MP4 project area

Ecosystem	Coronation Mining Area	Central Mining Area	Golden Bar / Haul Road	Total Affected area (ha)
Ephemeral	0.38	0.40	0.09	0.87
Sedgeland	0.38	0.11	0.72	1.21
Freshwater herbaceous	1.07	0.03	0.40	1.5

Shrubland wetland	0.007	-	0.01	0.017
Seepage	0.02	-	-	0.02
Total	1.86	0.54	1.23	3.62

Table 6-41. Extent of predicted effect (direct loss plus additional 20 m edge) of wetland ecosystems per MP4 project area through reclamation

Ecosystem	Coronation Mining Area	Central Mining Area	Golden Bar / Haul Road	Total Affected area (ha)
Ephemeral	0.39	0.62	0.13	1.14
Sedgeland	0.41	0.12	0.76	1.29
Freshwater herbaceous	1.25	0.03	0.41	1.69
Shrubland wetland	0.01	-	0.02	0.03
Seepage	0.02	-	-	0.02
Total	2.08	0.77	1.32	4.17

6.4.6.2.1.1 Dewatering and drainage

Outside of the impact area and 20 m buffer, but within 100 m of the proposed works, a cumulative 11.28 ha of wetland extent is present. Earthworks and pit expansion have the potential to alter the overall contributing surface water catchments and groundwater interactions to wetlands located outside of the Project Area, resulting in a reduction in hydrology to the wetlands through:

- Reduced overland flows and surface water flows due to catchment alteration and surface water diversion, resulting in the complete or partial drainage of wetlands; or
- Loss of interaction with the water table through shallow groundwater drawdown and reduced height of the groundwater table, resulting in the complete or partial dewatering of wetlands.

For the purpose of this assessment, drainage refers to the loss of surface water interaction to wetlands and dewatering refers to the loss of groundwater interaction to wetlands.

The disconnect from surface water and groundwater has the potential to lead to the drying of soils and the reduction of hydrological functioning and features of wetlands. This drying and reduction in hydrology may result permanent and/or intermittent saturation being reduced, leading to changes in vegetation community as hydric vegetation and wetland affiliated plants are no longer able to grow where they currently do, leading to invasion of dryland plant species. This may occur to such a degree that the wetlands habitat type changes, even if the area still retains wetland characteristics and there is no change in wetland extent, resulting in the shift of wetlands current ecosystem extent, such as Red Tussock land (WL16) to grassland, changing the fundamental structural class of the wetland and resulting in an overall change from current ecological values.

In regards to ephemeral wetlands, partial dewatering through any loss of shallow groundwater connection may result in prolonged periods of dryness leading to long-term changes in vegetation community as the seasonal shifts in wetland plants are no longer able to grow leading to prolonged invasion of dryland plant species and the potential for ephemeral wetlands to shift to an entirely terrestrial ecosystem. Annual wetland plant⁷ seeds may lose viability to germinate and grow if wetland

⁷ those which complete their entire life cycle in a single growing season

saturation returns after a period of years, resulting in more perennial and invasive wetland plants shifting the dominance in the wetland.

Reduced water levels and partial drainage/dewatering may then place existing wetland vegetation under increased stress, which then, cumulatively, with the impacts of other stressors, may lead to their loss from the wetland (e.g., stressed plants will then be more susceptible to impacts from diseases and competition than if they were otherwise healthy). Other sources of stress, such as climate change, may further exacerbate this, resulting in greater extents of wetland loss than predicted from groundwater and surface water effects.

6.4.6.2.1.1.1 Dewatering

The actual adverse effects on wetlands from drawdown is dependent upon the actual degree of groundwater disconnect, influence of surface water on those wetlands and the presence of perched groundwater tables. Drawdown effects have been modelled by GHD; however, this does not account for perched/shallow groundwater or surface water contributions. At Coronation, a potential groundwater drawdown of up to >20 m, potentially impacting 0.55 ha of wetland extent, consisting of 0.41 ha of freshwater herbaceous, and 0.14 ha of sedgeland. Groundwater contributions to Mareburn Creek and Deepdell Creek and their ephemeral tributaries has an estimated reduction of 3.1% and 6% (GHD, 2026). Whilst this estimated to be a relatively low reduction in baseflow, these wetlands have been conservatively considered to be of high risk of dewatering. An additional 0.38 ha of sedgeland and freshwater herbaceous wetland is of moderate risk of dewatering due to the potential drawdown of circa 6 m, however an existing storage pit located at the headwaters, where wetland habitats persist despite no discharge occurring.

Golden Bar pit modelling indicates a potential drawdown of 5 m to adjacent wetlands, potentially affecting an additional 0.39 ha of sedgeland wetland. Groundwater contribution reductions to Murphys Creek is estimated to be 0.2% of baseflow. As these wetlands are located in closer proximity to Golden Bar Pit, they have been conservatively estimated to be at moderate to low risk of dewatering. To emphasis, these modelled outcomes do not account for surface water contributions to the catchment, such as rainfall, catchment storage or perched groundwater.

The potential complete and/or partial dewatering of 0.55 ha of natural inland wetlands outside of the direct works area is representative of an additional loss of wetland extent as these habitats are expected shift to terrestrial ecosystems rather than remain as wetland. While these wetlands primary hydrology source may be surface water or shallow/perched groundwater and the potential drawdown effects may not be realised, these have nonetheless been conservatively assessed to be dewatered as the additional hydrological contribution are unknown. This complete dewatering and/or drainage represents an additional loss natural inland wetland, cumulating in an additional 1.9% loss of freshwater herbaceous and 0.7% of sedgelands within OGL Landholdings. On a landscape scale, this reduction in wetland extent represents a low magnitude of effect as this loss does not represent additional significant reductions in the existing ecosystem types within the Macraes ED.

Potential subsidence and the dewatering of Deepdell Creek and its adjacent wetland habitats through the continued expansion of GPUG has been identified by PSM. If this were to occur, it would likely result in reductions in any existing wetland extent and quality through the loss of hydrological drivers. It is understood further investigations are to be undertaken on the degree of subsidence; however the

overarching effects are likely to be minimised/mitigated through management actions and the implementation of "orange no-go zones" where subsidence is expected to be greatest.

6.4.6.2.1.1.2 Drainage

Earthworks, predominantly for the construction of Golden Bar Haul Road and Macraes Road realignment has the potential to intercept groundwater or alter the surface water catchments. Macraes Road consists of linear earthworks, setback from the edge of wetlands as far as practicable, with the majority of earthworks consisting of fill (McIlroy Consulting, 2025). These earthworks should not significantly alter the contributing catchment to adjacent wetlands as minimal earthwork are undertaken in the upper catchment of the adjacent gully wetlands. Where Macraes Road intersects existing wetlands, culverts are to be installed to retain connectivity to the upstream catchment, minimising the potential for drainage (McIlroy Consulting, 2026).

Golden Bar Haul Road (GBHR) is proposed to be upgraded through works on the historic gravel haul road, currently being utilised as a farm track. The GBHR is located along the ridgeline, in which earthworks will be undertaken upstream of wetland headwaters, albeit in close proximity to some wetlands, being 5 m to 25 m for gully wetlands, and 0.5 m to 5 m for ephemeral wetlands. This upgrading works on an existing road located on the ridgeline should not result in significant diversions of surface water away from wetland catchments to cause complete or partial drainage due to the placement and type of works proposed.

Wetland habitats, totalling 0.15 ha, located adjacent to mining activities at Coronation will experience a loss of upstream catchment due to reclamation. This reduction in surface water flow, coupled with the low drawdown levels may result in the complete or partial drainage of wetlands. Sediment Retention Ponds (SRP) are proposed to be placed adjacent to these wetland habitats at Trimbells Wasterock Stack. These SRP will discharge treated (via settlement) water back into the catchment providing hydrological supplementation. These SRP's have been sized in accordance with the upper catchment, therefore an equivalent volume of water should be discharged back into the catchment (EGL, 2026). This discharge should therefore avoid increase or decreases in catchment size, however the retention of water prior to its discharge may result in more permanent inputs into the wetland. This would likely be beneficial to the wetlands as the SRP's may provide a consistent source of water during the dryer months, increasing the survival of wetland affiliated species. No discharges are proposed to enter the ephemeral wetlands, therefore their hydroperiods should not be influenced by these structures.

The potential drainage of wetlands is largely minimised through construction design and mitigated through the implementation of SRP's, discharging equivalent catchment volumes back into the wider contributing catchment. The magnitude of effect for the drainage of wetlands has conservatively been assessed as **Low**. It is considered the activities which may alter surface water are unlikely modify hydrological function or result in a reduction of wetland values.

6.4.6.2.1.2 Diversion of water

The installation of the SCP will divert water seepage from the WRS's away from the wetlands, resulting in a reduction in sub-soil hydrological contributions to the wetlands. These sub-soil drains will not interfere with surface water contributions or natural groundwater table interactions with the wetland.

