MATAKANUI

GOLD LIMITED

Ardgour Restoration Area Management Plan

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DOCUMENT CONTROL

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1. INTRODUCTION

1.1. Plan purpose and scope

As part of the residual effects management package for the establishment and operation of the Bendigo Ophir Gold Project (BOGP), ecological restoration will be undertaken across parts of Ardgour Station, called the Ardgour Restoration Area.

The Ardgour Restoration Area (ca. 1263 ha, Figure 1) lies northeast of the mine footprint. A more detailed description of the site and its current environment can be found in the Vegetation Values Assessment report[1].

The overarching objective of this Ardgour Restoration Area Management Plan is to enhance ~~both~~ woody ecosystems and sustain indigenous dominated herbfield (cushionfield) ecosystems to compensate for residual adverse effects on native biodiversity ~~as a result of~~because of BOGP activities.

This management plan seeks to achieve the following 35-year outcomes:

- The area of vegetation that meets the definition of Native Dominant Scrubland has increased from 22 to at least 32 ha in LMU1, 82 to at least 123 ha in LMU 2 and 0 to at least 8 ha in LMU3 over 35-years from the commencement of management described in this plan~~In Land Management Units (LMUs) 1, 2 and 3, the area of woody vegetation where native woody species comprise >50% of the ground cover has increased by 50% over that mapped in 2026~~.
- The diversity of native tree, shrub and liane species in existing native scrubland has increased so that on average there are at least five native woody species (comprising at least two tree, two shrub and one liane species) in monitoring transects in LMUs 1 and 2.
- For non-woody areas of LMUs 1, 2 and 3 (excluding cushionfields), at least 30% of this area has native woody vegetation regenerating.

[1] Bendigo Ophir Gold Project Vegetation Values Assessment, RMA Ecology.

- The average annual abundance of native seed dispersing birds (tauhou, korimako and tuī) is at least 50% greater in native dominant scrubland and 25% greater in mixed scrubland in LMUs 1, 2 and 3 than they were in the 2023 and 2024 bird surveys in these areas.
- There is evidence of natural dispersal of native species within the areas of native woody vegetation in LMU 1 and 2 as evidenced by the presence of unplanted individuals of native shrubland and forest species (fern, herb, woody) (excluding matagouri, scented tree daisy and mingimingi) in at least 50% of vegetation monitoring transects.
- Kōwhai seedlings are establishing naturally in proximity (within 100 m) to at least five of the nine kōwhai groves that are currently present in the Ardgour Restoration Area).
- Survival of planted mataī and tōtara on alluvial surfaces in LMU 4 is >50% and surviving plants are >5m tall.
- The extent of cushionfields in LMU 5 is the same or greater than as mapped ~~in 2026~~through the *Applied Research Programme for Conservation Management, Rehabilitation and Expansion of Cushionfield*. The number of individuals of ~~the three~~four key Nationally Threatened and At-Risk cushionfield plant species present[2] within monitored populations shows an increasing or at least stable population in comparison to 2026 base line numbers (allowing for annual variation of ± 25%).

~~It is recommended that the following requirements are reflected in the proposed consent conditions for the BOGP that relate to the achieving of the 35-year outcomes for the Ardgour Restoration Area:~~

- ~~The costs of the obligations arising from this management plan are to be funded directly by the consent holder;~~
- ~~A covenant is registered which provides legal protection in perpetuity for the Ardgour Restoration Area within 12 months of mining activities within the BOGP commencing;~~

[2] *Ceratocephala pungens, Daucus glochidiatus, Myosotis brevis, Myosurus minimus* subsp. *novae-zelandiae.*

- ~~The provision of an annual report on progress on achieving the 35-year outcomes set out in this management plan to the Central Otago District Council each year. Each annual report should report on progress with the proposed conservation actions including:~~
  - ~~Verification that livestock have been excluded and/or that their numbers have been reduced to target stock density levels and/or stated timings in the Ardgour Restoration Area;~~
  - ~~A summary of native planting undertaken including representative photos;~~
  - ~~A summary of all mammalian pest and ecological weed management activities undertaken during the year, including corresponding results, dates and methods for each control activity;~~
  - ~~A summary of any adaptive management or contingency responses during the year where thresholds for control targets have not been achieved;~~
  - ~~Any challenges or issues encountered with livestock management, habitat relocation, mammalian pest or ecological weed management, or monitoring, along with how these difficulties were overcome or if they remain ongoing;~~
  - ~~Any new tools, technologies and methods deemed likely to improve the efficiency and effectiveness of livestock management, vegetation enhancement and habitat relocation, mammalian pest, or ecological weed management, which should be incorporated into the following years' pest management practices if suitable.~~

- ~~Prepare and submit to the Central Otago District Council successive detailed five-year restoration plans ("the Ardgour Restoration Area Plan") by the end of the five-year anniversary of the granting of all necessary approvals for the BOGP under the Fast-track Approvals Act. These plans should be prepared by a qualified Ecologist experienced in restoration ecology and include a detailed programme of activities to be carried out in next five years to contribute to achieving the 35-year outcomes set out in this management plan. These successive restoration plans should continue to be prepared until it can be demonstrated that the 35 year-outcomes set out in this management plan have been achieved.~~

- ~~The permanent removal of cattle grazing and cessation of the application of fertiliser or seed within the Ardgour Restoration Area prior to the commencement of any works within this area directed by this management plan;~~
- ~~In sourcing seeds for propagation and planting, ensure that at least 25% are sourced from outside the Dunstan Ecological District but within the Central Otago Ecological Region and, where appropriate, from sites in adjacent ecological regions.~~
- ~~Where the opportunity occurs, source seeds for propagation and planting from plants within the Direct Disturbance Footprint ("DDF").~~
- ~~Initiate and continue animal and plant pest control programmes within the Ardgour Restoration Area as laid out in the Mammalian Pest Management Plan[3] and Biosecurity and Plant Pest Management Plan[4].~~
- ~~Undertake annual operation monitoring, including using photo-points.~~
- ~~Undertake biodiversity outcome monitoring to assess progress against the 35-year outcomes as described in the Biodiversity Outcome Monitoring Plan[5].~~

Further details on the implementation, monitoring and reporting procedures outlined above are set out in this Ardgour Restoration Area Management Plan and the interlinking plans.

[3] ~~Habitat NZ Ltd. (2025). Bendigo-Ophir Gold Project: Mammalian Pest Management Plan. Habitat NZ Ltd., Auckland.~~

[4] ~~Habitat NZ Ltd. (2025). Bendigo-Ophir Gold Project: Biosecurity and Plant Pest Management Plan. Habitat NZ Ltd., Auckland.~~

[5] ~~Alliance Ecology Ltd. (2025). Bendigo-Ophir Gold Project: Biodiversity Outcome Monitoring Plan. Alliance Ecology Ltd., Auckland.~~

