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MP4 Fast-track, Macraes

Invertebrate Management & Monitoring Plan

for: OceanaGold New Zealand Limited

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Cover Illustration: *Hemiandrus maia*, Murphys Link, Macraes. Image by D. van Winkel.

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Executive summary

This Invertebrate Management and Monitoring Plan (IMMP) has been prepared by Bioresearches (Babbage Consultants) for OceanaGold New Zealand Limited (OGNZL) to guide the management of native invertebrates affected by the Macraes Phase 4 (MP4) Fast-track Project. The MP4 Project comprises multiple mine development stages over approximately ten years, with the first stage scheduled to begin in late 2027.

Field surveys conducted between 2022 and 2026 recorded a diverse indigenous invertebrate fauna across the project area, including 16 species of conservation interest classified as 'Threatened', 'At Risk', or 'Data Deficient' under the New Zealand Threat Classification System. The highest invertebrate values are associated with tussock grasslands and schist outcrop complexes. The MP4 Project will directly affect approximately 325 ha of suitable invertebrate habitat, with a further 197 ha potentially subject to indirect effects from construction and operational activities.

To avoid, minimise, and mitigate these effects, the IMMP sets out a salvage and relocation programme for invertebrates, as well management of specific larval host plants. Management measures will be applied in a staged manner both ahead of and during vegetation clearance and earthworks.

Salvaged invertebrates will be relocated to sites that closely match the habitat and host-plant characteristics of the affected areas, with host plants themselves salvaged and relocated alongside associated invertebrates. Post-relocation management includes weed control, grazing protection, and replacement planting to support host plant establishment, supplemented by predator control carried out under related fauna management plans.

Invertebrate monitoring to assess the continued presence of notable species at relocation sites, alongside monitoring of host plant survival and habitat condition will be undertaken. Findings will be reported annually to OGNZL and relevant stakeholders and will feed into adaptive management of relocation sites over time.

While the MP4 Project will result in unavoidable adverse effects on indigenous invertebrates, the IMMP outlines mitigation and monitoring measures that are expected to reduce potential adverse effects on invertebrates and maintain the viability and generate broader benefits for local populations of invertebrates over time.

1 Introduction

This Invertebrate Management & Monitoring Plan (IMMP) has been developed in response to the adverse effects on invertebrates identified in the Invertebrate Values Assessment (E3) and Ecological Impact Assessment (E7) (Bioresearches 2026b; f) (Table 2.1).

The purpose of this IMP is to describe the methods and management measures that will be implemented to avoid, minimise, and mitigate, as far as practicable, adverse effects on native invertebrates arising from the MP4 Project. In doing so, it addresses the requirements of Schedule 7 of the FTAA, including the requirement to describe "the methods to be used to safely, efficiently, and humanely catch, hold, or kill the animals and identify relevant animal ethics processes."

2 Purpose and scope of the IMMP

This IMMP is a project-specific plan prepared to identify and guide actions required to manage invertebrates and their habitats prior to and during disturbance or clearance of land as part of the MP4 Project. Few invertebrates, none of which occur in the Project footprint, are protected under law in New Zealand. Thus, this IMP aims to reduce the severity of effects on invertebrates and provides a means of mitigating effects on 'Threatened', 'At Risk', 'Data Deficient', and other notable species of invertebrate.

This IMMP has been developed to:

- Clearly document and describe the objectives, strategy, and actions that OGNZL will take to avoid, minimise, and mitigate adverse effects on both individual and populations of invertebrates arising from the MP4 Project.

Objectives of the IMMP include:

- Detail the actions to be followed by OGNZL to avoid and/ or minimise adverse effects of mining activities on invertebrates occurring in the MP4 Project impact area;
- Ensure as far as practicable, that the management of invertebrates during the pre-mining, operation, and post-mining phases of the mine complies with any consent conditions imposed;
- Identify the methodologies that will be used to salvage and relocate invertebrates from affected areas to suitably protected and enhanced sites;
- Identify and implement measures to enhance populations of invertebrate species in protected areas outside of the project impact areas (e.g., mitigation sites);
- Outline habitat enhancement measures relevant to invertebrates to be carried out at mitigation sites; and
- Identify and describe monitoring and reporting that will be undertaken to assess progress against the objectives of the IMMP.

Table 2.1. 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	Wetlands and TAR wetland plants	Bioresearches (2026h)
E10	Invertebrate Management & Monitoring Plan		Bioresearches (2026i)
E11	Lizard Management & Monitoring Plan		Bioresearches (2026j)
E12	Avifauna Management & Monitoring Plan		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)

2.1 Responsibilities and competencies

The roles and responsibilities for implementation of the IMMP are set out as follows. OGNZL hold overall accountability, and the Macraes environmental team and nominated project manager will be responsible for implementation and compliance with the IMMP, and any conditions listed as part of a resource consent issued to OGNZL.

The project ecologist (Dylan van Winkel) takes the technical lead and will liaise with the other roles through OGNZL's Project Manager. Supporting ecologists and/ or sub-contractors that will contribute to the IMMP protocols required before, during, and after mine development will act under the supervision of the lead project ecologist.

2.2 Mana whenua and stakeholder engagement

OGNZL is committed to engaging with Rūnaka in parallel with the processing of this application. A Process Agreement is in place supporting engagement between Rūnaka and OGNZL. Thus, it is reasonable to expect that Rūnaka will work with OGNZL to provide comments and suggestions on the IMMP.

OGNZL recognise the importance of mana whenua engagement in all aspects of ecological management as part of MP4 Project and are actively pursuing further engagement with mana whenua directly.

2.3 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.

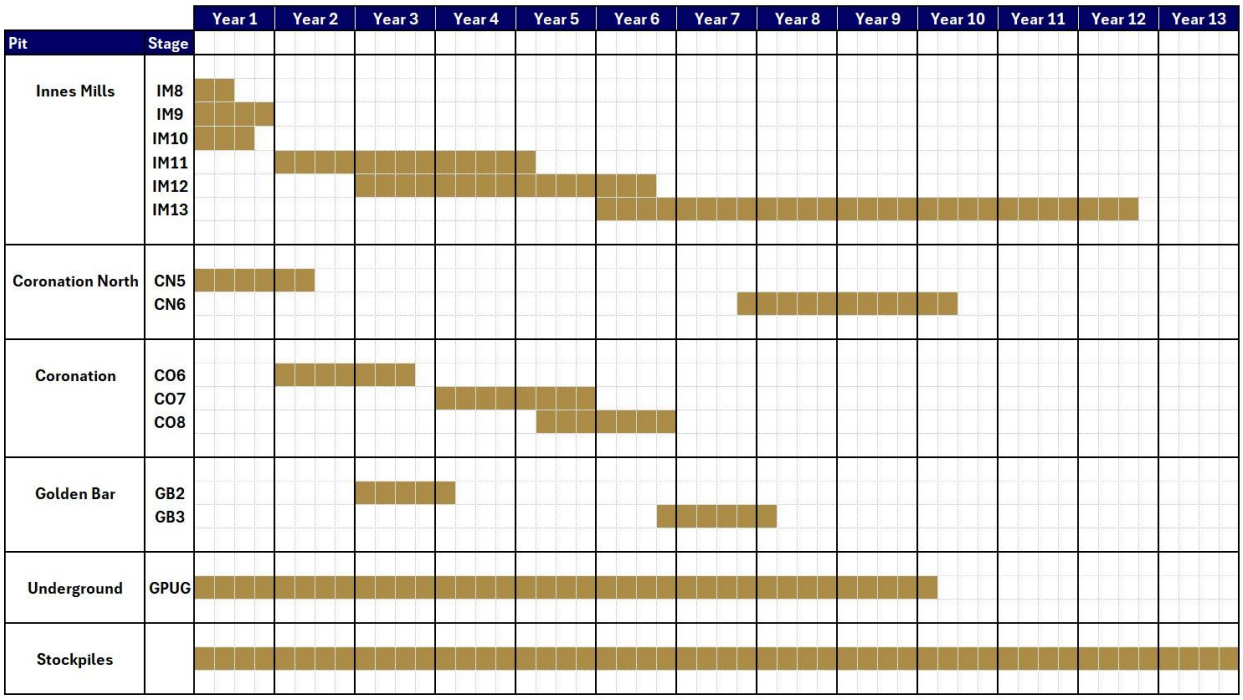
The activities described herein are expected to be generally sequenced as follows:

- 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 Year1 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 2.2 shows the anticipated sequencing of the proposed MP4 activities across the life of the project.

Table 2.2. Anticipated sequencing of MP4 activities



3 Summary of invertebrate values and effects assessment

This section provides a brief summary of the invertebrate values and effects associated with MP4, to recap the reader ahead of the remainder of this Invertebrate Management and Monitoring Plan. It should not be relied upon as the values and effects assessment in its own right. Comprehensive detail on invertebrate values, potential effects, and residual effects is provided in the Assessment of Invertebrate Values (Bioresearches 2026i), the Ecological Impact Assessment (Bioresearches 2026f), and the Residual Effects Analysis: Terrestrial Ecology (Bioresearches 2026l), respectively, and readers should refer to these documents for the full assessment.