Approximately 1.18 ha of natural wetland is adjacent to Frasers WRS, with these wetlands located within the upper reaches of the Waikouaiti North Branch. Historic aerial images show wetland features to be present prior to the WRS's construction, or during early stages of the WRS indicating they are hydrologically supported by the Waikouaiti catchment. These wetlands may experience minor dewatering following the creation of the SCD's due to the diversion of contaminated seepage away from the wetlands. Surface water flows generated on the WRS and natural flow paths are still able to flow and intercept these wetlands, and natural groundwater interactions would continue. Additional hydrological investigations to the extent of potential dewatering, including seepage and runoff volumes, and WRS shedding rates should be undertaken to confirm the potential catchment loss.

In total, 3.23 ha of induced wetland is located adjacent to Frasers WRS and 0.35 ha of induced wetland is located adjacent to Coronation North WRS. These induced wetlands have been created due to emerging seepage from the WRS's, in which they have limited connectivity to the wider catchment, a formed with a silty, sludge-like substrate and dominated by exotic vegetation. Surface water generated from the WRS's will still continue to flow into the wetlands, however the degree the seepage or surface water flows contribute to these wetlands is uncertain. Regardless, a cumulative 3.58 ha of negligible to low value, induced wetland extent has been conservatively estimated to be lost.

The diversion of water and resultant complete or partial dewatering of 3.58 ha of induced wetlands was considered to be of **Moderate** magnitude of effect on those wetlands from diversion of seepage water away from wetlands, leading to some partial or complete dewatering. The extent of dewatering is unknown as surface water flows from the WRS, and interactions with the natural groundwater table will continue to occur.

Wetland loss will arise from direct reclamation, dewatering and the diversion of water throughout the project area and affect multiple wetland ecosystem types. TAB presents the extent of wetland loss per project area, the wetland ecosystem type and the mechanism of wetland loss. Table 6-42 presents the total wetland loss per ecosystem type and the proportional loss of that ecosystem type throughout OGNZL Landholdings. In total, MP4 will result in 4.79 ha of natural occurring wetland, and 3.58 ha of induced wetland, with a cumulative 8.37 ha of wetland loss.

Table 6-42. Extent of wetland loss through the MP4 project per project area, wetland type and predicted mechanism of wetland loss.

Mechanism of wetland loss	Wetland ecosystem type	Coronation	Central Mining Area	Golden Bar	Waste Stacks	Rock	Total
Direct reclamation	Ephemeral wetland	0.39	0.62	0.13	-		1.14
	Sedgeland	0.41	0.12	0.76	-		1.29
	Herbaceous freshwater	1.25	0.03	0.41	-		1.69
	Shrubland	0.01	-	0.02	-		0.03
	Seep	0.02	-	-	-		0.02
	Sedgeland	0.14	-	-	-		0.14

Dewatering and drainage	Herbaceous freshwater	0.45	-	-	-	0.41
Seepage capture drains	Induced wetland	0.35	-	-	3.23	3.58
Total						8.30 ha

Within OGL Landholdings, a cumulative 55.36 ha of wetland extent has been mapped, consisting of 9.70 ha of ephemeral wetlands and 45.66 ha of “Gully wetlands”, have been identified through ground-truthing and aerial mapping. Gully wetlands broadly encapsulate those wetlands which are connected to the wider contributing catchment and located within the headwaters, gully floors and overland flow paths within the wider freshwater system. Table 6-43 details the cover estimates of gully wetland types within OGNZL Landholdings to provide a proportional loss estimate on a local scale.

Table 6-43. Cover estimates of ground-truthed gully wetland types (10.57 ha) within the mapped gully wetland extent (45.66 ha) throughout OGL Landholdings, to determine proportional wetland loss in unclassified gully wetland ecosystems. Note ephemeral wetlands are excluded from this table as 9.70 ha of ephemeral wetland extent has been mapped.

Wetland Type	Identified extent (ha)	Proportional Cover (%)	Representative “gully wetland” area (ha)
Sedgeland	2.93 ha	29%	13.24 ha
Freshwater herbaceous	6.96 ha	67%	30.59 ha
Seepage	0.02 ha	0.18%	0.082 ha
Shrubland	0.03 ha	0.28%	0.13 ha
Copper tussock	0.22 ha	2.1%	0.95 ha

Within OGL Landholdings, the total wetland loss represents 14.9% of *currently mapped* wetland extent (Figure 6.6). In actuality, the mapped wetland extent is a broadscale and coarse, where additional wetland extent is likely to be present throughout OGL Landholdings which has not been identified through the aerial mapping exercise. Table 6-44 presents the representative loss of wetland ecosystem types on a local scale and ED scale.

Table 6-44. Proportional direct loss of total wetland ecosystems arising from MP4, based on extent mapped within OGL Landholdings and the Macraes ED.

Wetland type	Impacted Area (ha)	Proportion within OGL Landholdings ⁸		Proportion within Macraes ED*		Magnitude
		(ha)	(%)	(ha)	(%)	
Ephemeral wetland	1.14	9.70	11.75%	135	0.84%	High**
Sedgeland***	1.43	13.24	10.8%	27	4.7%	Moderate

⁸ Based on the relative proportion (%) of wetland ecosystem types identified within the impact and buffer zone detailed in Table 6-43.

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Herbaceous freshwater***	2.14	30.59	6.9%	217	0.77	Moderate
Seep	0.02*	0.082	24%	9.3	0.2%	High
Shrubland	0.03	0.13	23%	NA	NA	High
Induced wetland	3.58	-	-	-	-	Low
Total	8.30	55.36	14.9	361.3	2.29	Moderate

*based on Otago Regional Council Ecosystems and Habitat Maps Current Indigenous Ecosystems Layer

** Magnitude increased one level to acknowledge Very High Value

*** Includes dewatered wetland extent

6.4.6.2.2 Habitat fragmentation and connectivity

Reclamation of wetlands has the potential reduce connectivity between remaining wetland bodies and fragment existing wetland habitats.

The reclamation of wetlands is primarily occurring within the upper headwaters and gullies, minimising fragmentation throughout the majority of wetlands. However, three headwater wetlands located at Coronation will be isolated from the wider catchment through the reclamation of lower extents from the placement of Trimbells WRS. A cumulative 0.20 ha of sedgeland and herbaceous freshwater wetlands will be isolated from the downstream catchment. No works are proposed within the upper catchment of these wetlands, where natural catchment flows should still be maintained to continue the support of wetland type.

Those ephemeral wetlands which will be segmented by pit expansions, WRS, etc have been accounted for within the wetland reclamation estimates. These areas will likely experience a significant reduction in wetland ecosystem function and are expected to shift to a more terrestrial ecosystem type. As such, these represent loss of wetland extent rather than fragmentation. An ephemeral wetland is located at Central Mining Area will experience a very small portion of encroachment (2.5 m²) on the outer boundary. This area has been allocated within the wetland reclamation. As this small portion is located on the outer edge of the wetland, it will not result in the fragmentation of the ephemeral wetland.

Although the wider Macraes landscape is already highly modified by pastoral land use and mining activities, indigenous tussock grassland and shrubland remnants provide ecological linkages for indigenous flora and fauna. Additional vegetation removal may further reduce continuity of these habitats at a local scale, and impact areas are generally associated with the current edges of existing infrastructure, including at Golden Bar, where works would re-impact previously disturbed vegetation environments where some indigenous vegetation is naturally regenerating. Overall fragmentation and connectivity effects would be **low**.

6.4.6.2.3 Seepage Capture Drain Construction

The majority of wetlands located adjacent to, and within the construction footprint, of the seepage capture drains are freshwater herbaceous wetlands, dominated by exotic species and lack of buffering vegetation. The seepage capture drains will directly impact 0.37 ha of wetland extent at Frasers WRS through earthworks to construct these drains. Earthworks to construct the seepage capture drain avoids wetland extent at Coronation North. Earthworks will consist of trenching to install the sub-soil bunds and toe drains, which are then buried below ground level and capped and re-levelled to prevent

surface flows from entering the drain, allowing surface water to flow over and into the existing wetlands.

Earthworks represent a temporary effect to wetland habitats to install the pipeline. The capping of the SCD's will allow for the wetland vegetation to recolonise the disturbed area. Isolated sedges may not establish due to limited rooting depth, however herbaceous wetland vegetation such as exotic grasses, isolepis and small rush species are expected to colonise the area. Wetland soils should be salvage from the disturbance footprint, including those with exotic dominance and temporarily stored and re-spread over the constructed SCD's.

The proposed earthworks should not result in a reduction in wetland extent, with temporary excavations remediated post works through the replacement of wetland soils, with wetland vegetation expected to recolonise the disturbed area. The magnitude of effect of the proposed earthworks is calculated to be **Moderate**.

6.4.6.3 Indirect Effects

Within the 100 m buffer zone, a remaining 7.08 ha of wetland extent is present when accounting for wetland extent lost through dewatering and diversion, and wetland extent considered lost within conservative 20 m buffer zone, as detailed in Table 6-42.

6.4.6.3.1.1 Catchment increase

Earthworks and mine expansion have the potential to alter the overall contributing catchment to wetlands located outside of the Project Area via diversion or the discharge of water *towards* wetlands, potentially raising the water levels within the wetland. Within 100 m of the proposed works, a cumulative 7.08 ha of wetland extent is present which may be subject to increases in contributing catchment.