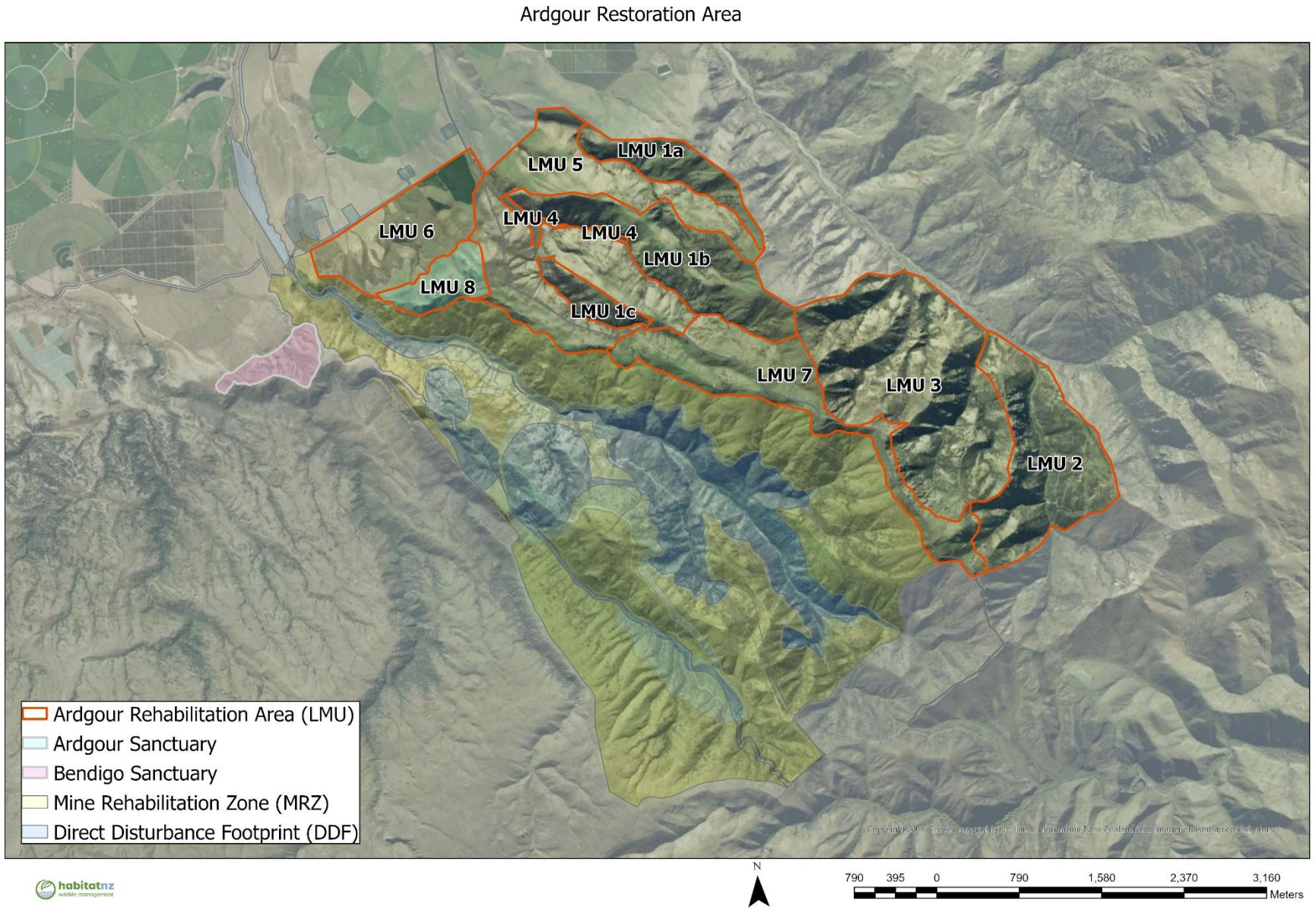

Figure 1. *The Ardgour Restoration Area (within red lines) and the individual land management units (LMU) that underpin this plan.*

2. CONDITIONS

The following consent conditions relate to achieving the 35-year outcomes for the Ardgour Restoration Area:

Ardgour Restoration Area Management Plan		
85	The consent holder must implement the Ardgour Restoration Area Management Plan ("ARAMP") certified as part of the approval of the BOGP pursuant to Section 81 of the Fast-track Approvals Act 2024 (or as amended in accordance with relevant conditions), and which forms part of the consents. The objective of the ARAMP is to enhance woody ecosystems and to sustain indigenous dominated herbfield (cushionfield) ecosystems to compensate for residual adverse effects on native biodiversity from the BOGP project.	Condition in line with Ardgour Restoration Area Management Plan.
86	To achieve the objective set out in Condition C85 above, the ARAMP must include, as a minimum: a. Restoration approach and intended outcomes; b. Property-wide management goals and actions, including those for fencing, access tracks, grazing and fertiliser use, restoration planting, wetlands, mammalian and plant pest management, Ardgour Rise road corridor, species specific management, fire management, biodiversity outcome monitoring and photo monitoring; c. Identification of land management units and management overview for each land management unit; and d. Inspection and compliance monitoring and reporting and continuous improvement process, including requirements to: i) Undertake annual operational monitoring, including using photo-points; and ii) Undertake biodiversity outcome monitoring to assess progress against the 35-Year outcomes listed in condition C87 (35-year outcomes below). The ARAMP required under Condition C86 [above] must also include the following specific requirements in Condition C84 to Condition C92 (specific conditions starting from condition directly below) which must be complied with.	

87	In addition to the requirements under Condition C86, the Consent Holder must incorporate the following 35-year outcomes in the ARAMP: *35-Year outcomes* a. The area of vegetation that meets the definition of Native Dominant Scrubland has increased from 22 to at least 32 ha in LMU1, 82 to at least 123 ha in LMU 2 and 0 to at least 8 ha in LMU3 over 35-years from the commencement of management described in this plan; b. The diversity of native tree, shrub and liane species in existing native scrubland has increased so that on average there are at least five native woody species (comprising at least two tree, two shrub and one liane species) in monitoring transects in LMUs 1 and 2; c. For non-woody areas of LMUs 1, 2 and 3 (excluding cushionfields), at least 30% of this area has native woody vegetation regenerating; d. The average annual abundance of native seed dispersing birds (tauhou, korimako and tuī) is at least 50% greater in native dominant scrubland and 25% greater in mixed scrubland in LMUs 1, 2 and 3 than they were in the 2023 and 2024 bird surveys in these areas; e. There is evidence of natural dispersal of native species within the areas of native woody vegetation in LMU 1 and 2 as evidenced by the presence of unplanted individuals of native shrubland and forest species (fern, herb, woody) (excluding matagouri, scented tree daisy and mingimingi) in at least 50% of vegetation monitoring transects; f. Kōwhai seedlings are establishing naturally in proximity (within 100 m) to at least five of the nine kōwhai groves that are currently present in the Ardgour Restoration Area); g. Survival of planted mataī and tōtara on alluvial surfaces in LMU 4 is >50% and surviving plants are >5m tall; and *h.* The extent of cushionfields in LMU 5 is the same or greater than as mapped through the *Applied Research Programme for Conservation Management, Rehabilitation and Expansion of*	Recommended condition from the Management Plan.

	Cushionfield. The number of individuals of four key Nationally Threatened and At-Risk cushionfield plant species present[6] within monitored populations shows an increasing or at least stable population in comparison to 2026 base line numbers (allowing for annual variation of ± 25%). *Advice Note: LMUs are identified in the ARAMP and include*: a. *LMU 1 – Broad Gully shrublands;* b. *LMU 2 – Upper Dry Creek shrublands;* c. *LMU 3 – Lower and Middle Dry Creek shrublands;* d. *LMU 4 – Alluvial valley flats;* e. *LMU 5 - Cushionfields;* f. *LMU 6 – Exotic pasture;* g. *LMU 7 – Short tussock grassland; and* h. *LMU 8 – Ardgour predator free sanctuary.*	
88	The Consent Holder must: a. Provide an annual report on progress on the ARAMP to Central Otago District Council by 30 November each year. Each annual report will report on progress with the proposed conservation actions including: i) Verification that livestock have been excluded and/or that their numbers have been reduced to target stock density levels and/or stated timings in the Ardgour Restoration Area; ii) A summary of native planting undertaken including species, grades, numbers, locations and methods including representative photos; iii) A summary of mammalian pest and ecological plant pest management activities undertaken during the year,	Condition in line with Ardgour Restoration Area Management Plan.