3.1 Invertebrate values

The MP4 Project area supports indigenous terrestrial invertebrate communities representative of the Macraes Ecological District, with suitable habitat occurring across tussock grasslands, indigenous shrublands, schist outcrops, riparian margins, wetlands, and gully systems. These habitats provide resources for a diverse range of native invertebrate taxa and contribute to the maintenance of ecological connectivity across the wider Macraes landscape.

Field surveys undertaken between 2022 and 2026, supplemented by desktop assessments and eDNA investigations, confirmed the presence of a diverse terrestrial invertebrate fauna. Surveys recorded a range of taxonomic groups including Lepidoptera, Coleoptera, Araneae, Hemiptera, Orthoptera, Trichoptera, and Plecoptera. Seventeen species of conservation interest were recorded, including several moth species classified as ‘Threatened’, ‘At Risk’, or ‘Data Deficient’ under the New Zealand Threat Classification System (Townsend *et al*. 2008; Rolfe *et al.* 2022) (Figure 3.1).

The highest invertebrate values are associated with areas containing extensive indigenous habitat, particularly tussock grasslands and schist outcrop complexes that support conservation-significant species and diverse native invertebrate assemblages. Several project areas met ecological significance criteria under the National Policy Statement for Indigenous Biodiversity (NPS-IB), the Otago Regional Policy Statement (ORPS), and the Waitaki District Plan based on the presence of quality invertebrate habitat and ‘Threatened’ or ‘At Risk–Declining’ species.

Overall, the MP4 Project area contains invertebrate values of local to regional importance, including habitat for several conservation-significant species. While the area does not support nationally exceptional concentrations of threatened invertebrates, it contributes to the persistence of indigenous invertebrate communities and conservation-priority species within the wider Macraes landscape.

3.2 Effects on invertebrates

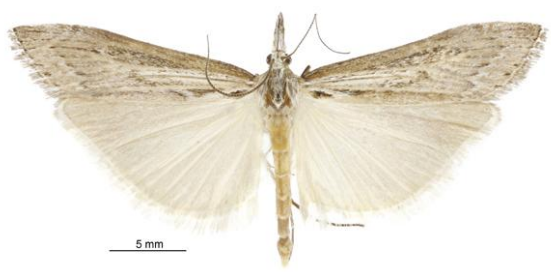
The MP4 Project will result in direct and indirect adverse effects on invertebrates through the loss, modification, degradation, and fragmentation of habitat associated with vegetation clearance, earthworks, road construction, and mining activities. Approximately 325 ha of suitable invertebrate habitat will be directly affected, with indirect effects potentially extending across a further 197 ha of adjacent habitat.

Direct effects include habitat loss, disturbance, displacement, and the injury or mortality of invertebrates during preparatory, construction, and operational activities. Indirect effects may arise

from noise, vibration, dust deposition, edge effects, and the spread of invasive species, which may reduce habitat quality in areas surrounding the Project footprint.

Many of the species recorded in the MP4 Project footprint are poorly known and some—e.g., those with specific host plant associations—are likely to be more sensitive to habitat loss and modification than other more generalist species. The potential effects of the MP4 Project on these notable species require specific consideration and management through the implementation of targeted avoidance and mitigation measures. Accordingly, a range of management measures will be implemented, including pre-clearance surveys, staged vegetation clearance, invertebrate salvage and relocation, host plant salvage and relocation, and habitat enhancement and habitat protection. Table 3.1 presents the proposed mitigation measures for each of the notable invertebrates identified in the MP4 Project footprint. The measures are intended to provide protective benefits for affected invertebrates and support the persistence of local populations.

Overall, while the MP4 Project will result in unavoidable adverse effects on indigenous invertebrates. However, the combination of mitigation, compensation, and long-term management measures are expected to maintain the viability of local populations and deliver enduring biodiversity benefits beyond the Project footprint.



Orocrambus sophistes (male) (©Landcare Research)

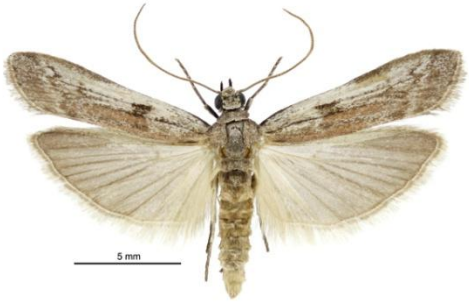
Agrotis admirationis (female). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.

Asaphodes recta (male). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.

Dasyuris partheniata (female). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.

Nyctemera annulata © Auckland War Memorial Museum.

Orthodera novaezealandiae (female). Image by B. McQuillan.



Patagoniodes farinaria (male). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.

Samana acutata (male). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.

Theoxena scissaria (male). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.

Bityla sericea (male). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.

Wiseana fuliginea (male). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.

Wiseana mimica (female). Image by Birgit E. Rhode, Landcare Research New Zealand Ltd.

Hemiandrus maia (female). Image by D. van Winkel.

Mecodema sp. "Oamaru." Image by D. van Winkel.

Figure 3.1. 'Threatened', 'At Risk', 'Data Deficient', and other notable species recorded on OGNZL landholdings between 24 February and 4 April 2026. No images available for *Pasiphila* sp. A (NZAC 04285480 "Carmichaelia"), *Zelandobius uniramus*, nor *Orocrambus* cf. *cyclopicus*.

Table 3.1. Summary of the effects management measures proposed for terrestrial invertebrates (project wide community), and 'Threatened', 'At Risk', 'Data Deficient', and other notable invertebrates present in the MP4 Project area.

Species	National threat listing (NZTCS)	Effects management measures
Invertebrate community (Project wide)	-	• Salvage, using moth traps, and relocation of flighted adults. • Salvage of terrestrial species using pitfall traps, Gee's minnow traps, hand-searches, and ACOs. • Salvage of host plants (*Chionochloa rigida* subsp. *rigida*) and larvae associated with these plants and relocation to nearby protected areas (e.g., Murphys Link, MEEA fence, My Highlay Station). • Replanting host plants (*Chionochloa rigida* subsp. *rigida*) in the 175 ha tussock planting area at Mt Highlay Station and Cranky Jims Link. • Salvage and relocation of host plants (*Carmichaelia crassicaulis* subsp. *crassicaulis*; *Carmichaelia petriei*; *Carmichaelia corrugata*, *Carmichaelia kirkii*) and larvae associated with these plants. Salvaged plants to be relocated to Murphys Link, the MEEA fence, and/ or Cranky Jims Link. • Replanting host plants (*Carmichaelia crassicaulis* subsp. *crassicaulis; Carmichaelia corrugata*, *Carmichaelia petriei*) as part of the 50 ha of shrubland and 175 ha of tussock enhancement planting at Cranky Jims Link and Mt Highlay Station, respectively. • Salvage and relocation of host plants (*Senecio glomeratus Poir. subsp. glomeratus, Ranunculus* spp.) and larvae associated with these plants. *Senecio glomeratus* Poir. subsp. *glomeratus* growing in the Central Mining Area is

Species	National threat listing (NZTCS)	Effects management measures
		proposed to be vegetation direct transferred (VDT) to the Mt Highlay Station (see vegetation management report), which will result in the relocation of *Asaphodes recta* larvae. • Replanting host plants (*Senecio dunedinensis*) in tor buffer planting areas in (e.g., MEEA, Mt Highlay Station) and *Ranunculus amphitrichus* and *R. ternatifolius* in ephemeral wetland protection areas. • Salvage and relocation of host plants (*Aciphylla subflabellata*) and larvae associated with these plants. Plants to be relocated to nearby protected areas (e.g., Murphys Link, MEEA fence, My Highlay Station). • Replanting host plants (*Aciphylla subflabellata*) 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 Link, and 252 ha of habitat within the predator-exclusion fence at MEEA. • Anticipated benefits from 0.17 ha of protected ephemeral wetland at Murphys Link. • 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 Link, and 252 ha of habitat within the predator-exclusion fence at MEEA. • Anticipated benefits from stream habitat protection within the 268 ha Murphys Link and 252 ha predator-exclusion fence at MEEA.
Orocrambus sophistes	Threatened – Nationally Vulnerable	• Salvage, using moth traps, and relocation of flighted adults. • Salvage of host plants (*Chionochloa rigida* subsp. *rigida*) and larvae associated with these plants and relocation to nearby protected areas (e.g., Murphys Link, MEEA fence, My Highlay Station). • Replanting host plants (*Chionochloa rigida* subsp. *rigida*) 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 Link and 252 ha of habitat within the predator-exclusion fence at MEEA.