Increases in catchment size may result in an overall increase in wetland extent as more terrestrial areas become frequently saturated. This increased hydrology may result in shifts in ecosystem classification within the wetlands, potentially reducing habitat complexity and mosaics throughout individual wetlands. Increases in water depth within the wetland may result in the submersion of facultative and facultative wetland plants which are adapted to slightly drier conditions or partial saturation, rather than open water and submerged conditions.

The increase in contributing catchment size may result in a positive effect to wetlands, in which the overall extent of wetland area may be induced through saturation of terrestrial systems or ephemeral streams. This would result in a shift of upland vegetation to hydrophytic vegetation communities, creating more wetland aligned habitats. This increase in wetland size is likely to occur within gully heads shallow valleys, where the dominant vegetation type is exotic pasture grasses rather than tussockland. Where this to occur, wetland values could be further supported through the planting of indigenous flora into these gully's, or the implementation of weed control to allow for indigenous wetland plants to establish.

As such, potential catchment increases from the SRP's was considered to have an overall **Low** magnitude of effect, with some positive effects potentially realised if induced wetlands are appropriately managed through stock exclusion and weed control.

6.4.6.3.1.2 Accidental encroachment

Works within close proximity to natural inland wetlands has the potential to accidentally encroach upon the wetland margins. This accidental encroachment may be from earthworks, construction of the new SRP's, vehicle tracking, deposition of rock or associated construction materials (i.e. stand down area), slope slippage, or accidental discharge contaminant. This has the potential to reduce the extent and/or value of the wetland through the crushing/smothering of wetland vegetation, soil compaction, reduction in hydrology or reduction in water quality and wetland health. Whilst wetlands within the 20 m buffer have been conservatively incorporated into the direct loss, adverse impacts as a result of accidental encroachment should be managed to minimise the potential adverse effects where unnecessary.

Accidental encroachment may then degrade wetland values with the overall magnitude of potential effect dependant on the activity undertaken (i.e. accidental vegetation clearance or vehicle tracking). As such, accidental encroachment is considered to have a **Low to Moderate** magnitude of effect, as it may result in permanent degradation of wetland values or loss of extent, or temporary disturbances.

6.4.6.3.1.3 Sedimentation and dust

Works within the site can generate sediment and dust, which would negatively impact wetland habitats adjacent to the site and the immediate downstream receiving environment. The effects of excessive sediment are recognised as a significant effect on river and land-use, and can impact aquatic fauna through increased turbidity, heat absorption and light refraction. Within wetlands, sediment inputs from mobilised silt from earthworks and dust may smother vegetation limiting photosynthesis, reduce the overall depth of open water pools and channels. Wetlands located on the outer edges of the impact area, in which the upper portions are to be reclaimed, have the potential to act as pathways for the transportation of fine sediments to the downstream reaches and catchment.

Whilst the intermittent and ephemeral nature of the upper catchment may naturally minimise the potential for the transport of fine sediments during the drier season, if this sediment is discharge via water, it has the potential to travel further downstream, smothering plants and habitats. During the wet season when these wetlands and streams are flowing, sediment may then be transported more easily, particularly if discharged via water.

Works within close proximity to wetlands may introduce fine sediments and dust to wetlands, which has the potential to reduce the overall condition of natural inland wetlands. Dust generated from overburden stripping, haulage and material handling may settle on surrounding vegetation and ground surfaces. Excessive dust deposition can affect vegetation structure and function, contaminate water within wetlands may then be transported downstream. The potential magnitude of sedimentation and dust effects on a Project wide scale, without minimisation, is considered to be **High** due to potential adverse effects to the immediate downstream receiving environment.

6.4.6.3.1.4 Water quality

Discharge of water associated with mine use to the wetlands has the potential to alter water chemistry within the wetlands which may lead to reductions in wetland condition. Discharged water, either from stormwater, erosion and sediment controls or due to seepage from Waste Rock Stacks has the potential to introduce additional contaminants to adjacent wetlands, reducing the water quality and inherent values present.

To minimise adverse effects to aquatic ecosystems from water discharges from mine activities, a variety of treatment options are to be implemented, dependent upon the water source and required management regime. These treatment options include sediment settlement ponds, clean and dirty water diversions, seepage catchment drains and direction into mine water management system

Ensuring water discharged to wetlands is appropriately treated, as determined by the source of water, no discernible effect to wetland habitats and values should occur, resulting in an overall **Low** magnitude of effect. Furthermore, as water percolates through wetland habitats, additional treatment and filtration of water will occur, further reducing the low magnitude effects on the downstream receiving environment.

6.4.6.4 Avoidance and minimisation

6.4.6.4.1 Avoidance

Avoidance has been applied through project design and footprint refinement. The most substantive wetland/riparian avoidance measure is the removal of the Back Road Waste Rock Stack from the Project footprint, thereby avoiding direct loss of a large area of wetland habitat. Further avoidance has occurred through refinement of infrastructure footprints where practicable, placement of new SRP's outside of wetland habitats, and retention of vegetation areas not required for construction or operation, and the design of Macraes Road and GBHR to avoid intercepting wetland habitats as far as practicable.

Complete avoidance of wetlands is not practicable for all receptors because the Project involves extensions to existing fixed-location mining infrastructure and ore bodies. Threatened wetland plants within the footprint and 20 m buffer are assumed to be unable to be avoided. These species will therefore require management through the Threatened Plant Management Plan, which may include vegetation direct transfer, seed collection, propagation, salvage, translocation and monitoring. Transfer or recipient sites are expected to require supporting management, such as stock exclusion and pest plant and animal control.

Ephemeral wetlands are located within closed depressions which lack surface flow outlets. These wetlands are hydrologically supported through seasonal variations in rainwater with some groundwater interaction, rather than surface water flows, with the water table fluctuating well above to well below ground level (Johnson and Gerbeaux, 2014). It is expected drawdown of groundwater would not result in noticeable changes in ephemeral wetlands as their primary driver is rainfall, however those with a "long-term" inundation hydroperiod may experience prolonged periods of drying at Macraes Central due to their more pronounced interaction with groundwater. Any hydrological supplementation would need to be carefully designed to ensure this does not result in the hydrological function and transition these wetlands into areas of permanently ponded water with no ephemeral wetland characteristics.

6.4.6.4.2 Minimisation

Dewatering may be minimised through grouting or recharge groundwater. Grouting is a process where cracks and fissures through which shallow groundwater drains are filled with a cement, chemical, polymer or resin-based grout to prevent water losses to the mine. This therefore maintains shallow groundwater levels. The recharge of groundwater involves capturing the groundwater inflowing to the

mine, which is part of normal operations, and returning a portion back into selected locations of an affected overlying aquifer. A determination would need to be made on whether the reinjected supply required treatment, but as it is the maintenance of the water level overlying the point of reinjection that is the objective, and not the discharge of the reinjected water into the surface water, treatment may not be necessary. In addition, flow augmentation may be carried out adjacent to the CSD's, where the potential of dewatering of natural wetlands is apparent. This would return treated seepage back to the affected wetlands, minimising hydrological changes.

Wetland drainage has been minimised through flow augmentation and placement of SRP's to provide supplementary water to the wetlands to maintain their water levels. It is expected that, if needed at all, application of supplementary water would only be needed in dry months such as summer when water levels are naturally lower. Supplementary water may be sourced from local boreholes (placed in such a location that the taking of water will not have other ecological consequences); from water collected locally in tanks located on existing drill platforms; or through the application of treated deep groundwater retrieved from within the mine. In addition, the implementation of prescribed "no-go" zones within Golden Point Underground, where subsidence effects are greatest to minimise changes to the water levels within Deepdell Creek and any adjacent wetlands.

Regardless of minimisation measures employed to reduce the severity of dewatering and drainage potential, those wetlands which have been identified as having a low to moderate potential for dewatering and drainage will be subject to hydrological monitoring and an adaptive management regime. Details regarding the monitoring and management of dewatering and drainage is provided within the Wetland Monitoring Plan and Wetland Maintenance Plan (Bioresearches, 2026h; 2026p).

The potential for excess fine sediment entering wetlands adjacent (i.e. within 20 m) to the proposed works area can be appropriately managed through the implementation of an Erosion and Sediment Control Plan (ESCP). This has been prepared and will be implemented by an appropriately qualified professional (EGL, 2026) using the industry best practice. The plan details methods on managing sediment in discharges of water as well as dust. No works should occur without the ESCP recommendations being in place. Maintenance and management of the controls adjacent to the wetland's streams should be stringent, with erosion and sediment controls checked prior to and immediately following heavy rain events to minimise the potential for failure and sedimentation of the downstream receiving environment

Dust generation will be managed through standard mining operational controls, such as water carts on haul roads, dust suppression measures during dry or windy conditions, and operational management of material handling to reduce dust emissions.