[6] *Ceratocephala pungens, Daucus glochidiatus, Myosotis brevis, Myosurus minimus* subsp. *novae-zelandiae.*

	including corresponding results, dates and methods for each control activity; iv) A summary of any adaptive management or contingency responses during the year to ensure thresholds for control targets will be achieved; v) Any challenges or issues encountered with livestock management, habitat relocation, mammalian pest or ecological weed management, or monitoring, along with how these difficulties were overcome or if they remain ongoing; and vi) Any new tools, technologies and methods deemed likely to improve the efficiency and effectiveness of livestock management, vegetation enhancement and habitat relocation, mammalian pest, or ecological weed management, which must be incorporated into the following years' pest management practices if suitable.	
89	In sourcing seeds for propagation and planting, the Consent Holder must ensure that at least 25% are sourced from outside the Dunstan Ecological District but within the Central Otago Ecological Region and, where appropriate, from sites in adjacent ecological regions. Where the opportunity occurs, source seeds for propagation and planting from plants within the DDF of the BOGP.	
90	The Consent Holder must initiate and continue mammalian and plant pest control programmes within the Ardgour Restoration Area as laid out in the Mammalian Pest Management Plan required under Condition C74, and Biosecurity and Plant Pest Management Plan required under Condition C69;	
91	The Consent Holder must permanently remove cattle grazing from, and cease applying any fertiliser or seed to, the Ardgour Restoration Area, prior to the commencement of any works authorised under this consent related to the Ardgour Restoration Area, except where fertiliser is specifically required for management purposes.	Recommended condition from the Management Plan.

92	The Consent Holder must prepare and submit to the Central Otago District Council successive detailed five-year restoration plans ("the Ardgour Restoration Area Plan") by the end of the five-year anniversary following commencement of the consent. These plans should be prepared by a qualified Ecologist experienced in restoration ecology and include a detailed programme of activities to be carried out in the next five years to contribute to achieving the 35-year outcomes set out in the RAMP and Condition C87. These successive restoration plans should continue to be prepared until it can be demonstrated that the 35 year-outcomes have been achieved.	Recommended condition from the Management Plan.

~~The following plans are also directly relevant to the Ardgour Restoration Area Management Plan:~~

- ~~The *Lizard Management Plan*[7], which provides detail on the measures employed to avoid or minimise effects on lizards, including the salvage and relocation of lizards into the Ardgour Restoration Area.~~
- ~~The *Terrestrial Invertebrate Management Plan*[8], which provides detail on the measures employed to avoid or minimise effects on invertebrates, including the salvage and relocation of invertebrates into the Ardgour Restoration Area.~~
- ~~The *Mammalian Pest Control Plan*[9], which provides detail on the measures employed to control introduced mammalian browsers and predators in ecological rehabilitation and offset/compensation sites.~~

~~[7] Alliance Ecology Ltd. (2025). Bendigo-Ophir Gold Project: Lizard Management Plan. Alliance Ecology Ltd., Auckland.~~

~~[8] Habitat NZ Ltd. (2025). Bendigo-Ophir Gold Project: Terrestrial Invertebrate Management Plan. Habitat NZ Ltd., Auckland.~~

~~[9] Habitat NZ Ltd. (2025). Bendigo-Ophir Gold Project: Mammalian Pest Management Plan. Habitat NZ Ltd., Auckland.~~

- The *Biosecurity and Plant Pest Management Plan*[10], which provides detail on the measures employed to control ecological weeds in ecological rehabilitation and offset/compensation sites.
- The *Biodiversity Outcome Monitoring Plan*[11], which provides detail on the monitoring and reporting of biodiversity outcomes within ecological rehabilitation and offset/compensation sites to inform adaptive management or contingency measures where required.

The *Applied Research Programme for conservation management, rehabilitation and expansion of cushionfield*[12], in accordance with which some of the applied research will be undertaken within the Ardgour Restoration Area and the results of which will inform subsequent management there.

[10] Habitat NZ Ltd. (2025). Bendigo-Ophir Gold Project: Biosecurity and Plant Pest Management Plan. Habitat NZ Ltd., Auckland.

[11] Alliance Ecology Ltd. (2025). Bendigo-Ophir Gold Project: Biodiversity Outcome Monitoring Plan. Alliance Ecology Ltd., Auckland.

[12] Manaaki Whenua – Landcare Research (2025) Applied Research Plan for conservation management, rehabilitation and expansion of cushionfield.

3. MĀTAURAKA MĀORI AND MANA WHENUA INVOLVEMENT

The Ardgour Restoration Area Management Plan will be implemented in a manner that recognises and provides for mātauraka Māori and the exercise of kaitiakitaka by mana whenua (Kāi Tahu), including their relationship with indigenous flora and fauna. Mana whenua will be involved in the monitoring and adaptive management of the Ardgour Restoration Area, and in the review and amendment of this management plan. Implementation of this Ardgour Restoration Area Management Plan will align with Cultural Impact Assessment recommendations and contribute to long-term outcomes for mana whenua.

The Ngāi Tahu Claims Settlement Act (NTCSA, 1998) lists taonga/taoka species that have special importance to Kāi Tahu. Those that have been recorded from the Ardgour Restoration Area and adjacent areas are listed in Table 1. Several of these will directly benefit from the restoration management proposed in this management plan. However, not all species that are important to mana whenua are listed in the NTCSA and many of these, especially those associated with more mature native forest, will also benefit from the restoration management outlined in this plan. These include plants such as kōwhai and koromiko which are included in the planting recommendations in this plan.

Table 1. Taoka birds and plants that are known or thought to be present in the Ardgour Restoration Area and surrounding environment. Those species that will benefit directly from restoration of the Ardgour Restoration Area are indicated in the right-hand column.

Birds		
Seen and/or heard in the area		
Kārearea (NZ falcon)	*Threatened – Nationally Vulnerable*	*Yes*
Pihoihoi (NZ pipit)	*At Risk -Declining*	
Kōau (black shag)	*At Risk*	
Karoro (black-backed gull)	*At Risk - Declining*	
Kāhu (Australasian harrier)	*Not threatened*	
Pūtakitaki (paradise shelduck)	*Not threatened*	
Miromiro (tomtit)	*Not threatened*	*Yes*
Riroriro (grey warbler)	*Not threatened*	*Yes*
Pīwakawaka (fantail)	*Not threatened*	*Yes*

Identified from records in the last 10 years		
Tara (black-fronted tern)	*Threatened – Nationally Endangered*	
Mātā (South Island fernbird)	*At Risk - Declining*	
Kōau (little shag)	*At Risk*	
Kōparapara/ korimako (bellbird)	*Not threatened*	*Yes*
Kūkupa/ kererū (NZ woodpigeon)	*Not threatened*	*Yes*
Poaka (pied stilt)	*Not threatened*	
Pūkeko	*Not threatened*	
Kōtare (kingfisher)	*Not threatened*	
Tete (grey teal)	*Not threatened*	
Plants		
Taramea (Aciphylla aurea - Golden Spaniard)	*Not Threatened*	*Yes*
Wī (Poa cita - silver tussock)	*Not Threatened*	*Yes*
Toetoe (Austroderia richardii - Richards toetoe)	*Not Threatened*	*Yes*
Korokio (Corokia cotoneaster)	*Not Threatened*	*Yes*
Kānuka (Kunzea robusta)	*Not Threatened*	*Yes*

~~2.~~4. RESTORATION APPROACH & INTENDED OUTCOMES

~~4~~2.1 Introduction

The focus of this Ardgour Restoration Area Management Plan is on ecosystem enhancement rather than on enhancing individual species generally, although the plan includes a focus on kōwhai and forest birds Korimako and tuī. However, in enhancing ecosystem condition (biodiversity uplift), the restorative management described here will benefit a wide range of individual plant and animal species including several that are ranked nationally or regionally as threatened and at risk.

The plan is intentionally non-prescriptive, recognising that ecological restoration is a dynamic process influenced by changing biotic and abiotic factors that cannot be fully anticipated at the outset. As restoration progresses, emerging ecological conditions, species responses, and environmental variables will require adaptive management approaches that differ from initial projections. For this reason, the first version of the Ardgour Restoration Area Management Plan is for a five-year period commencing when all necessary approvals and authorisations for the BOGP are granted.