Species	National threat listing (NZTCS)	Effects management measures
Agrotis admirationis	At Risk – Declining	• 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 Link and 252 ha of habitat within the predator-exclusion fence at MEEA.
Asaphodes recta	At Risk – Declining	• Salvage, using moth traps, and relocation of flighted adults. • Salvage and relocation of host plants (*Senecio glomeratus Poir. subsp. glomeratus, Ranunculus* spp.) and larvae associated with these plants. *Senecio glomeratus* Poir. subsp. *glomeratus* 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 *Asaphodes recta* larvae. • Replanting host plants (*Senecio dunedinensis*) in tor buffer planting areas in (e.g., MEEA, Mt Highlay Station) and *Ranunculus amphitrichus* and *R. ternatifolius* in ephemeral wetland protection areas. • Other hosts plants such as *Bellis* 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 Link.
Dasyuris partheniata	At Risk – Declining	• Salvage, using moth traps, and relocation of flighted adults. • Salvage and relocation of host plants (*Aciphylla subflabellata*) and larvae associated with these plants. Plants to be relocated to nearby protected areas (e.g., Murphys Link, MEEA fence, My Highlay Station). • Replanting host plants (*Aciphylla subflabellata*) 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 Link, and 252 ha of habitat within the predator-exclusion fence at MEEA.

Species	National threat listing (NZTCS)	Effects management measures
Nyctemera annulata	At Risk – Declining	• Salvage, using moth traps, and relocation of flighted adults. • Salvage and relocation of host plants (*Senecio* spp.) and larvae associated with these plants. Salvaged *Senecio* spp. to be relocated to nearby protected areas (e.g., Murphys Link, MEEA fence, My Highlay Station). • Replanting host plants (*Senecio dunedinensis*) within Murphys Link 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 Link, MEEA fence, Cranky Jims Link, Mt Highlay Station).
Orthodera novaezealandiae	At Risk – Declining	• 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 Link, and 252 ha of habitat within the predator-exclusion fence at MEEA.
Pasiphila sp. A (NZAC 04285480 "Carmichaelia")	At Risk – Declining	• Salvage, using moth traps, and relocation of flighted adults. • Salvage and relocation of host plants (*Carmichaelia crassicaulis* subsp. *crassicaulis*; *Carmichaelia petriei*; *Carmichaelia corrugata*, *Carmichaelia kirkii*) and larvae associated with these plants. Salvaged plants to be relocated to Murphys Link, the MEEA fence, and/ or Cranky Jims Link. • Replanting host plants (*Carmichaelia crassicaulis* subsp. *crassicaulis; Carmichaelia corrugata*, *Carmichaelia petriei*) 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 Link and 252 ha of habitat within the predator-exclusion fence at MEEA.

Species	National threat listing (NZTCS)	Effects management measures
Patagoniodes farinaria	At Risk – Declining	• 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 Link and 252 ha of habitat within the predator-exclusion fence at MEEA.
Samana acutata	At Risk – Declining	• Salvage, using moth traps, and relocation of flighted adults. • Salvage and relocation of host plants (*Carmichaelia crassicaulis* subsp. *crassicaulis*; *Carmichaelia petriei*; *Carmichaelia corrugata*, *Carmichaelia kirkii*) and larvae associated with these plants. Salvaged plants to be relocated to Murphys Link, the MEEA fence, and/ or Cranky Jims Link. • Replanting host plants (*Carmichaelia crassicaulis* subsp. *crassicaulis; Carmichaelia corrugata*, *Carmichaelia petriei*) 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 Link and 252 ha of habitat within the predator-exclusion fence at MEEA.
Theoxena scissaria	At Risk – Declining	• Salvage, using moth traps, and relocation of flighted adults. • Salvage and relocation of host plants (*Carmichaelia crassicaulis* subsp. *crassicaulis*; *Carmichaelia petriei*; *Carmichaelia corrugata*, *Carmichaelia kirkii*), as well as larvae and flightless females associated with these plants. Salvaged plants to be relocated to Murphys Link, the MEEA fence, and/ or Cranky Jims Link. • Replanting host plants (*Carmichaelia crassicaulis* subsp. *crassicaulis; Carmichaelia corrugata*, *Carmichaelia petriei*) 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 Link and 252 ha of habitat within the predator-exclusion fence at MEEA.

Species	National threat listing (NZTCS)	Effects management measures
Bityla sericea	At Risk – Uncommon	• Salvage, using moth traps, and relocation of flighted adults. • Host plant thought to be *Muehlenbeckia*, which is abundant in the surrounding landscape and will not be salvaged or relocated. • Replanting host plants (*Muehlenbeckia*) 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 Link and 252 ha of habitat within the predator-exclusion fence at MEEA, both areas of which support *Muehlenbeckia* host plants.
Wiseana fuliginea	Data Deficient	• 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.
Wiseana mimica	Data Deficient	• 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.
Zelandobius uniramus	Data Deficient	• 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 Link and 252 ha predator-exclusion fence at MEEA.

Species	National threat listing (NZTCS)	Effects management measures
Hemiandrus maia	Not Threatened	• 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 Link, 50 ha of Cranky Jims Link, and 252 ha predator-exclusion fence at MEEA.
Mecodema sp. "Oamaru"	Not listed	• 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 Link, 50 ha of Cranky Jims Link, and 252 ha predator-exclusion fence at MEEA.
Orocrambus cf. *cyclopicus*	Not listed	• Salvage, using moth traps, and relocation of flighted adults. • Salvage and relocation of host plants (*Chionochloa rigida* subsp. *rigida*) and larvae associated with these plants. • Replanting host plants (*Chionochloa rigida* subsp. *rigida*) 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 Link, and 252 ha of habitat within the predator-exclusion fence at MEEA.

• Moderate value, based on the presence of species assumed to be locally uncommon at the Ecological District scale.

4 Invertebrate salvage and relocation strategy

The salvage and relocation programme will implement reasonable and practicable measures to avoid, minimise, and mitigate adverse effects on native invertebrates. The programme aims to reduce injury and mortality as far as practicable before, during, and following project-related disturbance. Post-relocation management and monitoring will focus on maximising the likelihood of successful establishment of relocated invertebrates and maintaining suitable habitat conditions through habitat protection, enhancement, and long-term management. These measures are intended to provide enduring conservation benefits for both relocated populations and resident invertebrate communities at managed relocation sites.

Although invertebrate salvage and relocation programmes have been undertaken relatively infrequently in New Zealand, there is precedent for such management at the Macraes Operation. Previous invertebrate salvage and relocation programmes were successfully implemented as part of the Coronation North Stage 5 (CN5) and Continuity Consents Project Stage 2 (CCP2) developments (Bioresearches 2025; Bioresearches 2026q, 2026r), providing valuable experience to inform the MP4 programme.

The programme will primarily target the 17 notable invertebrate species known to occur within the MP4 impact footprint (Table 3.1). However, the largely non-selective nature of the proposed capture methods means that a much broader range of indigenous invertebrate species is expected to benefit from the programme. A combination of established survey and capture techniques, including artificial cover objects (ACOs), pitfall traps, systematic hand searching, and host plant management, will be used alongside more novel methods such as Gee's minnow funnel traps and targeted destructive searches—both of which have proven successful for capturing invertebrates in previous salvage operations (e.g., CN5 and CCP2).

Additionally, habitat management measures such as vegetation direct transfer (VDT) and larval host plant relocations (and associated invertebrate eggs, larvae, pupae, or other life stages) will be undertaken to reduce direct mortality associated with vegetation clearance and potentially facilitate the establishment or reinforcement of populations within recipient habitats and improve the likelihood of population persistence at relocation sites.

Together, these techniques are designed to maximise the recovery of invertebrates from impact areas and facilitate their successful relocation to suitable habitat.

4.1 Uncertainty associated with invertebrate management

It is recognised that there is inherent uncertainty in applying some of the invertebrate management measures described in this IMMP. While there is precedent for invertebrate salvage and relocation at the Macraes Operation (as described above), other practices such as vegetation direct transfer (VDT) and host plant relocation specifically for the benefit of invertebrates are more experimental in nature. That is, they can in theory work to reduce potential effects, but the expected benefits (e.g., post-

release survival of invertebrates, contributions to wider invertebrate populations) are largely unable to be quantified.

Vegetation direct transfer has been used successfully for ecosystem rehabilitation at Stockton Mine, West Coast, New Zealand, with positive outcomes demonstrated for invertebrates including beetles, wētā, and earthworms (Boyer *et al.* 2011; 2016; Rodgers *et al.* 2011). However, VDT has not previously been attempted at Macraes, where climate, soil conditions, and invertebrate fauna differ from those on the West Coast. To improve the likelihood of success, the technique will be carried out only by trained machine operators following best-practice guidelines, under the supervision of a qualified botanist and a person or people experienced in the technique.

Similarly, salvage and relocation of host plants is expected to benefit some invertebrates by transferring not only the plants themselves but also any eggs, larvae, pupae, or other life stages associated with them. This approach may reduce direct mortality caused by vegetation clearance and could help establish or reinforce populations within recipient habitats. As with VDT, using trained machine operators under the supervision of a qualified botanist will improve the likelihood of success. However, residual uncertainty remains, as it is not possible to quantify the numbers of eggs, larvae, pupae, or other life stages transferred with the plants, or their survival post-transfer.

These methods are therefore being used because they are anticipated to provide benefits over undertaking no management action at all. While it is acknowledged that directly demonstrating these outcomes may not be possible, the contribution of these measures to invertebrate mitigation may be indirectly evidenced through monitoring proposed as part of the Project—namely: (1) determining whether notable species and other indigenous invertebrate groups are present at the release sites in the years following relocation; and (2) determining the success of host plant translocation and planting in providing suitable habitat quality for relocated species (see section 5.3 for more detail).