Minimisation measures for wetlands will include clear demarcation of works boundaries, protection of retained vegetation, staged wetland reclamation, dust suppression and erosion and sediment controls to minimise sedimentation, weed hygiene and control, management of road drainage, runoff and controls on vehicle access and stock access where relevant. These measures are intended to reduce accidental vegetation loss, indirect degradation of retained vegetation and the spread of weeds into disturbed or retained indigenous habitats.

Table 6-45. Summary of avoidance and minimisation measures for wetland ecosystems vegetation.

Effect pathway	Management measure
Dewatering and drainage	Maintain hydrological inputs, through flow augmentation, grouting or recharge of groundwater to retained wetland ecosystems where practicable, manage road drainage and runoff, and monitor retained sensitive vegetation where hydrological effects are possible. Return of treated seepage capture to augment flow to wetlands.
Dust deposition	Implement dust suppression measures, including watering, stabilisation of exposed surfaces and management of haul roads, to reduce dust deposition on adjacent retained vegetation.
Sedimentation of retained wetland ecosystems	Apply stringent erosion and sediment controls to prevent sediment discharge to gullies and wetlands.
Accidental encroachment into retained vegetation	Use exclusion fencing, flagging, site inductions and construction drawings showing no-go areas to prevent accidental disturbance outside the approved works footprint.
Loss of Threatened, At Risk, Data Deficient or locally uncommon plants	Manage affected plants through the Threatened Plant Management Plan, which may include vegetation direct transfer, seed collection, propagation, salvage, translocation, recipient-site preparation and post-transfer monitoring.
Removal of wetland vegetation	Salvage of mature wetland plants, namely sedges, tussocks and rushes within affected wetlands. The rescue and relocation of indigenous herbaceous species
Weed invasion and edge effects	Implement weed hygiene, weed control and progressive rehabilitation measures to reduce weed establishment in disturbed margins and retained indigenous vegetation.

6.4.6.5 Level of effect

The level of effect following the avoidance and minimisation steps described above has been determined by combining ecological value and magnitude of effect, consistent with the EIANZ EcIA matrix adopted for this assessment (Roper-Lindsay *et al.*, 2018). Under that framework, effects assessed as Moderate or higher generally require further effects management through mitigation, offsetting or compensation, depending on the receptor and the nature of the residual effect.

The assessment below should be read as the level of effect after taking account of the project design and avoidance already incorporated into the footprint. The GPUG Extension is included only where potential surface vegetation effects are relevant, noting that substantial direct surface vegetation clearance is not proposed.

The highest vegetation-community effects are associated with the loss or modification of Very High and High value vegetation communities at Coronation Mining Area and Central Mining Area. These include Very High value ephemeral wetlands and high value freshwater herbaceous wetlands at Coronation Mining Area and High value ephemeral wetland at Central Mining Area, and high value freshwater herbaceous wetlands at Golden Bar.

Table 6-46. Overall level of effect for direct impacts for identified wetlands in relation to their location within the Project Area

Location	Vegetation system / ecosystem	Ecological value	Magnitude of direct effect	Level of direct effect
Coronation Mining Area	Ephemeral wetland	Very High	High	Very High
	Riparian freshwater herbaceous vegetation	High	Moderate	High
	Riparian sedgeland	Moderate	Moderate	Moderate
	Wetland freshwater herbaceous vegetation	High	Moderate	High
	Wetland sedgeland	Moderate	Moderate	Moderate
	Wetland seepage	High	High	Very High
	Wetland shrubland	Moderate	High	Moderate
Central Mining Area	Ephemeral wetland	Very High	Moderate	High
	Wetland freshwater herbaceous vegetation	Low	Moderate	Low
	Riparian shrubland	Moderate	Moderate	Moderate
	Sedgeland wetland	Moderate	Moderate	Moderate
Golden Bar Mining Area	Ephemeral wetland	High	Moderate	High
	Wetland freshwater herbaceous vegetation	Low	Moderate	Low
	Wetland sedgeland	Moderate	Moderate	Moderate
	Wetland shrubland	Moderate	High	Moderate

The vegetation-community effects assessed as Moderate or higher are therefore limited to:

- Very High level of effect on Coronation Mining Area ephemeral wetland;
- Very High level of effect on Central Mining Area ephemeral wetland;
- Very High level of effect on Coronation Seepage wetland;
- High level of effect on Coronation Mining Area wetland freshwater herbaceous vegetation; and
- Moderate level of effect on sedgelands and shrublands at Coronation Mining Area and Golden Bar

Indirect effects to wetland communities, including accidental encroachment and sedimentation and dust deposition is considered to be potential effects which can be appropriately managed through on-site controls and action plans, reducing the magnitude of effect and resulting in an overall Low level of effect is appropriately implemented and maintained. Table 6-47 to Table 6-50 summarise the level of effect for each indirect impact following mitigation measures for each project area.

Table 6-47. Overall level of effect for indirect impacts for identified wetlands at Coronation following mitigation measures

Effect	Vegetation system / ecosystem	Ecological value	Magnitude of indirect effect (prior to mitigation)	Magnitude of indirect effect (after mitigation)	Overall level of effect (after mitigation)
Dewatering/ drainage	Riparian freshwater herbaceous vegetation	High	Low	Low	Low
	Wetland freshwater herbaceous vegetation	High	Low	Low	Low
	Wetland sedgeland	Moderate	Low	Low	Low
	Red Tussock	Moderate	Low	Low	Low
Catchment Increase	Riparian freshwater herbaceous vegetation	High	Low	Low	Low
	Wetland freshwater herbaceous vegetation	High	Low	Low	Low
	Wetland sedgeland	Moderate	Very Low	Low	Low
	Red Tussock	Moderate	Low	Low	Low
Sedimentation and dust	Riparian freshwater herbaceous vegetation	Moderate	High	Low	Low
	Wetland freshwater herbaceous vegetation	Low	High	Low	Low
	Wetland sedgeland	Moderate	High	Low	Low
	Red Tussock	Moderate	Moderate	Low	Low
Accidental Encroachment	Riparian freshwater herbaceous vegetation	Moderate	High	Low	Low
	Wetland freshwater herbaceous vegetation	Low	High	Low	Low
	Wetland sedgeland	Moderate	High	Low	Low
	Red Tussock	Moderate	Low	Low	Low

Table 6-48. Overall level of effect for indirect impacts for identified wetlands at Central Mining Area following mitigation measures

Effect	Vegetation system / ecosystem	Ecological value	Magnitude of indirect effect (prior to mitigation)	Magnitude of indirect effect (after mitigation)	Overall level of effect (after mitigation)
Dewatering/ drainage	Ephemeral wetland	Very High	Low	Low	Low
	Wetland freshwater herbaceous vegetation	Low	Low	Low	Very Low
	Wetland sedgeland	Moderate	Low	Low	Low
Catchment Increase	Ephemeral wetland	Very High	Low	Low	Very Low
	Wetland freshwater herbaceous vegetation	Low	Low	Low	Very Low
	Wetland sedgeland	Moderate	Low	Low	Low
	Ephemeral wetland	Very High	High	Low	Low

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Sedimentation and dust	Wetland freshwater herbaceous vegetation	Low	Moderate	Low	Very Low
	Wetland sedgeland	Moderate	Moderate	Low	Low
Accidental Encroachment	Ephemeral wetland	Very High	High	Low	Low
	Wetland freshwater herbaceous vegetation	Low	Moderate	Low	Low
	Wetland sedgeland	Moderate	Moderate	Low	Low

Table 6-49. Overall level of effect for indirect impacts for identified wetlands at Golden Bar following mitigation measures

Location	Vegetation system / ecosystem	Ecological value	Magnitude of indirect effect (prior to mitigation)	Magnitude of indirect effect (after mitigation)	Overall level of effect (after mitigation)
Dewatering/ drainage	Riparian sedgeland	Moderate	Low	Low	Very Low
	Wetland freshwater herbaceous vegetation	Low	Low	Low	Very Low
	Wetland sedgeland	Moderate	Low	Low	Very Low
Catchment Increase	Riparian sedgeland	Moderate	Low	Low	Low
	Wetland freshwater herbaceous vegetation	Low	Low	Low	Low
	Wetland sedgeland	Moderate	Low	Low	Low
Sedimentation and dust	Riparian sedgeland	Moderate	Moderate	Low	Low
	Wetland freshwater herbaceous vegetation	Low	Low	Low	Low
	Wetland sedgeland	Moderate	Moderate	Low	Low
Accidental Encroachment	Riparian sedgeland	Moderate	Moderate	Low	Low
	Wetland freshwater herbaceous vegetation	Low	Low	Low	Low
	Wetland sedgeland	Moderate	Moderate	Low	Low

Table 6-50. Overall level of effect for indirect impacts for identified wetlands at Golden Bar Haul Road following mitigation measures.