This section outlines the biodiversity outcomes (uplift) that are predicted to be achieved in 35-years' time and then discusses how these are then implemented through five-year management goals and annual work plans. In developing both the 35-year outcomes and five-year goals, it is important to consider both the changes in biodiversity that might occur without restoration management (how "additional" restoration outcomes are) and ~~be clear about~~ the factors that ~~will~~ might constrain the ability of management to achieve these outcomes (in essence the risks that management needs to address)~~se~~. Trajectories of biodiversity change are discussed in Appendix 1 while ~~These~~ constraints are ~~in essence the risks that management needs to address and are~~ discussed in Appendix 2~~1~~.

~~4~~2.2 Land management units

A key part of the approach to management of the Ardgour Restoration Area is the division of the ~~area~~ Ardgour Restoration Area into eight unique LMUs (Figure 2). Each LMU has been distinguished based on restoration management goals (potential ecosystem composition) and management requirements. Some LMUs are large while others are small, but each has

a unique set of values and management requirements. Five-year goals and specific management actions for each LMU are discussed in Section ~~4~~6. A summary of the LMUs is provided in Table 2.

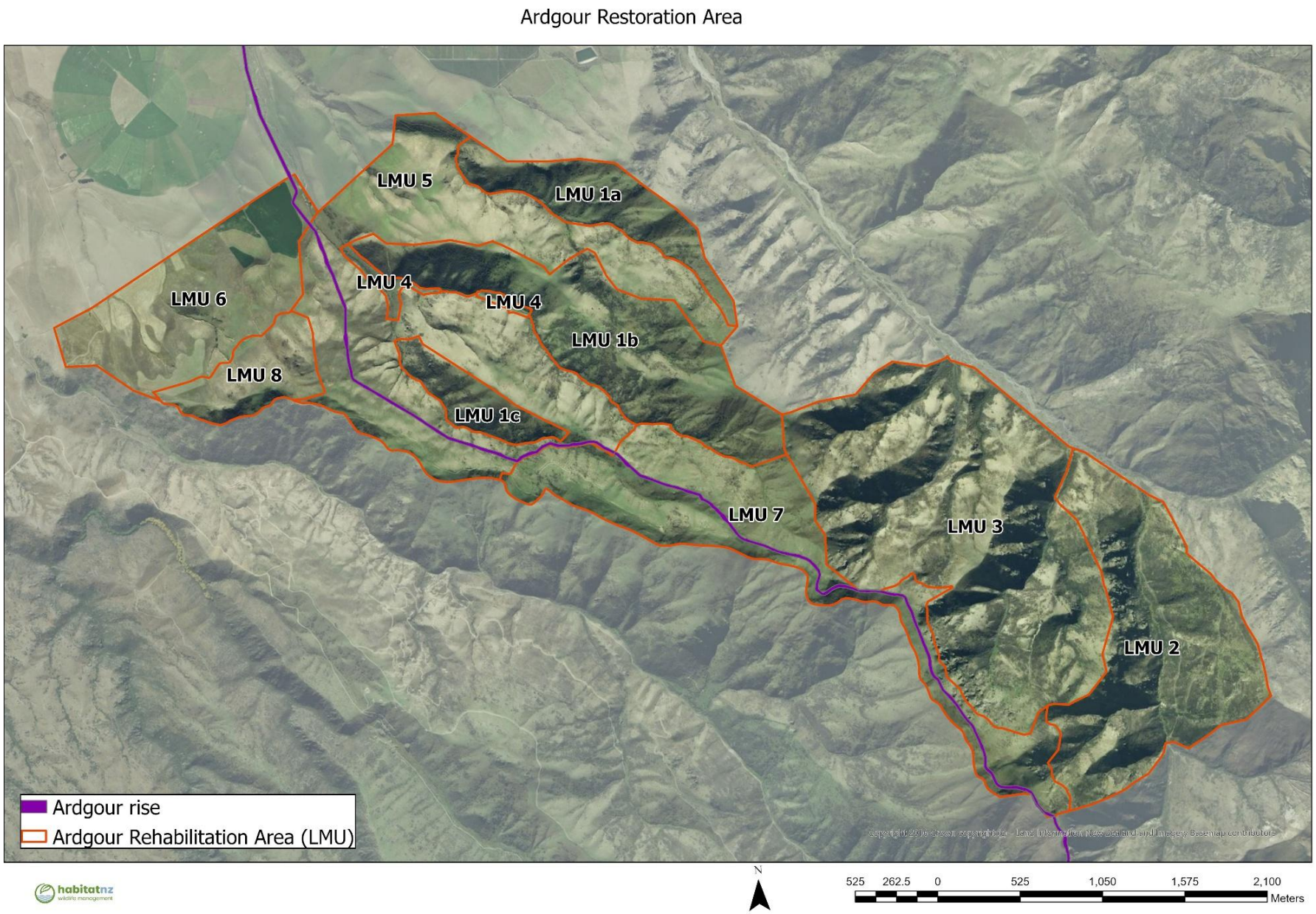

Figure 2. *Landscape Management Units- Ardgour Restoration Area*

Table 2. *Land Management Unit summary (Vegetation types: ExP, Exotic pasture; MDH, Mixed depleted herbfield (cushionfield) and grassland; MTS, Mixed tussock shrubland and grassland; MSc, Mixed scrubland; NDT, Native dominated tussockland; NHS, Native herbfield and shrubland; NDS, Native dominated scrubland).*

LMU	Unit name	Area (ha)	Current vegetation types (ha)						
			ExP	MDH	NHS	NDT	MTS	MSc	NDS
1	Broad Gully shrublands	217.2	38.1	11.1	0.0	33.0	112.4	0.8	21.6
2	Upper Dry Creek shrublands	167.6	0.6	0.0	0.0	21.1	61.6	2.3	82.0
3	Lower Dry Creek shrublands	298.6	0.6	35.0	0.0	58.8	120.5	83.8	0.0
4	Alluvial valley flats	8.1	0.0	0.8	0.0	0.0	6.0	0.0	1.3
5	Cushionfields	261.3	70.7	138.6	0.0	1.7	35.1	15.1	0.0
6	Exotic pasture	113.6	110.4	2.9	0.0	0.0	0.0	0.3	0.0
7	Short tussock grassland	158.2	27.1	20.1	5.5	93.0	12.4	0.0	0.0
8	Predator free area	38.3	12.3	20.0	0.0	0.0	3.2	0.0	2.9

~~42~~.~~33~~ 35-year outcomes

The~~se~~ 35-year outcomes focus on the expected condition of native biodiversity in the Ardgour Restoration Area (the biodiversity uplift that is achieved) rather than on the management inputs that will be used to achieve this (e.g. number of plants established~~,~~ or pest animals killed). The focus is on ecosystems rather than threatened species, although the threatened species present will directly benefit from this restorative management (see Section ~~43~~.10).

It is predicted that in 35 years' from granting of consent that the following biodiversity outcomes will have been achieved because of restoration management in the Ardgour Restoration Area (the performance measures that will be used to measure success against these eight biodiversity outcomes are discussed in Section 5.12):

~~1.~~ The area of vegetation that meets the definition of Native Dominant Scrubland has increased from 22 to at least 32 ha in LMU1, 82 to at least 123 ha in LMU 2 and 0 to at least 8 ha in LMU3 over 35-years from the commencement of management described in this plan.~~In LMUs 1, 2 and 3, the area of woody vegetation where native~~

~~woody species comprise >50% of the ground cover has increased by 50% over that mapped in 2026.~~

1.