4.2 Project staging and timing of salvage operation

The MP4 Project comprises multiple mine development components that will be implemented in stages over an approximately 10-year period. The first stage is currently scheduled to commence in late 2027. Invertebrate management measures outlined in this Plan will be applied prior to, during, and following each stage of development where invertebrate habitat is affected.

Because the activity patterns, life cycles, and periods of detectability of invertebrates vary considerably among species and across seasons, salvage and relocation activities will be timed to maximise capture success and minimise adverse effects. The timing of salvage operations will therefore be tailored to the ecological requirements of target species and is described further in section 4.6 Timing of Salvage Operations.

4.3 Demarcation of the works footprint

Salvage effort will be focused on suitable invertebrate habitats within impact areas, with particular emphasis on habitats known or considered likely to support notable invertebrate species. Areas of habitat adjacent to the Project footprint that will not be directly disturbed by mining activities, but

may be subject to indirect effects, will not be actively searched or included within the salvage programme.

However, some salvage methods, particularly light trapping for moths and other flying invertebrates, are likely to attract individuals from habitats beyond the immediate impact footprint. Consequently, a proportion of invertebrates originating from surrounding areas may be captured and relocated as part of the salvage programme.

4.4 Invertebrate relocation sites

Selection of suitable relocation sites is critical to the success of the invertebrate salvage programme, as many native invertebrates have highly specific habitat requirements and close associations with particular host plants, vegetation communities, soil conditions, or microclimates. Some species are also vulnerable to predation by exotic mammals—particularly rodents—and site selection for these species needed to consider predation risk, favouring locations where mammalian pest management offers protection.

Relocation sites have therefore been selected to closely match the habitat characteristics of the impact areas, support existing populations of the same host plant species, be subject to revegetation and/ or habitat enhancement, and preferably be subject to active mammalian predator management. Preference was given to sites that already support similar invertebrate communities and that will be protected (covenanted) and managed (revegetated, enhanced) over the long term. A summary of the chosen invertebrate relocation sites is provided in the sections below and Table 4.1 identifies the specific areas where invertebrate salvage will be undertaken (the MP4 impact areas) and the locations within the surrounding landscape that will be protected, enhanced, and managed as recipient sites for relocated invertebrates.

The habitat requirements of each notable invertebrate species (Table 3.1; also see Table 4.1), together with those of any other species encountered during salvage operations, was considered when selecting specific release locations. Matching recipient sites to the ecological requirements of target species will maximise the likelihood of survival, establishment, and long-term persistence of relocated invertebrate populations.

4.4.1 Mount Highlay Restoration Area

The Mount Highlay Restoration Area combines approximately 175 ha of tussock restoration planting with removal of plantation saplings over 265 ha (Bioresearches 2026g, l, n, o). Without intervention, the plantation will naturally develop towards a closed-canopy exotic forest with limited indigenous understory value and would displace or fragment fauna and flora populations. Removing the young plantation averts that future loss and allows recovery towards tussock-dominated vegetation through planting, VDT and ongoing management. The site will be stock-proof fenced and covenanted as part of the Project ensuring long-term conservation benefits. Pest management at this site will involve only browser control to reduce browsing and disturbance of indigenous vegetation, VDT areas, rock outcrops, and restoration plantings (Alliance Ecology 2026).

4.4.2 Cranky Jims Link and dryland podocarp restoration

Cranky Jims Link establishes approximately 50 ha of indigenous shrubland and protects or enhances existing shrubland and rock habitat (Bioresearches 2026g, l, n, o). The site connects the currently separated covenant areas of Cranky Jims Ecology Covenant, Cranky Jims Wetland Covenant, and Island Block Covenant, improving habitat continuity and resilience.

Foundational planting over approximately 21 ha is also intended to initiate the return of dryland podocarp forest (Bioresearches 2026g, l, n, o). This vegetation type represents the probable pre-human forest cover of parts of the Macraes Ecological District but is now functionally extinct there. Re-establishment is necessarily long term and uncertain, but it offers ecological, cultural and landscape benefits that are not captured by a like-for-like tussock or shrubland accounting model. The site will be stock-proof fenced and covenanted as part of the Project ensuring long-term conservation benefits. Pest management at this site will focus on the control of rodents, possums, mustelids, and feral cats (Alliance Ecology 2026), and will be implemented until 2050, aligning with New Zealand's Predator Free 2050 vision.

4.4.3 Murphys Ecological Enhancement Area (MEEA)

Murphys Ecological Enhancement Area is the core fauna and landscape restoration component of the MP4 Project. A pest-exclusion fence will create an approximately 252 ha area in the Murphys Creek catchment where pest mammals will be eliminated and maintained at zero density (Alliance Ecology 2026). This is supported by surrounding landscape-scale mammalian pest control over approximately 1,170 ha, weed management, habitat enhancement, and enduring legal protection (Bioresearches 2026g, l, n, o).

The wider Murphys Link (south of the MEEA fence) connects the enhancement area with the existing Redbank Station Covenant and other protected habitat (Bioresearches 2026g, l, n, o). This strengthens ecological continuity for fauna, including invertebrates, and reduces the isolation of existing conservation areas. Pest management at this site will focus on the control of rodents, possums, mustelids, and feral cats (Alliance Ecology 2026) and will be implemented until 2050, aligning with New Zealand's Predator Free 2050 vision.

The MEEA will provide a landscape scale ecological protection and enhancement area, securing local biodiversity values into the future. OGNZL will maintain the fence for the life of the consent (35 years).

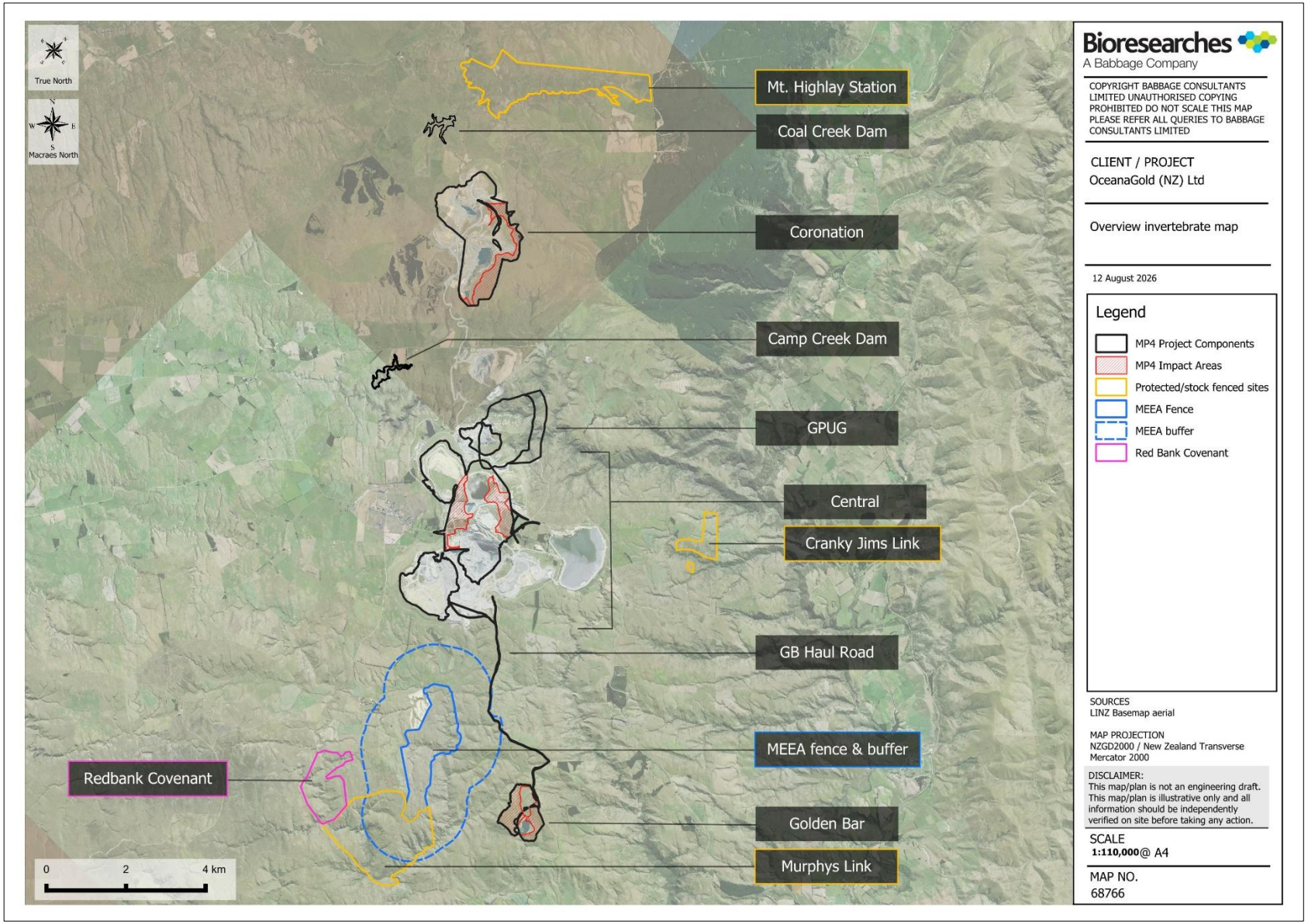


Figure 4.1. Map showing the locations of the MP4 impact areas where invertebrate salvage will take place and select relocation sites within the surrounding landscape.