Location	Vegetation system / ecosystem	Ecological value	Magnitude of indirect effect (prior to mitigation)	Magnitude of indirect effect (after mitigation)	Overall level of effect (after mitigation)
Dewatering/ drainage	Ephemeral wetland	High	Low	Low	Low
	Wetland freshwater herbaceous vegetation	Low	Low	Low	Very Low
	Wetland sedgeland	Moderate	Low	Low	Low
Catchment Increase	Ephemeral wetland	High	Low	Low	Low
	Wetland freshwater herbaceous vegetation	Low	Low	Low	Very Low
	Wetland sedgeland	Moderate		Low	Low

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Sedimentation and dust	Ephemeral wetland	High	High	Low	Low
	Wetland freshwater herbaceous vegetation	Low	High	Low	Very Low
	Wetland sedgeland	Moderate	High	Low	Low
Accidental Encroachment	Ephemeral wetland	High	High	Low	Low
	Wetland freshwater herbaceous vegetation	Low	Moderate	Low	Very Low
	Wetland sedgeland	Moderate	Moderate	Low	Low

Overall, the direct level of effect on wetlands is assessed as variable across the Project Area. Most affected wetlands (1.12 ha) have a Low or Very Low level of effect, but a Moderate to Very High level of effect occurs for selected wetlands, (3.60 ha), predominantly ephemeral wetlands. Indirect effects, such as dewatering/drainage has the potential to adversely affect an additional 0.55 ha of wetland extent, culminating in a total 4.72 ha of wetland loss. Sedimentation and accidental encroachment has the potential to adversely affect a cumulative 4.72 ha of wetland extent. These indirect effects are considered to be appropriately minimised through management measures to reduce the level of effect to **Low**. These effects will require management through relevant wetland management measures (indirect effects), and residual effects analysis (direct effects) where residual adverse effects that are more than minor remain.

6.4.6.6 Camp Creek and Coal Creek wetlands

OceanaGold holds a suite of resource consents issued as part of MP3 that authorise the construction, operation and maintenance of a freshwater reservoir within the Camp Creek catchment. The dam has not yet been constructed but remains an available option to provide a constant or seasonally varied water supply downstream to supplement naturally occurring low flows in Deepdell Creek for purposes of maintaining water quality. The consented dam consists of an embankment with an approximate height of 29 m behind which approximately 1.4 million m³ of water can be stored when at full capacity, with a reservoir footprint of approximately 13.7 ha.

In addition to the MP3 resource consents, OceanaGold holds resource consents issued as part of the Coronation Mining Area Project that authorise the construction, operation and maintenance of a freshwater reservoir within the Coal Creek catchment. The dam has not yet been constructed but remains an available option to provide a constant water supply downstream, of approximately 5 litres per second, to supplement naturally occurring low flows in Coal Creek and Mare Burn for purposes of maintaining water quality. The consented dam consists of an embankment with an approximate height of 27 m behind which approximately 670 million litres of water can be stored when at full capacity, with a reservoir footprint of approximately 9.3 ha.

Whilst Camp Creek and Coal Creek reservoir dams have been consented, this does not include consent under the NES-F. Legal and planning investigations into consent requirements concludes vegetation clearance, earthworks, or land disturbance associated with the construction and operation of Coal Creek and Camp Creek Dams requires a new s9 land use consent from the regional council in accordance with Regulation 45D (1)-(3) of the NES-F. This includes vegetation clearance that would occur as an effect of inundation. Whilst OGL seek consent under the NES-F for the alteration (i.e. removal) of natural inland wetlands via inundation, this project component is assessed independently

of MP4 as these are discrete consents and implementation of the two dams are not guaranteed to occur as they are on an “as needed” basis.

6.4.6.7 Actual and Potential Effects

Camp Creek and Coal Creek reservoirs, if implemented, will result in direct effects on wetland ecosystems through alteration of vegetation in the form of inundation. These effects will be realised in three wetland ecosystem types present between both reservoirs. These wetlands included areas of elevated ecological value due to the rarity and localised occurrence of TAR wetland flora.

Within Camp Creek:

- 0.19 ha of freshwater herbaceous wetland; and
- 0.05 ha of sedgeland wetland.

Within Coal Creek:

- 0.21 ha of copper tussock;
- 0.26 ha of sedgeland; and
- 2.49 ha of freshwater herbaceous wetland extent (Whirika, 2026).

6.4.6.8 Direct Effects

The proposed Camp Creek will result in the direct loss of 0.24 ha of generally moderate value wetland extent, whilst Coal Creek will result in the direct loss of 2.96 ha of moderate to high value wetland extent. These wetlands, whilst hosting a suite of TAR plants, generally contained low cover of indigenous vegetation, moderate species richness (up to 13 indigenous species throughout 2.49 ha of wetland) and showed evidence of impacts with exotic weed invasion and stock impacts, including pugging and grazing. Wetland values have been determined based on available vegetation data, and with respect to wetland ecosystem types located within similar areas to Camp Creek and Coal Creek.

Wetland loss will occur through the flooding of Camp and Coal Creek, inundating wetland vegetation, “drowning” the wetland extent. The maximum depth and variable water levels within the majority both dams will prevent the establishment of open water wetland types, such as raupō reedland (WL19), therefore the replacement of wetland extent cannot be achieved within the dams. However, around the shallower edges and gullies feeding into the dams, there is potential for open water wetland vegetation to establish. The proportion of wetland loss in regard to mapped wetland extent within OGL Landholdings and the Macraes ED is presented in Table 6-51.

Table 6-51. Proportion of wetland type impacted at Camp and Coal Creek in relation to the Macraes ED.

Impact	Wetland type	Ecological Value	Area impacted (ha)	Proportion within OGL Landholdings*		Proportion within Macraes ED (%)		Magnitude
				(ha)	(%)	(ha)	(%)	
Camp Creek	Sedgeland	Moderate	0.05	13.24	0.37	135	0.7	Negligible
	Freshwater herbaceous	Moderate	0.19	30.58	0.62	217	0.002	Low
Coal Creek	Sedgeland	Moderate	0.26	13.24	1.96	135	0.9	Low

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	Freshwater herbaceous	High	2.49	30.58	8.14	9.3	0.019	Moderate
	Copper tussock	High	0.21	0.95	22	217	0.002	High
	Total	Moderate to High	3.20	45.66	7	361.3	0.88	Moderate

*minus wetlands reclaimed under proposed MP4 to account for cumulative effects

Cumulatively, Camp and Coal Creek will result in an additional reduction of 2.92% of sedgeland, 8.57% of freshwater, and 50% of copper tussock (WL16) wetland extent on a local scale. The proportion of identified copper tussock wetland within OGL Landholdings is low, at 0.42 ha, however this proportional representation is based on mapped wetland ecosystems derived from classifications undertaken through MP4 wetland assessments. It is likely greater copper tussock extent is present within OGL Landholdings, as supported by the extent mapped within the Macraes ED. However, in lieu of ground-truthing of mapped ecosystem types, this wetland type extent has been conservatively retained as 0.42 ha.

6.4.6.9 Indirect effects

From desktop analysis, no natural inland wetland extent appears to be present immediately downstream, and within 100 m downstream of the dam face. Approximately 0.39 ha of potential natural inland wetlands appear to be present within 100 m of the upper tributaries which drain into Coal Creek. Indirect effects of the proposed reservoirs are primarily related to potential increases in water levels within these tributaries.

Wetland present upstream may potentially experience increases in inundation periods and water levels, with the flow of water reduced due to the damming. This would potentially lead to the creation of more wetland extent as water is held within the gullies and allowing wetland plants to grow, providing water depths do not exceed depths where plants are able to grow. These existing and induced wetlands would likely experience various hydroperiods, dependant upon their placement within the gullies, where permanent, intermittent and ephemeral wetlands may be established. In addition, wetland vegetation would likely establish around the lake edge, creating lacustrine wetland extent.

6.4.6.10 Level of effect

The level of effect has been determined by combining ecological value and magnitude of effect, consistent with the EIANZ EcIA matrix adopted for this assessment (Roper-Lindsay *et al.*, 2018). Under that framework, effects assessed as Moderate or higher generally require further effects management through mitigation, offsetting or compensation, depending on the receptor and the nature of the residual effect.

The assessment below should be read as the level of effect before residual offsetting or compensation, but after taking account of the project design and avoidance already incorporated into the footprint. The highest vegetation-community effects are associated with the modification of Moderate to High value vegetation communities at Camp Creek and Coal Creek.

Table 6-52. Overall level of effect for indirect impacts for identified wetlands at Camp Creek and Coal Creek.

Location	Vegetation system / ecosystem	Ecological value	Magnitude of effect	Level of effect
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Camp Creek	Freshwater herbaceous wetland	Moderate	Low	Low
	Wetland sedgeland	Moderate	Negligible	Very Low
Coal Creek	Freshwater herbaceous wetland	High	Moderate	High
	Wetland sedgeland	Moderate	Low	Low
	Copper tussock	High	High	Moderate
Within 100 m	Undefined, likely freshwater herbaceous	Moderate	Low	Positive

The vegetation-community effects assessed as Moderate or higher are therefore limited to freshwater herbaceous wetlands and Copper Tussock wetlands in Coal Creek

The level of effect on freshwater herbaceous wetland varies by location. It is conservatively Moderate at Camp Creek due to the overall low species assemblage, low area of impact, and low quantity of TAR plants, and the local magnitude is assessed as Low. The level of effect is assessed as High at Coal Creek where the freshwater herbaceous wetland is of Higher value, due to the greater extent and suite of TAR and common indigenous flora, and where the magnitude of effect is Moderate.