2. The diversity of native trees, shrub and liane species in existing native scrubland has increased so that on average there are at least five native woody species (comprising at least two tree, two shrub and one liane species) in monitoring transects in LMUs 1 and 2.
3. For non-woody areas of LMUs 1, 2 and 3 (excluding cushionfields), at least 30% of this area has native woody vegetation regenerating.
4. The average annual abundance of native seed dispersing birds (tauhou, korimako and tuī[13]) is at least 50% greater in native dominant scrubland and 25% greater in mixed scrubland in LMUs 1, 2 and 3 than they were in the 2023 and 2024 bird surveys in these areas.
5. There is evidence of natural dispersal of native species within the areas of native woody vegetation in LMU 1 and 2 as evidenced by the presence of unplanted individuals of native shrubland and forest species (fern, herb, woody) (excluding matagouri, scented tree daisy and mingimingi) in at least 50% of vegetation monitoring transects.
6. Kōwhai seedlings are establishing naturally in proximity (within 100 m) to at least five of the nine kōwhai groves that are currently present in the Ardgour Restoration Area).
7. Survival of planted mataī and tōtara on alluvial surfaces in LMU 4 is >50% and surviving plants are >5m tall.
8. The extent of cushionfields in LMU 5 is the same or greater than as mapped through the *Applied Research Programme for conservation management, rehabilitation and expansion of cushionfield*~~in 2026~~. The number of individuals of ~~the three~~four key Nationally Threatened and At-Risk cushionfield plant species[14] present within

[13] Note only tauhou have bee recorded on site to date, but it is expected that through restoration management korimako and tuī will also occur here.

[14] *Ceratocephala pungens, Daucus glochidiatus, Myosotis brevis, Myosurus minimus* subsp. *novae-zelandiae*.

monitored populations shows an increasing or at least stable population in comparison to 2026 base line numbers (allowing for annual variation of ± 25%).

~~8.~~

~~2.5~~4.4 Relationship between 35-year outcomes and five-year goals

The 35-year outcomes focus on the expected condition of native biodiversity in the Ardgour Restoration Area in 35 years' time, relating specifically to the biodiversity uplift that is expected to occur. The five-year goals that are outlined in the next two sections relate to the management actions that represent the stepping-stones towards achieving the 35-year outcomes ~~(these are also summarised in Appendix 2)~~. These five-year goals are split into those that apply across the whole of the Ardgour Restoration Area (Section ~~3~~ 5 - property wide management) and those that relate to the individual land management units (Section ~~4~~ 6 - land management units). The use of five-year goals is important because:

- The type of management undertaken will vary through time (e.g. fencing will mainly occur in the first five-year period), and
- The approach being taken to management is adaptive, whereby future management (e.g. species planted or livestock grazing patterns) can be adjusted based on the results of monitoring to make sure restoration stays on course to achieve the 35-year outcomes.

These five-year goals will be updated every five years. The process for doing this is described in Section 7~~5~~. The actual on-the-ground management will then be outlined in annual one-year workplans. An indicative year-one workplan is included as Appendix 3~~3~~, although some of the details are likely to be modified depending on when consent is granted for the mine as some of the management actions can only occur in particular seasons (e.g. seed collection). These work plans will be produced annually in August/September based on a review of the previous year's management work and progress against outcomes (see Section 7~~5~~).

~~3.~~5. PROPERTY WIDE MANAGEMENT

~~5~~3.1 Introduction

This section outlines management goals and actions that relate to aspects of restoration management that occur across all the Ardgour Restoration Area. Management goals for the individual LMUs are discussed in detail in Section 6~~4~~. There will also be specific species relocations and applied research that occurs in the Ardgour Restoration Area, and these are detailed in other plans[15]. In the present section, property wide management actions are detailed.

~~5~~3.2 Fencing

Fencing is critical to control livestock access. Livestock will need to be removed from areas where management aims to enhance the diversity and species richness of woody vegetation (~~especially~~ specifically LMUs 1, 2 and 4 in the first five years). Conversely, livestock will need to be grazed in other areas, especially in LMU 5 (Cushionfields), where they will be used to control the unwanted growth of exotic plant species, as well as for maintaining short exotic pasture to act as firebreaks to protect woody regeneration. ~~Parts of the Ardgour Restoration Area will not be subject to restoration management during the life of this first five-year restoration plan and can continue to be grazed (e.g. LMU 3, 6 and 7).~~Some additional fencing may be required for livestock management purposes as restoration fencing will alter paddock layouts.

Where possible, existing fencing will be used to manage livestock and all existing fences around LMU 1, 2 and 4 will need to be inspected to make sure that they are sheep-proof. However, new fencing will also be required and will need to be sheep proof, either 7-wire or sheep netting. There will also be a need for some rabbit proof fencing, primarily around kōwhai clusters, which will require rabbit netting (see Appendix 4~~4~~.3). New fence lines will primarily~~be~~ located in exotic pasture vegetation and will specifically avoid cushionfields. Guidance on the appropriate fence type and final fence location will be sought from both

[15] Ref LMP and ARPCSAP.

the grazier and the fencing contractor that is engaged to do this work, but indicative new fences are shown in Figure 3. All fences will require gates both to provide management access into these areas and to muster out any stock that accidentally get into fenced areas – advice on gate location will be sought from the grazing lessee.

Parts of the Ardgour Restoration Area will not be subject to restoration management during the life of this first five-year restoration plan and can continue to be grazed (e.g. LMU 3, 6 and 7). Fencing plans for these areas will be included in subsequent five-year management plans.

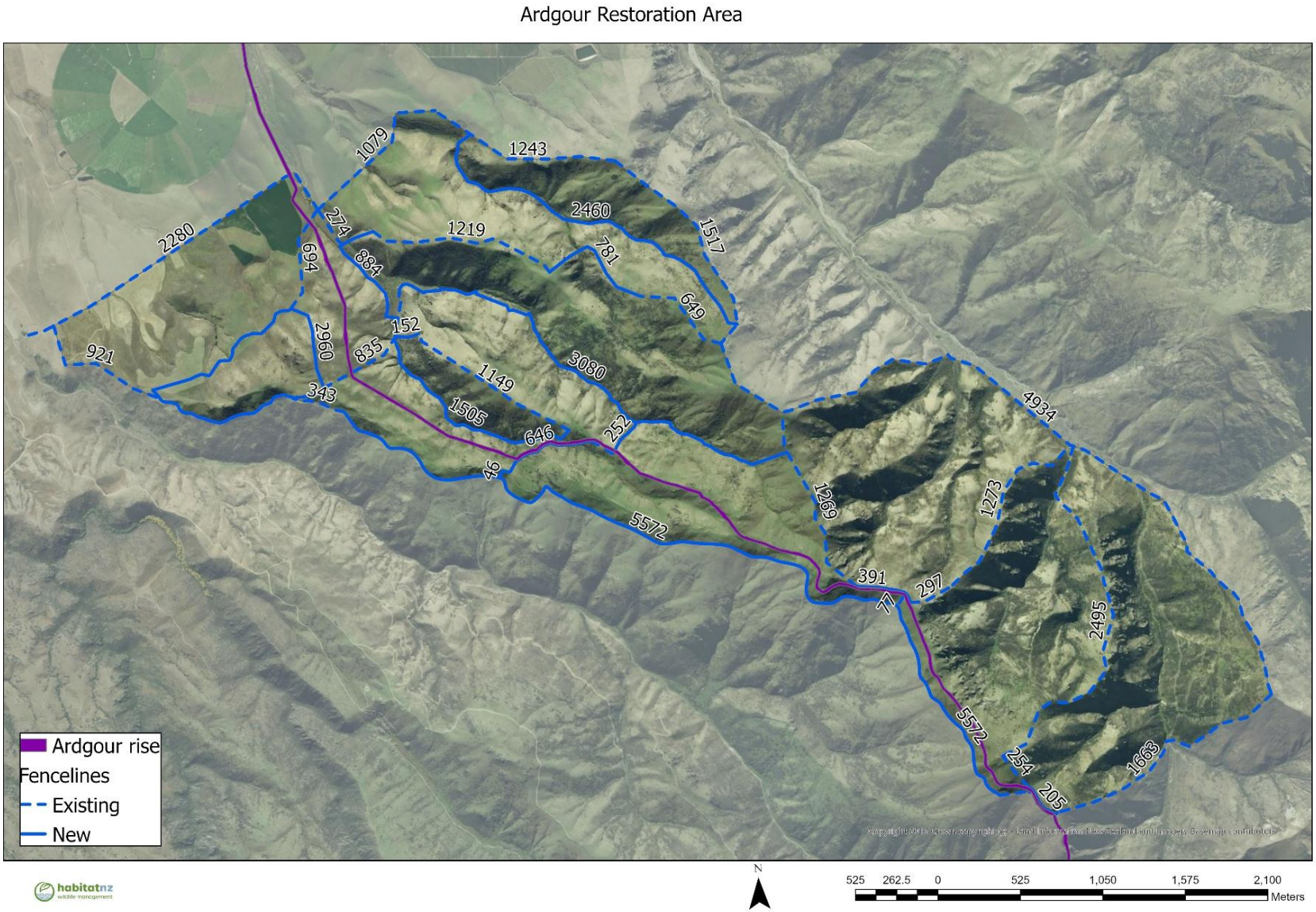

Figure 3. *Indicative plan of where new fences are required.*

In locating new fencing, and its staging, several factors need to be considered including:

- Practicalities of fence building and maintenance – new fence lines will need to be located in areas where it is easy to install the fence and will ~~primarily~~ be in existing exotic pasture avoiding cushionfields.
- Implications for stock movement – location of new fences ~~also~~ needs to avoid the risk of stock smothering and allow for stock to readily access all parts of a grazing paddock.
- ~~Some additional fences may also be required to better manage livestock within the residual grazing areas (decisions on this will be made in consultation with the grazier).~~
- Provision of stock water – new fencing will need to be located so that stock have access to drinking water (e.g. natural water courses, dams or reticulated water). ~~It may be necessary to install reticulated water for paddocks where new fencing will preclude stock from accessing the existing water sources.~~
- Management access – new fences need to be built in a way that allows for ~~easy~~ efficient management access, especially via access tracks (see Section 3.3).

Fences that are being used to exclude livestock need to be checked annually to make sure that they continue to be stock proof. Given that the grazier will be aware when they muster livestock if any stock are missing, this probably does not need to be undertaken in a formal manner but is something that both the grazier and the restoration managers do need to be aware of.

All proposed new fencelines will be walked by an experienced ecologist with the fencing contractor prior to installation to ensure that impacts on ecological values are minimised.

Year five goals:

Fencing has been upgraded or installed to a standard that protects biodiversity values in LMUs 1, 2 and 4.

Management actions:

Year 1 – ensure that the existing fences around LMU 1 and 2 are stock proof.

Year 1 – have an experienced ecologist walk all proposed fencelines with fencing contractor to make sure that ecological impacts are minimized. This needs to be undertaken in September/October for all areas that may contain spring annuals.

Years 1-3 – install new fencing to allow stock exclusion from LMU 1 (but noting that some fencing around LMU 1 might be temporary until LMU 4 fencing has been completed).

~~**Year 2 –** as required install additional fences for efficient livestock grazing.~~

Year 2 – complete fencing of kōwhai clusters across the Ardgour Restoration Area using rabbit netting. These fences should be located at least 25 m from remnant kōwhai trees to allow room for planting and natural regeneration.

Year 3 ~~– onwards =~~fully fence ~~off~~ LMU 4 ~~as dictated by planting plans for this LMU~~ (see Section ~~6~~4.5).

~~5~~3.3 Track establishment and management

Good access is important for restoration management and needs to be suitable for at least a 'side-by-side' vehicle so that plants, traps and other equipment can ~~easily~~ safely be taken into areas where they are required. Access is also required for the grazing lessee so they can move livestock.

Tracking will primarily utilise existing farm tracks, but all will need to be checked, and upgraded as required, to make sure they are of a standard to allow 'side-by-side' access. Track upgrades and installation of new tracks will need to be undertaken in a manner that reduces the need for ongoing maintenance.

The proposed alignment of any new tracks will be walked by an experienced ecologist with the contractor prior to construction to ensure that impacts on ecological values are minimised. New tracks will be in areas of existing pasture avoiding cushionfields.

Year five goals:

Tracking has been upgraded and new tracks installed to support restoration management.

Management actions:

Year 1 – have an experienced ecologist walk all proposed new track lines with contractor to make sure that ecological impacts are minimized. This needs to be undertaken in September/October for all areas that may contain spring annuals.

Year 1 – upgrade existing tracks to 'side-by-side' standard.

Year 1-2 – install additional tracks ('side-by-side' standard) to provide management access.

Year 2 onwards – maintain tracks.

53.4 Grazing and fertiliser

Management of the Ardgour Restoration Area requires ongoing grazing for several reasons:

- To reduce the spread of unwanted plants onto cushionfields (LMU 5), especially tall exotic herbs like thistles and the shrub sweet brier.
- To help keep vegetation short around areas of regenerating shrubland to act as a fire break.
- Because it is not possible to restore the whole site in the first five years, ongoing grazing helps prevent the development of rank grass swards and the expansion of unwanted weeds in areas that are not going to be subject to active restoration management initially.

All livestock grazing will be sheep only. Cattle will not be grazed anywhere within the Ardgour Restoration Area because of the damage they do to wetlands, cushionfields and regenerating shrubland. Fertiliser and seed will also not be applied anywhere in the Ardgour Restoration Area, except where required for restoration management purposes.

It is proposed that for the five years covered by this management plan grazing will involve running 1000 two-tooth hoggets post-shearing within the Ardgour Restoration Area, excluding LMU1 and 4 and the three Dry Creek blocks. These two-tooth hoggets will be kept in this area until March each year. As these sheep are not lambing ewes there will be no major issues with access for construction of the Ardgour Rise road or for ecological restoration work (spring annual surveys, setting up restoration programme).

In addition, up to 600 single ewes (ie ewes carrying one lamb) will be run in the three Dry Creek blocks (Lower, Middle and Upper Dry Creek) for lambing. This will be from mid-September through until mid-November, when they will be shifted back to Cloudy Peak. This will continue annually in all three Dry Creek blocks, except grazing will cease in Upper Dry Creek (LMU2) when planting commences there. Management access will still be possible to the Dry Creek paddocks as single ewes are less prone to disturbance than those with twins. Access will only be required at this time for photo-point setup and some

animal pest control/monitoring and some of this can possibly occur after the ewes have been removed.

Cattle will not be run at any time, nor will there be any fertiliser applied, or other improvements made including spraying of woody vegetation or sowing of pasture grasses other than that needed for erosion management of larger earth-worked areas (e.g. parts of Ardgour Rise Road).

~~Final decisions on specific grazing management will be made with the grazier, but it is expected to include the following:~~

- ~~Sheep grazing will mainly involve a single mob grazing small areas for short durations, before being moved on to the next block.~~
- ~~Grazing will primarily occur in spring and early summer when grass and legume growth is at a maximum.~~
- ~~Lambing will not be undertaken within the Ardgour Restoration Area because it limits management access.~~

It is expected that, through this style of grazing, sheep will keep biomass low to reduce fire risk through the driest parts of summer when the fire risk is highest, while also reducing the spread of weed species within the areas that are being grazed.

Year five goals:

Sheep have been grazed in a manner that supports biodiversity outcomes.

Management actions:

Year 1 – establish a contract grazing arrangement with a grazier that supports the restoration goals of this management plan including sheep grazing only.

Year 1 – ensure that stock water is available in all grazed areas.

~~**Year 1** – install additional fences to allow for effective and efficient management of livestock.~~

Year 1 onwards – no fertiliser or grass/pasture seed will be applied ~~except where required for restoration management~~for grazing purposes.

Year 2 onwards – annually review the effectiveness of grazing on biodiversity outcomes.

53.5 Restoration planting

This section sets out the broad approach to establishing restoration plantings in the Ardgour Restoration Area. It is, however, important that the approach to planting is adaptative in terms of species choice and planting densities. This is necessary as planting should be informed by success to date and will obviously also be influenced by the availability of planting material (species and numbers). More detailed information on species choice for planting is provided in Appendix 44.

- Four different types of restoration planting are proposed in this first five-year planning period:
    - Enrichment of existing native woody vegetation in LMU 1 and 2.
    - Addition of kōwhai and other speciesplants around existing kōwhai trees throughout the Ardgour Restoration Area.
    - Restoration of alluvial podocarp dominated forest in LMU 4.
    - Enrichment plantings of short tussocks and taramea in LMU 7 (if required).