4.5 Invertebrate trapping and capture

A variety of proven and reliable live trapping and capture techniques will be employed to increase the probability of invertebrate capture. Techniques will include, but may not be limited to hand-searches, sweep-netting, light trapping, pitfall traps, Gee's Minnow (funnel) traps, and artificial refuges. Learnings from the CN5 and CCP2 invertebrate salvages will be incorporated into the current salvage methods.

4.5.1 Moth light trapping

Moths and other flying nocturnal insects will be sampled using Heath moth traps (Patrick 2016). Heath moth traps consist of a fluorescent bulb (8-watt black light tube, UV A type lamp with a wavelength range of 320–420 nm) positioned on top of a funnel, on top of a plastic base. The bulb is surrounded by plastic fins that deflected moths flying towards the light down through the funnel and into the base. A mesh bag inserted into the hole in the plastic base acts to contain the captured individuals. Pieces of egg carton will be placed inside the mesh bag to provide a place for the insects to settle once inside the trap. Each trap will be powered by a 12 V battery, and a light sensor will automatically activate the bulb on dark to attract insects. On sunrise, the light sensor automatically deactivates the lighting unit.

The 'light reach' from a Heath moth trap, which effectively attracts mobile invertebrates to the trap, is relatively small (e.g., less than 50 m radius from the trap itself). Therefore, captures in a Heath moth trap may represent either local species (i.e., those occurring in the area immediately surrounding the trap), or species dispersing through the landscape at the time of trapping. To counter this sampling effect, moth traps will be rotated around the salvage sites on a nightly basis to ensure full coverage of the salvage areas. The traps will be set daily, run overnight and collected the following morning when all captured invertebrates will be relocated to the release site(s).

4.5.2 Pitfall traps

Live pitfall trapping is a standard and effective technique for capturing terrestrial invertebrates in New Zealand (Sherley & Stringer 2016). Pitfall trapping will involve the installation of plastic pails, dug into the ground with the top of the bucket flush with ground level, and covered with a lid wider than the aperture of the pail (Figure 4.4). A small amount of soil and leaf litter is placed in the bottom of the traps to provide cover for captured invertebrates. Pitfall traps will be installed (inactivated by filling to the brim with vegetation) in the field at least two weeks prior to the commencement of the salvage. A longer 'settling time' is not considered necessary because the pitfall traps will be baited and will immediately attract invertebrates. Traps will be activated by adding a lure (e.g., soft fruits or protein baits).

The pitfall traps used for salvaging invertebrates will be the same as those installed for capturing lizards. Arrays of pitfall traps will be installed throughout the impact areas; their specific locations and density to be determined by the project ecologist. The locations of all pitfall traps would be recorded on a GPS. Once activated by removing the vegetation, and traps would be inspected at least every 24 hours (possibly twice per day) for the duration of the pre-works salvage operation. All captured invertebrates will be relocated to the release site(s) the same day.

Figure 4.2. Images of the invertebrate (moth) salvage-relocation undertaken as part of the CCP2 Project in March 2026. Upper images: salvage site moth trapping; lower images: relocation site moth release.

4.5.3 Gee's Minnow traps (funnel traps)

Gee's Minnow or funnel traps are small fish traps that typically consist of two funnel-shaped entrances at either end of a mesh cylinder. Funnel traps are a passive sampling method because they rely on invertebrates encountering and willingly entering the trap by climbing up the shallow incline funnel (cf. pitfall traps where invertebrates fall into the trap). They can be used to capture invertebrates in a wide range of habitats because they can be positioned on or above ground, can be nestled among dense vegetation, and can easily be relocated without disturbing the soil.

The funnel traps used for salvaging invertebrates will be the same as those installed for capturing lizards. Arrays of funnel traps will be installed throughout the impact area to compliment the pitfall traps. The specific locations and density of the funnel traps to be determined by the project ecologist. Each funnel trap would be half-filled with vegetation matter and baited with a lure (e.g., soft fruit or protein-based lure). The locations of all funnel traps would be recorded on a GPS, and traps would be inspected at least every 24 hours (likely twice per day) for the duration of the pre-works salvage operation. The traps will be set daily, run overnight and collected the following morning when all captured invertebrates will be relocated to the release site(s).

4.5.4 Artificial cover objects (ACOs)

Artificial cover objects (ACOs) are a standard tool for detecting, surveying, capturing, and monitoring invertebrates in New Zealand (Sherley & Evans 2016).

The ACOs used will constitute single- or double-layered, 400 mm x 475 mm corrugated *Onduline* sheets. *Onduline* is a bituminous corrugated roofing material that has heat retention properties, providing refuge and thermoregulatory benefits (Figure 4.4).

ACOs require a period of settlement following installation to allow any scent to equalise, and invertebrates to find and become familiar with the devices. Accordingly, ACOs would be installed in the field at least one month prior to being inspected for invertebrates. ACOs will then be repeatedly inspected, and all invertebrates found beneath captured.

Arrays of ACOs will be installed throughout the impact area; the specific locations and density to be determined by the project ecologist. The locations of all ACO will be recorded on a GPS and ACOs would be inspected at least every 24 hours (likely twice per day) for the duration of the pre-works salvage operation. All captured invertebrates will be relocated to the release site(s) the same day.

4.5.5 Diurnal searches and sweep netting

Diurnal hand-searches and sweep netting will be carried out by ecologists moving through the landscape actively lifting habitat features and ground debris and sweeping vegetation with a sweep net. Searches and sweep-netting will be undertaken alongside the lizard salvage operations, which propose to extend over 40–60 days per season, with a minimum of 120 person search hours per hectare invested.

4.5.6 Invertebrate handling, storage, and release

Terrestrial invertebrates will be transferred to large plastic bins that will be filled with foliage and soft debris. Care will be taken not to crowd each storage bin with too many invertebrates, and large predatory invertebrates (e.g., *Megadromus* beetles, large spiders) will be separated to limit impacts on other smaller species.

Light-trapped and sweep-netted invertebrates will be stored in large mesh, drawstring bags, which will be hung up to prevent invertebrates being crushed.

All invertebrates captured during salvage activities will be transferred to a temporary processing station for holding and documentation prior to release. Accurate field identification of many invertebrate taxa, particularly moths and poorly known groups, can be difficult and time-consuming. Accordingly, invertebrates will not generally be identified to species in the field. Instead, photographs will be taken where practicable and recorded alongside the date and location of capture.

As a result, it will generally not be possible to determine whether notable species (e.g., ‘Threatened’, ‘At Risk’, or ‘Data Deficient’ taxa) have been successfully captured during salvage operations. Similarly, given the potentially large number of invertebrates encountered, detailed counts of all individuals will not be undertaken. The primary objective of the salvage programme is therefore to maximise the number of invertebrates relocated from impact areas, rather than to generate comprehensive species inventories or abundance estimates.

Invertebrates will be held temporarily for no longer than 24 hours before being relocated and released. Terrestrial invertebrates will be released into dense vegetation (e.g., tussock, shrubland, dense grass, or rock outcrops) at the relocation site(s). Nocturnally active invertebrates (e.g., moths) will be released in the evening by inverting the mesh bags and allowing the individuals to fly away freely.

If forecasted weather conditions are deemed too unsuitable for invertebrates to be released (e.g., snowfall or temperatures low enough to compromise activity and movement, e.g., < 10°C), invertebrate capture and/ or release will be delayed until the conditions improve. The notable exception is the salvage and relocation of the moth *Theoxena scissaria,* which is an Autumn flier and thus, the low temperature limit will not apply for this species.

4.5.6.1 Inadvertent invertebrate injury or death

Killing of invertebrates is not intended but is an unavoidable and foreseeable consequence of the works. Any injured invertebrates will be released, and deceased individuals will be retained and stored in a freezer. Any deceased invertebrates resembling notable species will be sent to relevant experts for identification. Consultation will be undertaken with mana whenua and other stakeholders (e.g., Department of Conservation) or interested parties (e.g., Manaaki Whenua Landcare Research) regarding the appropriate fate of any deceased invertebrates, to ensure the most appropriate outcome is achieved.

4.5.7 Accidental discovery protocol

Considering the presence of some TAR invertebrates in the Project footprint and surrounding landscape, and the inherent detectability limitations associated with invertebrate survey (refer section 2.3.6 of the Invertebrate Values Assessment; Bioresearches 2026b), there remains a possibility that other TAR invertebrates not previously identified could be encountered during salvage and vegetation clearance. Accordingly, an invertebrate accidental discovery protocol (IADP) is proposed to ensure that any such finds are appropriately managed as they arise, providing a practical safeguard for incidentally detected taxa.