Wetlands located within the 100 m buffer, but outside the indicated “lake” areas will likely have a positive level of effect as greater quantity of water would be held within the wetlands, and providing it is at a depth which allows vegetation to grow, reducing dryland plant invasion and increasing the proportion of hydric vegetation. In addition, the wetted edges of the reservoir would likely facilitate the growth of wetland vegetation to induce a lacustrine wetland system.

6.4.6.11 Overall wetland loss

In total, MP4 and Camp and Coal Creek have a total wetland area, including those within the impact area and 100 m buffer, a cumulative 19.03 ha of wetland extent is present. In considering the overall wetland loss from the MP4, seepage capture drains, and Camp Creek and Coal Creek, the loss of a cumulative 11.50 ha of wetland extent (MP4, seepage capture drains and Camp Creek and Coal Creek), ranging from Low to Very High ecological value will occur. This correlates to a loss 20.77% ha of 55.36 ha of mapped wetland extent within OGL Landholdings, including of 11.75% of ephemeral wetland extent (9.70 mapped), and 22.69% of gully wetland (45.66 ha) identified within OGL Landholdings, resulting in an overarching **Moderate** magnitude of effect of total wetland extent. This correlates to a **Low** to **High** level of effect.

Table 6-53. Overall loss of wetland extent lost through MP4 expansion and Camp and Coal Creek (direct and indirect loss), and the overall magnitude of effect and level of effect as it pertains to wetland ecosystem type.

Area	Ephemeral	Sedgeland	Freshwater Herbaceous	Shrubland	Seepage	Copper tussock	Induced wetland	Total
Coronation	0.39 ha	0.54 ha	1.66 ha	0.01 ha	0.02 ha	-	0.35 ha	2.97 ha
Central Mining Area	0.62 ha	0.12 ha	0.03 ha	-	-	-		0.77 ha
Golden Bar/Haul Road	0.13 ha	0.77 ha	0.41 ha	0.02 ha	-	-		1.33 ha
Camp Creek	-	0.05 ha	0.19 ha	-	-	-		0.24 ha
Coal Creek	-	0.26 ha	2.49 ha	-	-	0.21 ha		2.96 ha
Waste Rock Stacks							3.23 ha	3.58 ha
Total	1.14 ha	1.74 ha	4.78 ha	0.03 ha	0.02 ha	0.21 ha	3.58 ha	11.50
Magnitude	High	Moderate	Moderate	High	High	High	Low	Moderate
Level of Effect	Very High	Moderate	High	Moderate	Very High	High	Low	Low to High

7 Summary of effects: Macraes Phase 4

This section provides an overall summary of the ecological effects assessment for MP4. The detailed assessment of ecological values, magnitude of effects, and levels of effect is provided in Sections 4 to 6. The purpose of this section is to consolidate the assessment outcomes and identify the ecological components for which residual adverse effects remain after proposed avoidance, minimisation and remediation measures.

The Project will result in permanent and temporary adverse effects on terrestrial and wetland ecological values through vegetation clearance, wetland reclamation, earthworks, road construction, landform modification, waste rock placement, pit expansion, tailings storage, and associated mine infrastructure. Effects are concentrated within the surface work areas at Coronation Mining Area, the Central Mining Area, Golden Bar Haul Road, and the Golden Bar Mining Area. The Golden Point Underground Extension is predominantly subterranean and is not expected to result in measurable surface habitat loss, while consents enabling the construction of BRWRS are being surrendered.

7.1 Terrestrial ecology

The terrestrial effects assessment identifies adverse effects on indigenous vegetation, TAR plants, invertebrates, lizards, avifauna and associated habitats. Much of the affected area comprises modified habitats, including exotic grassland, mine-disturbed land, roads, pine forest, felled pine forest and rehabilitated mine surfaces. These areas generally have Low or Negligible ecological value, although some provide functional habitat for indigenous fauna.

The principal terrestrial effects relate to the loss and modification of indigenous tussock grassland, shrubland, rock habitat, TAR plant habitat, lizard habitat, and open-country avifauna habitat. These effects are greatest where higher-value indigenous habitats occur within the Project footprint, particularly at Coronation Mining Area and Golden Bar. Proposed avoidance, minimisation and remediation measures include avoidance of BRWRS, final set-out and no-go areas where practicable, construction controls, dust and sediment controls, weed hygiene, ecological supervision, vegetation and threatened plant management, invertebrate management, lizard salvage and relocation, and avifauna breeding management.

A summary of terrestrial ecological effects, proposed avoidance, minimisation and remediation measures, and final levels of effect after those measures is provided in Table 7-1. The final level of effect in Table 7-1 does not include biodiversity offsetting or compensation.

Table 7-1. Summary of terrestrial ecological effects, avoidance, minimisation and remediation measures, and residual level of effect for terrestrial ecological components affected by MP4. The table summarises direct and indirect adverse effects, the unmitigated magnitude and level of effect, proposed avoidance, minimisation and remediation measures, and the residual level of effect after those measures. The residual level of effect does not include biodiversity offsetting or compensation.

Terrestrial ecological component	Ecological value	Direct adverse effects	Indirect adverse effects	Overall Magnitude of effect	Overall Level of effect (unmitigated)	Proposed avoidance, minimisation and remediation measures	Residual level of effect (after avoidance, minimisation and remediation)
Tussock grassland	Very High	Permanent clearance and modification of tussock grassland associated with pit extensions, waste rock storage, road works, backfilling and associated earthworks. Loss includes tussock vegetation structure, indigenous plant cover and terrestrial fauna habitat.	Dust deposition, weed invasion, edge effects, accidental encroachment, altered runoff or soil moisture near retained vegetation, and local changes in exposure and microclimate.	High	Very High	Final works footprint demarcation to avoid spill-over; dust suppression; erosion and sediment controls; weed hygiene and weed control; Direct Vegetation Transfer (DVT), rehabilitation of temporary disturbance areas where practicable.	Very High Residual effects addressed through compensation.
Dry Shrubland	Moderate	Clearance and modification of dry shrubland vegetation within the works footprint, including loss of indigenous shrub structure and associated fauna habitat.	Weed invasion, dust deposition, edge effects, reduced habitat connectivity, increased exposure, accidental encroachment and degradation of retained shrubland margins.	Low	Low	Final works footprint demarcation; no-go areas where practicable; retention of shrubland outside the approved footprint; staged clearance where practicable; weed hygiene and weed control; dust suppression; erosion and sediment controls; rehabilitation of temporary disturbance areas where practicable.	Low Residual effects addressed through compensation.
Rock habitat	Very High	Direct disturbance, burial or removal of localised rock habitat and associated vegetation during earthworks, pit development, waste rock placement or road formation. Loss may include specialised plant habitat and refugia for lizards and invertebrates.	Dust deposition, altered runoff, accidental encroachment, edge effects, increased exposure of retained rock features, disturbance to retained refugia and weed invasion around disturbed margins.	Low	Moderate	Avoidance of retained rock habitat where practicable; works boundary demarcation; no-go areas; pre-clearance ecological checks; careful removal of rock refugia where required; salvage or direct transfer of associated plants and substrate where feasible; dust and access controls; protection of retained rock features adjacent to works.	Moderate Residual effects addressed through compensation.
Threatened, At Risk, Data	Very High	Loss or disturbance of recorded plants and supporting habitat	Dust deposition, weed invasion, altered runoff or soil moisture,	High	Very High	Pre-clearance surveys to identify salvage requirements; demarcation, fencing and	Very High: 6 spp.

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Deficient and locally uncommon terrestrial plants		where individuals occur within the works footprint and cannot be avoided. Effects include removal of small or localised populations and loss of associated seedbank or habitat conditions.	edge effects, accidental encroachment, and degradation of retained habitat or nearby plant records.			no-go areas; vegetation direct transfer; seed collection & propagation; salvage and translocation; recipient-site preparation; weed control; dust suppression; monitoring of transferred or salvaged material.	High: 3 spp. Moderate: 5 spp. Low: 5 spp. Very Low: 5 spp. Residual Effects addressed in part through compensation
Terrestrial invertebrates	High	Loss of tussock, shrubland, wetland-margin, riparian, rock and modified grassland habitats supporting invertebrate communities. Potential mortality during vegetation clearance, soil stripping and excavation.	Habitat fragmentation, reduced local habitat continuity, dust effects on vegetation, weed invasion, altered microhabitat conditions, artificial lighting effects on nocturnal taxa and reduced host-plant availability.	High	Moderate	Invertebrates Management Plan; salvage and relocations; Staged vegetation clearance; vegetation direct transfer; dust and lighting controls; weed management; targeted management for TAR and notable invertebrates.	High Residual effects addressed through compensation
Lizards	High	Loss of tussock grassland, rock habitat, shrubland, dense grass, wetland-margin and modified habitats used by McCann's skink, southern grass skink and kōrero gecko. Potential injury or mortality during vegetation clearance, earthworks and removal of refugia.	Habitat fragmentation, reduced refugia, increased edge exposure, dust effects on vegetation and prey, noise and vibration near retained habitat, increased predation risk along new edges and reduced habitat connectivity.	High	High	Lizard Management Plan; pre-clearance habitat checks; salvage and relocation where required; staged habitat clearance; careful removal of refugia; relocation-site preparation; habitat enhancement at relocation sites; dust and access controls; monitoring of salvage and relocation outcomes.	Moderate to Very high Residual effects addressed through compensation.
Avifauna	Moderate	Loss and modification of open-country, tussock, shrubland, wetland-margin, pond-margin and mine-modified habitats used by indigenous birds. Potential disturbance, displacement or direct effects on nests if works occur during the breeding season.	Noise, vibration, lighting, dust, vehicle movement, habitat fragmentation, reduced habitat availability, increased edge effects and disturbance of retained foraging or nesting habitat.	Moderate	Moderate	Avifauna Management Plan; pre-works checks; seasonal controls where practicable; nest management procedures for ground-nesting and other protected birds; staged clearance; minimisation of disturbance near active nests; dust and lighting controls.	Low Residual effects addressed through compensation.