Because much of the methodological approach for planting is similar and because both enrichment and kōwhai planting occur across several LMUs, the approach to planting (including management actions) is described here rather than for the individual LMUs in Section 64. More details are also provided in Appendix 44. The methodological approach for alluvial podocarp planting in LMU 4 is also described here, but the management actions are included in Section 64.5.

The general approach to restoration planting includes:

- Plant ecologically appropriately sourced species adapted to local conditions (but including an elementat least 20% of non-local genetic material to increase genetic diversity as a contingency against future climate change especially resistance to drought and heat).
- Plant in both autumn and late winter/early spring t, at least initially, too avoid winter frosts but provide the longest possible time for root systems to develop before

~~summer droughts occur~~spread the risk of adverse weather events impacting plantings.

- Use an herbicide application, or hand weeding, to kill pasture grasses and forbs prior to planting where required. The use of herbicide helps maintain a (dead) ground cover to reduce risk of frost heave, wind erosion and establishment of weeds.
- Ensure ~~vulnerable~~ plants are protected against lagomorphs (guards or netting) and all plants are staked at planting if required.
- Use mulch where possible to help retain soil moisture and reduce weed competition.
- Include a fertiliser tab at planting~~.~~, placed at the side/base of the planting hole.
- Undertake post-planting weed control as required.

A reputable nursery will be contracted to propagate and establish the restoration plantings, and they will be asked to follow industry best-practice for sourcing, propagation , hardening off and planting.

Collection and propagation of plant material:

Eco-sourcing is important to ensure that plants are adapted to local conditions. Where possible plants for restoration will be sourced from wild seed sources in the Dunstan Ecological District. No seeds will be sourced from garden or similar domestic plantings. Many species that have been identified for planting are not present or difficult to access in the Dunstan Ecological District (e.g. podocarp's), so sources further afield (especially in drier climates) will be required. These may include the Pisa Range, but sourcing from more distant populations is also likely to be necessary. Ideally, seed should be sourced from populations with greater than 20 individuals, and across at least three discrete populations. In addition, at least 20~~-25~~% of all plants for each species to be planted should be sourced more widely from the Central Otago Ecological Region (outside the Dunstan

Ecological District) to introduce a greater genetic base into plantings thus increasing their resilience to potential future climate change[16].

Kōwhai is an important target species for restoration, but collection of suitable kōwhai seed does have a number of challenges. Because of known hybridization issues within the kōwhai genus (*Sophora*), only parent plants at least 1 km distant from known plantings will be used. Because most wild kōwhai trees occur as single isolated individuals, genetic variability within seeds from single trees is very low. Kōwhai seed sourcing will therefore be spread over a minimum of at least 20 sites, with at least half the sites having >~~five~~ 5 kōwhai trees present. These sites will need to be spread widely across the Central Otago Ecological Region (Lindis, Pisa, Dunstan, Old Man, Maniototo Ecological Districts) as well as including plants from sites in adjacent ecological regions (Wā~~a~~naka, St Bathans and Hawkdun Ecological Districts). Taking this very broad approach to seed collection will facilitate the development of a more genetically diverse range of planting material, with plantings in individual kōwhai clusters comprising a minimum of plants from a least 5 of these sites.

Two nationally threatened and at risk *Carmichaelia* species are proposed to be included in the kōwhai clu~~a~~ster plantings[17]. All efforts should be made to source seed from plants of these species that are located within the DDF.

Details on sourcing will be discussed with the plant propagation contractor that is engaged to undertake this work, but all plants will be propagated from seed. All collection of seeds for propagation will follow guidelines from landowners, local government and the Department of Conservation as appropriate for the site and species.

In consultation with Kāi Tahu, species additional to those listed in Appendix 4 will be established. These might be taoka species or other species that have important values to mana whenua. Species will need to be appropriate for the environmental conditions

[16] See also Tanes Tree Trust Fact Sheets 2 and 15 for further information on seed collection (https://docs.tanestrees.org.nz/)

[17] *Carmichaelia crassicaulis* subsp. *crassicaulis* (Threatened – Vulnerable) and *Carmichaelia petriei* (At Risk – Declining).

present in the Ardgour Restoration Area as well as the overall objectives of restoration management.

Species choice for restoration is based on a mixture of what might have occurred in this area in the past, what occurs in this landscape today and what ecological experience suggests might grow here under current and potential future conditions. In addition, species choice is influenced by known growth rates (faster growing species are preferred because they shade out grass more quicklyer), the ability of a species to provide suitable conditions for subsequent indigenous regeneration, and the attractiveness of the species to seed dispersing birds (fruit and nectar). Overall species choice represents a balance between those species that will grow best under the prevailing environmental conditions and are likely to contribute most to meeting the restoration goals for the Ardgour Restoration Area. More detail on seed sourcing is provided in Appendix 4.

Details on plant propagation and the likely preferred sizes of plants for planting will be developed in consultation with the contractor engaged to undertake this work. Plant size will vary among species and sites and will follow best-practice guidelines appropriate for this area. A suitable 'hardening off' site will be provided as part of the mine infrastructure to make sure that plants are well adapted to local conditions prior to planting.

Site preparation and planting:

Site preparation and planting will vary depending on the local situation and will differ between the three planting situations described above and are covered in detail in Appendix 54. A suitable 'hardening off' site will be constructed as part of the mine infrastructure and will be fenced to exclude livestock, feral ungulates and lagomorphs (rabbits and hares). Ongoing possum and rodent trapping control will also be undertaken to protect plants stored there. All plants will be hardened off in this area prior to planting unless hardening off is done elsewhere.

The timing of planting is largely dictated by climatic conditions, microsite attributes and plant growth patterns. Both autumn and spring planting will be undertaken, especially in the first few years. Based on initial experience, it might be that subsequently one season is shown to be preferable to the other for planting. The exact time in autumn and spring that planting occurs will depend on seasonal conditions (particularly when the soils become wet in autumn/winter) and the microsites available for planting.The annual work cycle is

~~focused on late winter/spring planting with the aim of gaining full benefit from the period when soil moisture is likely to be at a peak. However, plants must also be suitably hardened off prior to planting to withstand conditions at the time of planting. Sites protected from severe frost may be planted in August, but in more frost-sensitive sites planting should be delayed until September and October).~~

Where possible (LMU4 and the kōwhai clusters), mulch will be used at planting. Plant guards will be used for all plantings as they provide some protection against adverse climate conditions as well as protecting against rabbits and hares.

Post-planting maintenance:

Post-planting weed control will be undertaken as required to ensure that grass and woody weeds do not suppress the plantings – the herbicide used will depend on what weed species are being targeted and will meet all regulatory requirements. In all situations it is proposed to spread planting over several years to reduce the risk of failure in any one year, with blanking undertaken if mortality is greater than 30% in years two and three for kōwhai and alluvial podocarp plantings and repeated with additional amendments until numbers of growing seedlings meet requirements.~~.~~

Timing summary:

The following are the main restoration planting actions and their seasonal timing.

- Autumn – seed collection and pre-planting spraying where required, and planting i~~–~~n suitable sites.
- ~~Winter – start planting in frost free sites in late winter.~~
- Spring – finish planting in suitable sites, and post planting maintenance.
- Summer – further post planting maintenance and seed collection.

The exact timing of when the first planting is undertaken will depend on the start date of management of the Ardgour Restoration Area. This will influence when a suitably qualified plant propagator(s) can be contracted and then when seed collection can occur (which is usually ~~restricted to~~in late summer and autumn). Plant propagation and then planting cannot occur until after seed collection has occurred.

Restoration planning for ongoing planting in LMUs 1, 2 and 4, and in other LMUs (e.g. LMU 3) will be included in subsequent five-year management plans and will draw heavily on the experiences learnt from the first five years.

Year five goals:

1. Initial plantings have been undertaken in LMUs 1, 2 and 4.
2. Kōwhai groves have been rabbit fenced, and a start made to planting these.
3. For difficult to source and/or grow plants such as podocarps, seeds have been collected, and propagation has started.