Under the IADP, all site personnel involved in salvage and vegetation clearance will receive training to recognise the general habitat features and life stages (e.g. larvae, pupae, adults) associated with TAR invertebrate species known to occur in the Project Area (e.g., *Orocrambus sophistes*, *Agrotis admirationis, Asaphodes recta,* etc.) or occurring (e.g., 'Threatened – Nationally Vulnerable' *Hierodoris polita*) in the wider Macraes landscape. Should a suspected TAR invertebrate(s), or an aggregation of invertebrates suspected to be of conservation significance, be encountered during salvage or vegetation removal, works in the immediate vicinity (20 m surrounding the detection point) will temporarily cease and the Project ecologist or a suitably qualified entomologist will be contacted to assess the find within 24 hours.

Where the Porject ecologist/ entomologist confirms the presence of a previously unknown TAR species or an aggregation of invertebrates suspected to be of conservation significance, a stop-work protocol will apply to the affected area until an appropriate management response has been determined and agreed with the relevant regulatory authority (as required). This may include, depending on the species, its conservation status, and the nature and extent of the find, options such as translocation of individuals, modification of the immediate works methodology, or targeted salvage prior to works recommencing. Where the find is confirmed not to be a TAR species, or where an appropriate management response has been implemented, works may recommence in the affected area. All accidental discoveries, and the

management response applied, will be recorded and reported in accordance with the Project's findings report requirements, to inform adaptive management over the life of the Project.

4.6 Relocation of invertebrate communities and larval host plants

Salvaging and relocating vegetation (including specific invertebrate larval host plants) and habitat can provide a mitigation mechanism for invertebrate species by transferring not only the plants or habitat, but also any eggs, larvae, pupae, or other invertebrate life stages associated with them. This approach may reduce direct mortality of some invertebrates associated with vegetation clearance and potentially facilitate the establishment or reinforcement of invertebrate populations within recipient habitats and improve the likelihood of population persistence at relocation sites.

There is a moderate level of uncertainty associated with the success of this mitigation measure (as outlined in section 4.1 above). Notwithstanding this uncertainty, vegetation and habitat relocation will be undertaken rather than no management action at all. Two types of vegetation relocation will be carried out: 1) VDT, to relocate both host plants and invertebrates communities, and 2) TAR invertebrate host-specific plant salvage-relocation. Both are detailed further below.

Detailed methodologies for the VDT and collection, handling, treatment, transport, and relocation of host plants are provided in the Residual Effects Terrestrial Restoration Plan (E15), Vegetation and TAR Flora Management Plan (E8), and Wetland Management Plan (E9) (Bioresearches 2026g, 2026h, 2026n). Refer to these documents for further information.

Table 4.1 identifies the host plant species proposed for relocation and the associated invertebrate species that utilise them.

4.6.1 Vegetation direct transfer (VDT)

Vegetation direct transfer is a salvage technique where sections of vegetation and topsoil are cut from the ground and transferred as entire blocks directly to a receiving environment. This process is intended to transfer full plant communities, topsoil, biological material, as well as any microbial soil communities and small fauna associated with the plants and soil, from one location to another. Within New Zealand this process has largely been used for mine rehabilitation on the West Coast.

As part of the Project, VDT of 5.5 ha of snow tussock from the Coronation Mining Area (representing 10% of the tussock grassland within this site), 0.67 ha of snow tussock from the Central Mining Area, and 0.95 ha of snow tussock from Golden Bar Mining Area will be translocated to Mt Highlay Station. A detailed description of the VDT methods are outlined in the Vegetation and TAR Flora Management Plan (E8; Bioresearches 2026g). It is anticipated that the VDT will in tandem relocate adults, larvae, and eggs of many species of invertebrates, including those living both within the foliage of the vegetation and the topsoil layer.

4.6.2 TAR species larval host plant relocation

The host plants of all TAR and notable species will be relocated to carefully selected recipient sites where the same plant species is already present. This approach increases the likelihood that any larvae or other

invertebrate life stages associated with relocated plants can disperse onto adjacent established host plants, even if the survival of the host is compromised by the translocation process.

For smaller host plants (e.g., *Senecio* spp.), individuals will be carefully dug out of the soil and replanted into suitable habitat at the receiving sites. For larger and more abundant plants (e.g., *Chionochloa* spp., *Aciphylla subflabellata*), replanting individuals may not be possible due to the volume of material being relocated. Accordingly, these plants are uplifted, transported and placed up against or spread out amongst existing accumulations of those species, to allow free movement of larvae from relocated to resident plants.

Table 4.1. Host plant species proposed for relocation as part of the MP4 Project, the invertebrate species associated with each host plant, the number of plants proposed for relocation, and the recipient sites.

Plant species	Associated invertebrate	Compensation actions	Recipient site
Tussock: *Chionochloa rigida, C. rubra* subsp. *cuprea, Festuca novae-zelandiae, Poa cita, P. colensoi*	*Orocrambus sophistes*	• VDT of snow tussock (including *C. rigida,* likely including *F. novae-zelandiae, P. cita* and *P. colensoi*) • Planting of *C. rigida, C. rubra* subsp. *cuprea, F. novae-zelandiae, P. cita* and *P. colensoi*	• Mt Highlay Station tussock planting (175 ha) • Mt Highlay Station VDT
Herbs in open areas	*Agrotis admirationis*	• VDT of snow tussock (with associated herbs) • Planting of ephemeral wetlands	• Mt Highlay Station VDT • Compensation ephemeral wetlands
Ranunculus, Senecio	*Asaphodes recta*	• VDT of snow tussock (likely including plants of *R. foliosus* from Coronation and *S. glomeratus* from Central) • Planting of *S. dunedinensis, R. amphitrichus, R. ternatifolius* • Salvage of *Ranunculus* from wetlands and grasslands	• Mt Highlay Station VDT • Compensation ephemeral wetlands
Aciphylla subflabellata	*Dasyuris partheniata*	• Salvage of individual plants from proposed works footprint • Propagation and planting of plants within covenanted areas	• MEEA (including within fence)
Senecio spp.	*Nyctemera annulata*	• VDT of snow tussock (likely including plants of *S. glomeratus* from Central) • Planting of *S. dunedinensis*	• Mt Highlay Station VDT

Plant species	Associated invertebrate	Compensation actions	Recipient site
Carmichaelia spp.	*Pasiphila* sp. A (NZAC 04285480 "Carmichaelia")	• Salvage of individual *Carmichaelia* plants • Planting of *C. crassicaulus* subsp. *crassicaulis, C. petriei* and *C. corrugata*	• Mt Highlay Station (rock outcrop areas) • Cranky Jims Link
Senecio species	*Patagoniodes farinaria*	• VDT of snow tussock (likely including plants of *S. glomeratus* from Central) • Planting of *S. dunedinensis*	• Mt Highlay Station VDT
Carmichaelia spp.	*Samana acutata*	• Salvage of individual *Carmichaelia* plants • Planting of *C. crassicaulus* subsp. *crassicaulis, C. petriei* and *C. corrugata*	• Mt Highlay Station (rock outcrop areas) • Cranky Jims Link
Carmichaelia spp.	*Theoxena scissaria*	• Salvage of individual *Carmichaelia* plants • Planting of *C. crassicaulus* subsp. *crassicaulis, C. petriei* and *C. corrugata*	• Mt Highlay Station (rock outcrop areas) • Cranky Jims Link
Muehlenbeckia spp.	*Bityla sericea*	• VDT of narrow-leaved snow tussock (expected to contain *Muehlenbeckia complexa*) • Planting of *M. complexa*	• Mt Highlay Station VDT • Murphys Link (lizard rock stacks)
Grasslands and shrublands	*Wiseana fuliginea*	• Planting of snow tussock community • Planting of dry shrubland ecosystems • VDT of snow tussock	• Mt Highlay Station tussock planting (175 ha) • Cranky Jims Link • Mt Highlay Station VDT

4.7 Timing of salvage operations

The timing of invertebrate salvage is an important consideration because many species exhibit seasonal patterns in activity, development, and detectability. Moth species vary considerably in their adult flight periods, with some species active only during short seasonal windows, while others are present as eggs, larvae, or pupae for much of the year. Salvage activities will therefore be timed, where practicable, to coincide with periods when target species are most detectable and recoverable, while also considering the location of vulnerable life stages on host plants and within habitats. This approach is intended to maximise salvage success and minimise mortality of species of conservation interest. Figure 4.3 presents the appropriate salvage methods and salvage period for each species of notable invertebrate in the MP4 Project area.

Invertebrate salvage will be undertaken alongside the lizard salvage operations, which propose to extend over 40–60 days per season (October to April), with a minimum of 120 person search hours per hectare invested. The exception will be targeted salvage of the Autumn flying moth *Theoxena scissaria*.

Figure 4.3. Summary of the seasonal activity, behaviour, and appropriate salvage methods and timing for the focus invertebrate species.