7.2 Wetland ecology

The wetland effects assessment identifies adverse effects on natural inland wetlands through direct loss, drainage and dewatering, altered catchments, sedimentation, dust deposition, accidental encroachment and potential changes in water quality. Affected wetland types include sedgeland, freshwater herbaceous wetland, seepage wetland, shrubland wetland and ephemeral wetland. These wetland systems are small and scattered across the Project area but include features of elevated ecological value, particularly where ephemeral wetlands and TAR wetland plant species occur.

Proposed avoidance, minimisation and remediation measures include wetland boundary demarcation, hydrology monitoring and adaptive management, sediment and dust controls, water quality controls, wetland plant salvage and propagation where practicable, and management of indirect effects on retained wetlands. These measures reduce the risk of avoidable or indirect effects on retained wetlands, but do not fully address the permanent loss of wetland extent and values within the Project footprint. In total, 4.72 ha of wetland extent is estimated to be lost through the MP4 expansion through direct reclamation and indirect dewatering, 3.58 ha of induced wetland through the diversion of seepage, and a total 3.2 ha of wetland loss via inundation at Camp Creek and Coal Creek will occur, culminating in a total reduction of 11.50 ha, representing 20.77% of wetland extent within OGL Landholdings.

A summary of wetland ecological effects, proposed management measures and overall levels of effect is provided in Table 7-2. The residual effects management package for wetlands is addressed separately in the Residual Effects Analysis Report: Wetland Ecology and associated residual effects management documents.

Table 7-2 Summary of wetland ecological effects, management measures and overall level of effect for wetland and riparian receptors affected by MP4. The table summarises direct and indirect adverse effects, the unmitigated magnitude of effect, proposed avoidance, minimisation and remediation measures, residual effects management, and the overall level of effect after management.

Wetland ecological type	Overall ecological value	Direct adverse effects	Magnitude of direct effect*	Indirect adverse effects	Overall magnitude of indirect effect, unmitigated	Proposed avoidance, minimisation and remediation measures for indirect effects	Overall level of indirect effect after management	Overall level of direct effect (residual adverse effect)
Ephemeral wetland	Very High	Direct reclamation and effective loss of ephemeral wetland extent within the works footprint and 20 m buffer. Loss of naturally uncommon wetland ecosystem values and associated indigenous wetland plant habitat.	High	Potential drainage or dewatering, altered surface-water inputs, altered inundation frequency, sedimentation, dust deposition, weed invasion and accidental encroachment. Ephemeral wetlands are sensitive to changes in wetting and drying cycles.	Low to High	Final footprint demarcation, no-go areas, wetland boundary protection, erosion and sediment controls, dust suppression, hydrology monitoring and adaptive management, weed control, salvage and translocation of viable TAR species and salvage or transfer of wetland soils, seedbank or plant material where practicable.	Low	Moderate to Very High. Direct effects cannot be managed. Residual effects addressed through wetland compensation.
Riparian freshwater herbaceous vegetation	High	Direct loss or modification of riparian herbaceous wetland vegetation located within the works footprint or where wetland function is effectively lost.	Moderate	Potential sedimentation, dust deposition, altered runoff, water-quality effects, weed invasion and edge effects along retained riparian wetland margins.	Low to High	Works boundary demarcation, protection of retained wetland extent and buffers, erosion and sediment controls, dust suppression, runoff management, weed hygiene, weed control, salvage and translocation of viable TAR species, and reinstatement of temporarily disturbed wetland margins where practicable.	Low	High. Direct effects cannot be managed. Residual effects addressed through wetland compensation
Riparian sedgeland	Moderate	Direct loss or modification of riparian sedgeland vegetation within the works footprint or where wetland function is effectively lost.	Moderate	Potential sedimentation, altered runoff, dust deposition, weed invasion, water-quality effects and accidental encroachment.	Low to High	Boundary demarcation, no-go areas where practicable, erosion and sediment controls, dust suppression, weed control, runoff management, salvage and translocation of viable TAR species and reinstatement of disturbed riparian margins where practicable.	Low	Moderate. Direct effects cannot be managed. Residual effects addressed through wetland compensation
Riparian shrubland	Moderate	Direct loss or modification of riparian shrubland or wetland-margin shrub vegetation where	Moderate	Potential edge effects, altered runoff, sedimentation, dust deposition, weed invasion and accidental encroachment.	-	No indirect effects identified	-	Moderate. Direct effects cannot be managed. Residual effects addressed

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		located within the works footprint or 20 m buffer.						through wetland compensation
Wetland freshwater herbaceous vegetation	High	Direct reclamation and loss of freshwater herbaceous wetland extent. Includes loss of wetland vegetation, hydrological function and potential rare wetland plant habitat where present.	Moderate	Potential drainage or dewatering, altered runoff or catchment inputs, sedimentation, dust deposition, weed invasion and water-quality effects on retained wetland areas.	Low to Moderate	Wetland boundary demarcation, fencing or no-go areas where required, erosion and sediment controls, dust suppression, water-quality controls, hydrology monitoring where relevant, weed management, and salvage and translocation of viable TAR species	Low	Low to High. Direct effects cannot be managed. Residual effects addressed through wetland compensation
Wetland sedgeland	Moderate	Direct reclamation and loss or modification of sedgeland wetland extent within the works footprint or 20 m buffer.	Moderate	Potential drainage or dewatering, sedimentation, dust deposition, altered runoff, weed invasion, water-quality effects and accidental encroachment.	Low to High	Wetland demarcation, fencing or no-go areas where required, erosion and sediment controls, dust suppression, hydrology monitoring where relevant, weed control, salvage and translocation of viable TAR species and reinstatement of disturbed margins where practicable.	Low	Low to Moderate. Direct effects cannot be managed. Residual effects addressed through wetland compensation
Wetland seepage	High	Direct loss of small seepage wetland extent within the works footprint. Loss of seepage-fed wetland vegetation and associated wetland function.	High	Potential drainage or dewatering, altered shallow groundwater inputs, sedimentation, dust deposition, weed invasion and water-quality effects.	-	No indirect effects identified	-	Very High. Direct effects cannot be managed. Residual effects addressed through wetland compensation.
Wetland shrubland	Moderate	Direct loss or modification of small wetland shrubland extent and associated wetland-margin vegetation.	Moderate	Potential edge effects, altered runoff, sedimentation, dust deposition, weed invasion, water-quality effects and accidental encroachment.	-	No indirect effects identified	-	Moderate. Direct effects cannot be managed. Residual effects addressed through wetland compensation
Copper tussock	High	Direct reclamation and loss of copper tussock wetland extent.	High	Potential edge effects, altered runoff, sedimentation, dust deposition, weed invasion, water-quality effects and accidental encroachment.	High	Wetland demarcation, fencing or no-go areas where required, erosion and sediment controls, dust suppression, hydrology monitoring where relevant, weed control, salvage and translocation of viable TAR species and reinstatement of disturbed margins where practicable.	Low	Very High. Direct effects cannot be managed. Residual effects addressed through wetland compensation.

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*Direct impacts on wetlands cannot be avoided, minimised or mitigated as the direct impact will result in the loss of wetland extent and values

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Applicability and Limitations

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of Oceana Gold (New Zealand) Limited as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk. Babbage/Bioresearches acknowledges that this report will be relied on by a Panel appointed under the Fast Track Approvals Act 2024 and these disclaimers do not prevent that reliance.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts. Do not scale any of the maps, plans or figures in this report. Any information shown here on maps, plans and figures should be independently verified on site before taking any action. Sources for map and plan compositions include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Babbage Consultants Limited.

Reliability of Investigation

Babbage/ Bioresearches has performed the services for this project in accordance with the standard agreement for consulting services and current professional standards for environmental site assessment. No guarantees are either expressed or implied.

APPENDIX A

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 matters, 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 B

TAONGA/TAOKA SPECIES IDENTIFIED IN THE PROJECT AREA

Table 0-1. Schedule 97 taoka bird species recorded in the MP4 EcIA and Avifauna Values Assessment.