Species	Flight period and behaviour	Salvage method and period
Orocrambus sophistes	Adults found from mid-January to April but most common mid-February to early March. The single specimen caught in Golden Bar was caught on the wing in May 2022. Adult males can easily be disturbed by day, but the species comes readily to light indicating it is a nocturnal species.	**Salvage methods:** • Moth light trapping • Diurnal sweep netting **Salvage period:** Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May
Agrotis admirationis	Single individual caught in early April on OGNZL landholdings. Adults attracted to light.	**Salvage methods:** • Moth light trapping. **Salvage period:** Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May
Asaphodes recta	Two individuals caught in late March on OGNZL landholdings. Adults attracted to light.	**Salvage methods:** • Moth light trapping **Salvage period:** Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May
Dasyuris partheniata	Adults on the wing October to March. Adults attracted to light.	**Salvage methods:** • Moth light trapping **Salvage period:** Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May

Nyctemera annulata	Diurnal flying species but may also be caught in moth light traps. Active most of the year but more prevalent over the warmer months.	**Salvage methods:** • Diurnal sweep netting • Moth light trapping **Salvage period:** Jun, Jul, Aug, Sep, Oct, Nov, Dec, Jan, Feb, Mar, Apr, May
Orthodera novaezealandiae	Active year-round but especially conspicuous and active during warm, sunny, and dry conditions.	**Salvage methods:** • Hand-searches • Diurnal sweep netting **Salvage period:** Jun, Jul, Aug, Sep, Oct, Nov, Dec, Jan, Feb, Mar, Apr, May
Pasiphila sp A (NZAC 04285480 "Carmichaelia")	Poorly known species. Adults attracted to light and were caught in February, March, and April on OGNZL landholdings.	**Salvage methods:** • Moth light trapping **Salvage period:** Jun, Jul, Aug, Sep, Oct, Nov, Dec, Jan, Feb, Mar, Apr, May
Patagoniodes farinaria	On the wing from October to April. Active at night, attracted to light.	**Salvage methods:** • Moth light trapping **Salvage period:** Jun, Jul, Aug, Sep, Oct, Nov, Dec, Jan, Feb, Mar, Apr, May
Samana acutata	Adults on the wing from September to April. Attracted to light.	**Salvage methods:** • Moth light trapping **Salvage period:** Jun, Jul, Aug, Sep, Oct, Nov, Dec, Jan, Feb, Mar, Apr, May

Theoxena scissaria	They are most frequently observed on the wing from May to July (Patrick 2014), though a single specimen was captured on BRWRS in September.	**Salvage methods:** • Moth light trapping **Salvage period:** Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May
Bityla sericea	Adults attracted to light and on the wing February to May. Individuals were caught in February, March, and April on OGNZL landholdings.	**Salvage methods:** • Moth light trapping • Diurnal sweep netting **Salvage period:** Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May
Wiseana fuliginea	Very poorly known species and adults have rarely been caught. Larva of this species found in May (Southland), but follow-up light trapping in January at the same site failed to detect adults. A closely related *W. mimica* was captured near Murphys Creek in March. Presumed summer flyer.	**Salvage methods:** • Moth light trapping • Diurnal sweep netting **Salvage period:** Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May
Zelandobius uniramus	Adults collected January, November, December (McLellan 1993). Can be caught using lights or in malaise traps, but sweeping streamside vegetation is more productive.	**Salvage methods:** • Diurnal sweep netting • Moth light trapping **Salvage period:** Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May
Hemiandrus maia	Frequently observed during the warmer summer months. Active at night but easily trapped in pitfall and Gee's minnow funnel traps and found beneath rocks and debris.	**Salvage methods:** • Hand-searches • Pitfall and Gee's Minnow funnel trapping **Salvage period:** Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May

<table>
<tr>
<td>Mecodema sp. “Oamaru”</td>
<td>Observed during the warmer summer months. Active at night but likely to be trapped in pitfall and Gee’s minnow funnel traps and also found beneath rocks and debris.</td>
<td>Salvage methods:
• Hand-searches
• Pitfall and Gee’s Minnow funnel trapping
Salvage period:
<table>
<tr><td>Jun</td><td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td><td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td></tr>
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<td>Orocrambus cf. cyclopicus</td>
<td>Poorly known but several individuals captured in March and April on OGNZL landholdings. Attracted to light.</td>
<td>Salvage methods:
• Moth light trapping
• Diurnal sweep netting
Salvage period:
<table>
<tr><td>Jun</td><td>Jul</td><td>Aug</td><td>Sep</td><td>Oct</td><td>Nov</td><td>Dec</td><td>Jan</td><td>Feb</td><td>Mar</td><td>Apr</td><td>May</td></tr>
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4.8 Habitat degradation and invertebrate capture

Site preparation for mining activities involves the stripping of vegetation and topsoil and removal of unstable rocky areas to create a uniform and structurally stable surface for excavation or deposition of waste rock. It is during this pre-mining process that the project ecologists and salvage team will work directly with machine operator(s) to progressively dismantle habitat features and clear vegetation. While this method will primarily for the purpose of capturing lizards, all invertebrates encountered will be captured too.

The invertebrate salvage undertaken during vegetation clearance and habitat dismantling does not necessarily represent a distinct, sequential phase following pre-works management. Habitat simplification, including the staged removal of complex vegetation, may be implemented at any stage of the salvage process to improve invertebrate detectability and capture success.

The timing, location, and extent of machine-assisted vegetation clearance and habitat dismantling will be determined at the discretion of the Project ecologists, based on observed site conditions, species specific requirements (such as those for *Theoxena Scissaria*) and salvage outcomes to be achieved. Dedicated capture efforts using live traps and intensive hand-searching will continue to be undertaken during vegetation stripping and progressive habitat degradation.

4.8.1 Physical vegetation and habitat removal methodology

It is crucial that there is clear coordination and communication between the field team and machine operator(s) to minimise health and safety risks. The project ecologist and machine operator(s) will review the methodology and agree on processes and activities prior to commencing this work in the field.

For areas that support abundant and dense vegetation cover such as tussockland habitats, clearance will be carefully carried out by a small excavator, fitted with a toothed bucket or root raker attachment, and supervised by the project ecologist and/ or trained members of the salvage team. Invertebrates will be captured both by hand during the vegetation stripping process and pitfall traps remaining in the ground will be utilised to continue to trap invertebrates. That is, as vegetation is progressively stripped along the moving front, invertebrates will be disturbed, uncovered, and will flee activities and be caught in pitfall traps or move under ACOs. Invertebrates will be progressively removed from pitfall traps and then the pitfall traps will also be removed from the site as they are encountered at the edge of vegetation stripping.

In instances where debris or rocky areas cannot be physically moved or searched by the salvage team, an excavator(s) dedicated to the salvage will be used to, as far as practicable, lift or dismantle the feature to reveal invertebrates for hand capture. It is likely the excavator(s) will use a grapple attachment to allow precision lifting of objects and to reduce scraping or shearing of rock surfaces, which may injure or kill invertebrates. In some instances, a toothed bucket attachment may be used to lift or roll large heavy objects (Figure 4.4).

The direction of the vegetation clearance and invertebrate salvage operation will occur from inside the affected area (i.e., areas closest to the existing mine pit or existing disturbed areas) towards the outside (i.e., areas furtherest away from the mine pit, up against adjacent unaffected habitat), or starting at one end and working toward the other in areas not currently disturbed. This intentional approach may assist

with driving some invertebrates away from the vegetation clearance zones and out towards the boundaries of the affected area, where they can disperse into adjacent unaffected habitat.

Where practicable, complex vegetation (e.g., large tussock clumps) will be carefully lifted by excavator and relocated to a nearby unaffected site. These will be placed adjacent to comparable habitat to enable any undetected invertebrates to disperse naturally. This measure is precautionary and intended to maximise the likelihood that invertebrates are protected and salvaged.

Figure 4.4. Images of capture techniques. Upper left: Onduline Artificial Cover Object (ACO); upper right: pitfall trap; lower left: machine-assisted dismantling of a rock tors during the CN5 Project, and lower right: and ecologist supervised machine-assisted vegetation clearance.

4.9 Salvage findings reporting

Following completion of each years' invertebrate salvage efforts, a report detailing the results of the operation will be prepared and provided to OGNZL and relevant stakeholders within three months (e.g., by end of July). The results reported will include but not be limited to salvage conditions, general descriptions of invertebrates salvaged and relocated, and the species and numbers of host plants salvaged and relocated.

5 Invertebrate relocation management

Relocation management is specifically concerned with the management of notable invertebrates at the relocation site, which includes monitoring host plant relocation and monitoring the presence of notable species over time.

5.1 Invertebrate release strategy

As previously mentioned, invertebrates will be released directly into appropriate habitat and at the appropriate time of day at the release sites. Relocated invertebrates will be dispersed evenly across the release sites to reduce the risk of 'overstocking' specific areas of the recipient site(s).

5.2 Relocation site management

5.2.1 Relocation and maintenance of invertebrate host plants

Relocated host plants will be placed in areas supporting comparable environmental conditions and, where practicable, alongside existing populations of the same plant species. Following relocation, host plants will be maintained as required to promote establishment and survival, including protection from grazing, noxious weed control, and replacement planting where necessary. The successful establishment of host plants is considered a key component of providing long-term habitat for relocated invertebrate populations.