Species	Scientific name used in MP4 assessment	National threat status	Regional threat status
Kārearea / eastern falcon	<i>Falco novaeseelandiae</i>	Threatened – Nationally Vulnerable	Threatened – Regionally Vulnerable
Pīhoihoi / New Zealand pipit	<i>Anthus novaeseelandiae</i>	At Risk – Declining	Regionally Not Threatened
Kōau / black shag	<i>Phalacrocorax carbo</i>	At Risk – Relict	Threatened – Regionally Endangered
Karoro / southern black-backed gull	<i>Larus dominicanus</i>	Not Threatened	Regionally Not Threatened
Kāhu / swamp harrier	<i>Circus approximans</i>	Not Threatened	Regionally Not Threatened
Pūtakitaki / paradise shelduck	<i>Tadorna variegata</i>	Not Threatened	Regionally Not Threatened
Riroriro / grey warbler	<i>Gerygone igata</i>	Not Threatened	Regionally Not Threatened
Pīwakawaka / South Island fantail	<i>Rhipidura fuliginosa</i>	Not Threatened	Regionally Not Threatened
Poaka / pied stilt	<i>Himantopus leucocephalus</i>	Not Threatened	Regionally Not Threatened
Kuruwhengu / Kuruwhengi / Australasian shoveler	<i>Spatula rhynchotis</i>	Not Threatened	Regionally Not Threatened
Kūkupa / Kererū / New Zealand pigeon	<i>Hemiphaga novaeseelandiae</i>	Not Threatened	Regionally Not Threatened
Pākura / Pūkeko	<i>Porphyrio melanotus</i>	Not Threatened	Regionally Not Threatened
Kōtare / sacred kingfisher	<i>Todiramphus sanctus</i>	Not Threatened	Regionally Not Threatened
Tete / grey teal	<i>Anas gracilis</i>	Not Threatened	Regionally Not Threatened
Tūī	<i>Prosthemadera novaeseelandiae</i>	Not Threatened	Regionally Not Threatened
Ruru koukou / morepork	<i>Ninox novaeseelandiae</i>	Not Threatened	Threatened – Regionally Vulnerable

Table 0-2. Schedule 97 taoka plant species recorded in the MP4 project area.

Species	Scientific name	National threat status	Regional threat status
Aruhe / bracken	<i>Pteridium esculentum</i>	Not Threatened	Regionally Not Threatened
Kōwahi / kōwhai	<i>Sophora microphylla</i>	Not Threatened	Regionally Not Threatened
Pātōtara / dwarf mingimingi	<i>Leucopogon fraseri complex</i>	Not Threatened	Regionally Not Threatened
Taramea / golden speargrass	<i>Aciphylla aurea</i>	Not Threatened	Regionally Not Threatened
Taramea / narrow-leaved speargrass	<i>Aciphylla subflabellata</i>	At Risk – Declining	Threatened – Regionally Vulnerable
Toetoe	<i>Austroderia richardii</i>	Not Threatened	Regionally Not Threatened
Wharariki / mountain flax	<i>Phormium cookianum subsp. cookianum</i>	Not Threatened	Regionally Not Threatened
Wī / silver tussock	<i>Poa cita</i>	Not Threatened	Regionally Not Threatened
Wīwī / Edgar's rush	<i>Juncus edgariae</i>	Not Threatened	Regionally Not Threatened
Wīwī / two-storey rush	<i>Juncus distegus</i>	Not Threatened	At Risk – Regionally Declining

APPENDIX C

LIZARD SPECIES POPULATION AND SUITABLE HABITAT ESTIMATES AT LOCAL AND ECOLOGICAL DISTRICT SCALES

Conservative estimates of the extents of suitable lizard habitat at the local (OGNZL landholdings) and Macraes Ecological District scales.

Species	Local extent (ha)	Extent of local suitable habitat (10%)	Macraes ED extent (ha)	Extent of suitable habitat in Macraes ED (10%)
McCann's skink/ Southern grass skinks, Kōrero gecko	13,063	1,306	113,818	11,382

Conservative estimate of population sizes for each lizard species at the local (OGNZL landholdings) and Macraes Ecological District scales.

Species	Estimated density (Lizard Values report)	10% of Local extent (13,063 ha)	Local population estimate	10% Macraes ED extent (113,818 ha)	Macraes ED population estimate
McCann's skink	1,107	1,306 ha	1,446,074	11,382	12,599,874
Southern grass skink	626	1,306 ha	817,556	11,382	7,125,132
Kōrero gecko	50	1,306 ha	65,300	11,382	569,100

APPENDIX D

CAPTURE SEEPAGE DRAIN WETLAND VALUES ASSESSMENT.

Methodology

Putative wetlands located along the toe of waste rock stacks at Coronation North, were assessed via desktop review. Wetlands located along Frasers WRS were assessed via site assessment and, noting the timing of the field survey was outside the Otago wetland growing season. Wetlands associated with the WRS's are to be assessed within the Otago growing season during the Spring 2026 field surveys.

This values assessment generally follows the EclA Guidelines for use in New Zealand published by the Environmental Institute of Australia and New Zealand (EIANZ) (Roper-Lindsay et al., 2018). The EclA Guidelines provide a standardised matrix framework that allows ecological effects assessments to be clear, transparent, and consistent. The EclAG framework is generally used in Ecological Impact Assessments in New Zealand as good practice.

Coronation

Alongside Coronation North WRS, 0.35 ha of wetland extent was mapped and identified on high-level site verification. Wetland extents were mapped changes to vegetation cover on aerial images and location to mapped rivers and waterways. In total, four putative wetlands were identified, ranging between 0.03 ha to 0.23 ha in size. These wetlands are considered to be induced, as prior to the construction of the WRS, overland flow paths were present, however the degree of wetland features appears to be minimal.



Figure 7. Wetlands identified adjacent to Coronation North WRS

The wetlands do not contain buffering vegetation, are open to stock access and/or mining disturbances. Given their induced nature, location at the headwaters and being hydrologically

supported by WRS seepage which is generally of poor quality, these wetlands are predicted to be predominantly exotic dominant, likely with jointed rush (*Juncus articulatus*), creeping bent (*Agrostis stolonifera*), and potentially blue-green sweet grass (*Glyceria declinata*), if they are wetlands. The wetlands are considered unlikely to support TAR flora or fauna species due to their induced, and likely degraded nature, however this will be confirmed during the spring surveys. Based on desktop assessment and field verification, the wetlands were considered to be of **Low** ecological value as they are likely to consist of exotic dominant vegetation with limited ecological function.

Frasers

Alongside Frasers WRS, 4.6 ha of wetland extent has been identified via aerial mapping, located within 100 m of the WRS. These wetlands consist of a combination of natural and induced wetlands which have formed around constructed waterbodies. Review of historic aerial images reveals 0.45 ha of identified wetland extent is associated with the Frasers Dredge Ponds and cut-off drain. As these wetlands have formed in and around a constructed body of water, they are excluded from the natural inland wetland definitions.

Of the natural inland wetland extent identified (cumulative 4.15 ha), 0.97 ha of wetland extent can be observed within upper tributaries and flow paths of the Waikouaiti North Branch, prior or shortly after the construction of the WRS. These wetlands have been classified as natural wetlands which would be hydrologically supported by overland flows and groundwater interaction, with some contribution from the seepage. Approximately 3.23 ha of wetland extent has been induced by the escaping seepage from the WRS. These wetland extents are absent on historic aerial images, with their overall extent increasing over time as great seepage volumes emerge from the WRS.



Figure 0.8. Wetlands identified adjacent to Frasers WRS

The natural wetlands identified from desktop investigations range between 0.02 ha to 0.54 ha in size. At the time of assessment, water was present within the wetlands at variable depth. These wetlands were predominantly exotic dominant (>70%), with soft rush (*Juncus effusus*), jointed rush (*Juncus articulatus*), creeping bent (*Agrostis stolonifera*), knee foxtail (*Alopecurus geniculatus*) and blue sweet grass (*Glyceria declinata*), with some indigenous vegetation present, such as pūrei (*Carex secta*), wiwi (*Juncus edgariae*), copper tussock (*Chionochloa rubra* subsp. *cuprea*), and sparse TAR plants *Juncus distigeus* and *Shawia bullata*. The wetlands showed impacts from mammalian browsing, including grazed vegetation and extensive pugging.

The natural wetlands were considered to be of **Low** ecological value. These wetlands were primarily dominated by exotic vegetation with limited indigenous cover, however sparse TAR plants are present. These wetlands have been impacted through land use practices, including mammalian browsing and access, and shallow groundwater seepage emerging from the WRS.

The induced wetlands range between 0.02 ha to 1.2 ha in size. These induced wetlands contain highly silty, sludge substrates throughout with a predominantly exotic vegetation cover, including creeping bent, marsh foxtail, jointed rush and soft rush. Occasional channels flowing through. This wetland is not visible on aerial images prior to Fraser's WRS being constructed, with the emerging seepage from the WRS inducing a poor-quality wetland.

The induced wetland was considered to be of **Negligible** ecological value, due to its sludge-like substrate, exotic dominant vegetation cover, lack of buffering vegetation and, lack of ecological service it provides.

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