Host plant management will primarily be undertaken through the relevant vegetation management programmes, including the Residual Effects Management Plan (E13; Bioresearches 2026l), Vegetation and TAR Flora Management Plan (E8; Bioresearches 2026g), Residual Effects Terrestrial Restoration Plan (E15; Bioresearches 2026n), Residual Effects Wetland Management Plan (E16; Bioresearches 2026o). Refer to these documents for detailed information on planting, VDT methods, plant protection and maintenance, adaptive management, and monitoring.

5.2.2 Mammalian predator control

Mammalian predators such as rodents, mustelids, hedgehogs, and possums pose a threat to native invertebrates through both direct predation and competition for food resources. While predator control is not specifically proposed for invertebrate management, it will be implemented as part of other fauna and flora management at sites where invertebrates will be relocated to. Relocating invertebrates into mammal exclusion areas (MEEA fence) or mammal suppressed areas (Murphys Link) is expected to provide secondary benefits for invertebrates.

Pest animal control implemented as part of the MP4 Project—described in detail in the Pest Control and Elimination Plan prepared by Alliance Ecology (2026)—in conjunction with existing pest control operations on OGNZL landholdings (e.g., Island Block Covenant, Cranky Jims Ecology Covenant) is likely to provide wider, landscape-scale benefits for invertebrates susceptible to pest mammals.

5.3 Invertebrate monitoring

Monitoring of invertebrates at release sites, together with monitoring of host plant relocation and planting success, is important for evaluating the effectiveness of the proposed management measures and determining whether the intended conservation outcomes are being achieved. Given that invertebrate salvage-relocations (other than land snails and peripatus) have rarely been undertaken in New Zealand, there remains considerable uncertainty regarding the success of these techniques and the factors that influence long-term outcomes.

Furthermore, because collection and accurate recording of invertebrate data during salvages is challenging, or not feasible, the approach for the MP4 Project is focussed on monitoring habitat quantity and quality and undertaking surveys of local invertebrates (including the 17 notable species highlighted in this report) demonstrate their continued persistence at relocation sites on the landholdings.

Information collected through monitoring could provide valuable insights into the response of relocated invertebrates and host plants, helping to refine future management practices and improve the evidence base for invertebrate conservation. The results will not only inform ongoing management at the Macraes Mine but will also contribute to broader knowledge of invertebrate mitigation and relocation techniques in New Zealand, where such information is currently limited.

5.3.1 Monitoring objectives

The objectives of the monitoring programme are to:

- Determine whether notable species, and other indigenous invertebrate groups, are present at the release sites in the years following the relocations.
- To determine the success of host plant translocations and planting of host plants for notable invertebrates, to assess the potential habitat quality for relocated species.

5.3.2 Monitoring methods

Invertebrates will be monitored through a combination of passive and active monitoring. Passive monitoring for terrestrial invertebrates will be undertaken using live pitfall traps installed within the MEEA, both inside and outside (Murphys Link) the predator-exclusion fence. While these traps are primarily intended for lizard monitoring, they will also provide an opportunity to record invertebrates encountered during trapping sessions. Any notable invertebrates observed will be photographed and documented, providing a low-effort method of gathering information on invertebrate persistence and distribution over time.

Targeted monitoring of moth species will also be undertaken using light trapping and will be undertaken at sites where host plants specific to notable moths have been relocated or vegetation direct transferred to (e.g., Mt Highlay Station, MEEA fence, Murphys Link, and/ or Cranky Jims Link). Light traps will be operated during suitable weather conditions and at times corresponding with the expected flight periods of species of interest. Captured moths will be identified where practicable, photographed, and released. The results will provide information on species presence, relative activity, and whether populations of notable or relocated species appear to be persisting within the managed areas.

Invertebrate host plant monitoring will primarily be undertaken through the relevant vegetation management and monitoring programmes, including the Residual Effects Management Plan (E13;

Bioresearches 2026l), Vegetation and TAR Flora Management Plan (E8; Bioresearches 2026g), Residual Effects Terrestrial Restoration Plan (E15; Bioresearches 2026n), Residual Effects Wetland Management Plan (E16; Bioresearches 2026o). Information relating to the establishment, survival, condition, and reproductive success of host plant species will be extracted from these programmes and interpreted in the context of invertebrate monitoring results. This integrated approach will help assess the effectiveness of habitat restoration and determine whether suitable resources are being maintained to support notable invertebrate populations over time.

5.3.3 Measuring success and adaptive management

Measuring the success of invertebrate management will be primarily focused on determining and maintaining the presence of TAR, notable, and other invertebrate species expected to occur in the habitats being protected and enhanced at the relocation sites. This focus on presence, rather than on more measures such as abundance or population trend, is in response to the detectability constraints inherent to invertebrate survey (see Section 2.3.6 of the Invertebrate Values Assessment; Bioresearches 2026b). Because detection probability for cryptic, small-bodied, and seasonally restricted invertebrates is inherently imperfect, and is further influenced by extraneous factors such as monitoring timing, seasonal conditions, weather, and species-specific behaviour, there is too much uncertainty surrounding measures of abundance to reliably distinguish genuine ecological change.

Presence, by contrast, is a more interpretable metric under these conditions: while a single non-detection cannot be taken as evidence of absence, repeated confirmation of a species' presence across multiple monitoring years provides a cumulative and increasingly reliable line of evidence that the species or a population is persisting at the relocation site. Considering this, success will be achieved where TAR, notable species , and other invertebrates are detected at the relocation sites and where these species continue to be detected in subsequent years. Invertebrate monitoring of relocation sites will additionally contribute to the limited knowledge base surrounding invertebrate relocation and mitigation practices in New Zealand, supporting continuous improvement in how such measures are designed and implemented.

In the instance where TAR and notable species outlined in this IMMP are not detected through annual monitoring then further investigation into why this is the case will be undertaken, and adaptive management will be sought. Adaptive management will primarily focus on habitat quality and security rather than on direct responses to invertebrate species themselves, and this represents the most robust and practicable framework available given the constraints outlined above. Because invertebrate abundance cannot be measured with sufficient confidence to detect meaningful trends, and because demonstrating a direct increase in invertebrate numbers in response to management intervention is not achievable with reasonable certainty, using invertebrate metrics as the primary trigger for adaptive management would risk both false confidence in outcomes that are not real and unwarranted management responses to apparent declines that are, in fact, artefacts of imperfect detection.

Adaptive management actions for invertebrate habitat will include replacement planting, weed control, and pest animal control, as well as identifying other on-site factors that may be hindering restoration efforts, such as damage to fencing, drought, or poor establishment of certain seed stock. These methods are described in detail in the Residual Effects Terrestrial Restoration Plan (E15; Bioresearches 2026n) and the Vegetation and TAR Flora Management Plan (E8; Bioresearches 2026g). Importantly, improving planting success, replacing plants, and managing competitive weeds will provide the best opportunity for the establishment and maintenance of invertebrate habitat, including the specific host plants relied on by

both TAR and the wider invertebrate community at Macraes. Taken together, the presence-based species monitoring and the habitat-based adaptive management framework are intended to operate as complementary lines of evidence: direct monitoring confirms whether target species remain established at the relocation sites over time, while habitat-based adaptive management provides the responsive mechanism through which the underlying conditions needed to sustain those populations are actively secured and improved.

5.3.4 Monitoring reporting

All reporting requirements outlined in resource consent conditions will be adhered to.

Where possible, invertebrate capture and relocation data will be compiled, summarised, and presented in findings reports issued annually, within three months of the end of a salvage season. Reports will include at least the following information:

- Descriptions of the invertebrate monitoring methods and the invertebrate salvage effort employed (e.g., number of light trap nights);
- Assessment of the survivorship and health of relocated and planted host plants (those relevant to focus invertebrates), and reporting on requirements for replacement planting where necessary; and
- Recommendations to improve health or survivorship of host plants, where necessary.

6 Review of the Invertebrate Management and Monitoring Plan

The IMMP will be formally reviewed on a regular basis (e.g. every five years or following each reclassification cycle of the New Zealand Threat Classification System, whichever occurs sooner) to ensure that management measures remain current and effective. Threat status designations for invertebrate species are periodically reassessed by the Department of Conservation, and a species' classification may change between review cycles as new information becomes available on distribution, abundance, or trend. Each review of the IMMP will therefore include a check of the current threat status of all species addressed in the IMMP, with management provisions updated accordingly where a change in classification alters the significance of potential effects or the level of management response required.

The review process will also provide an opportunity to incorporate improvements in survey, salvage, and translocation techniques as they develop over the life of the Project. Methodologies for invertebrate salvage are an evolving field, and approaches found to be effective elsewhere, or refinements identified through monitoring of salvage and translocation outcomes on this Project, will be incorporated into the IMMP to improve the likely success of future management actions. Where monitoring indicates that a particular technique is not achieving its intended outcome, the review will consider alternative or supplementary methods in consultation with a suitably qualified entomologist(s). Any changes arising from a review will be documented, along with the rationale for the change, and where relevant will be provided to the appropriate regulatory authority prior to implementation.

7 References

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Applicability and Limitations

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of OceanaGold New Zealand Limited as our client with respect to the brief.

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.

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