Management actions:

Year 1 – contract a suitably qualified plant propagator (nursery).

Year 1 onwards – seed collection and propagation.

Year 1 or 2 – establish a suitable 'hardening off' site as part of the mine infrastructure.

Year 2 – map all kōwhai trees/groves and plan sites for new kōwhai groves (see Appendix 44.3).

Year 2 or 3 onwards – planting and ongoing maintenance.

Year 3 or 4 – plant kōwhai at five existing groves and establish at least five new groves (including rabbit fencing).

Year 3 or 4 onwards – monitor kōwhai plantings.

Year 4 or 5 – plant kōwhai and other species at four existing groves and establish at least six new groves (including rabbit fencing).

Year 4 or 5 – commence a programme of enrichment plants with short tussocks and taramea in LMU 7 if required.

53.6 Wetlands

A few small wetlands are present in the Ardgour Restoration Area (Figure 4) including swamps/marshes, fens and seeps[18]. Swamp/marsh is the main wetland type and are mainly centered on the stream draining Top Broad Gully and Broad Gully South, although some additional areas are in Broad Gully North. Because of their very small spatial extent (1.5 ha) and scattered distribution, they have not been delineated as a separate LMU.

Two major factors that have the potential to impact wetlands are cattle pugging and disturbance through fence and track construction. In addition, any public access using off-road vehicles (including bikes) can quickly damage wetlands, as can poor construction practices associated with the Ardgour Rise Road. Cattle pugging will not be an issue as cattle will not be grazed in the Ardgour Restoration Area. New track and fence lines will be sited to avoid impacts on wetlands. Future impacts of climate change on wetlands are also possible, although the restoration of woody vegetation in the catchment of the Broad Gully blocks should reduce the amount of sediment impacting wetlands, thereby offsetting any potential climate change impacts.

[18] See *Wetland Values Assessment* report.

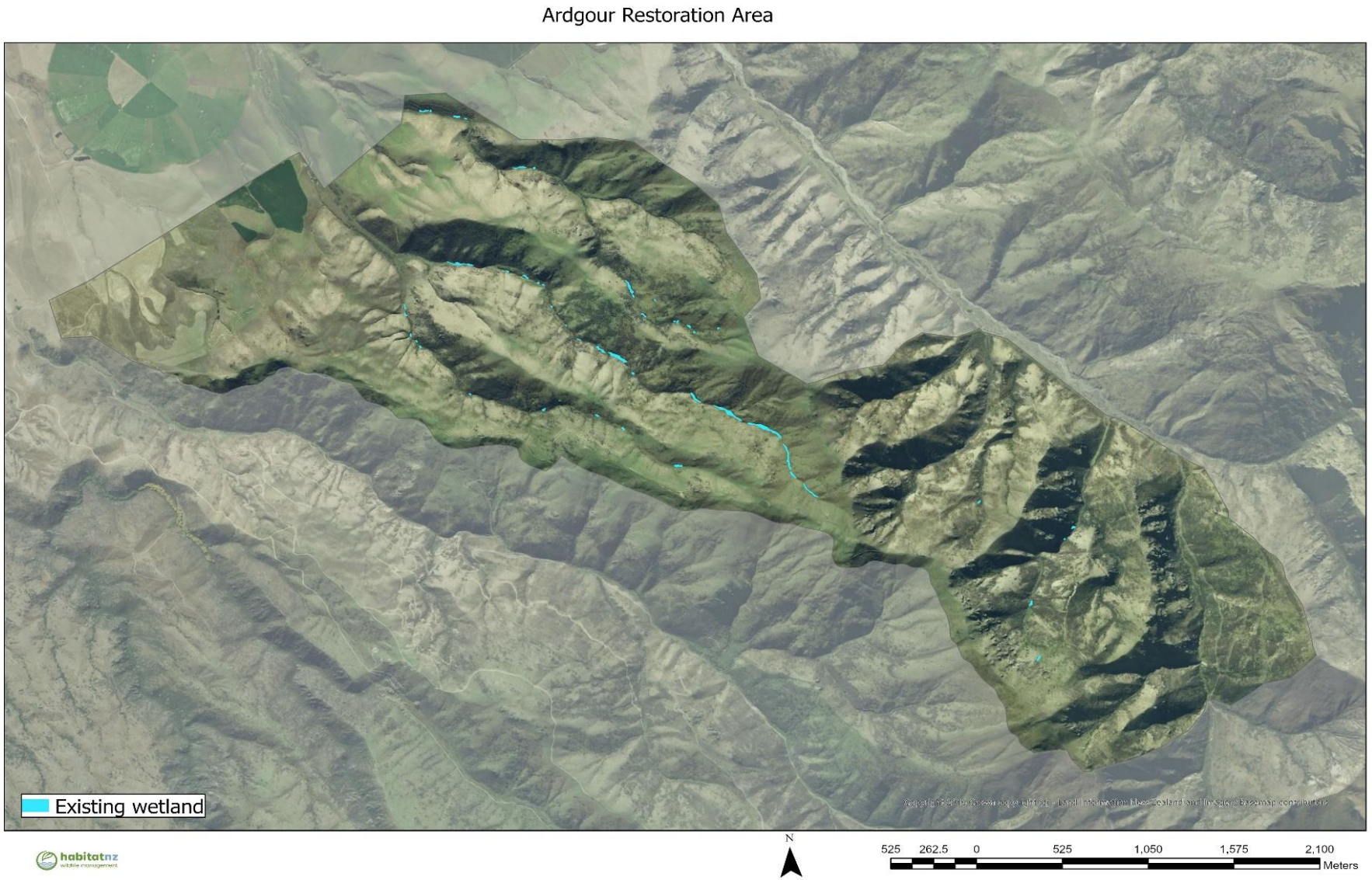

Figure 4. *Mapped wetlands (shown in blue) in the Ardgour Restoration Area.*

Year five goals:

The composition and condition of the mapped areas of wetland within the Ardgour Restoration Area is similar to what it was on Year 1.

Management actions:

Year 1 – ensure new fencing and tracking avoids any wetlands.

~~**Year 1** – where reticulated water needs to be taken from wetlands, make sure that this does not adversely impact wetlands.~~

Year 4 – repeat wetland photo-monitoring[19].

53.7 Mammalian pest management

Mammalian pest species, including herbivores (deer[20], goats, hares, rabbits), omnivores (pigs, possums, hedgehogs, rats, mice) and carnivores (mustelids, cats), can limit the success of this restoration project. Herbivores browse and graze vegetation, impacting existing native vegetation, natural regeneration and plantings. However, herbivory is also an important management tool in some situations, especially to prevent exotic plant species outcompeting low-growing cushionfield vegetation (LMU 5). Pig rooting can have a serious impact on seedlings and other ground vegetation and restoration plantings, as well as impacting soil biota (invertebrates and fungi) and soil structure. Carnivores impact native fauna including large invertebrates such as weevils and molluscs, lizards and birds.

While it would be best to eradicate all these pest species from the Ardgour Restoration Area this is not feasible or even necessarily desirable (in the case of rabbits and cushionfields). Instead, the approach taken here (and expanded on in the *Mammalian Pest Control Plan*) is to focus control where impacts on biodiversity uplift are likely to be greatest (considering the practicalities and cost of control).

In this Ardgour Restoration Area Management Plan, the outcome requirements for mammalian pest management in the Ardgour Restoration Area are outlined, while details on control methods are included in the *Mammalian Pest Management Plan*.

Ungulates (deer, goats, pigs) outcomes:

[19] See RMA Ecology Wetland Values Assessment report.

[20] Primarily fallow deer but also occassional red deer.

- Maintain at zero density[21] throughout the Ardgour Restoration Area.
- Respond quickly to any incursions noted (especially pigs).
- If monitoring indicates that problems persist, then investigate targeted exclusion ~~fencing~~ options for deer.
- Use~~Consider using~~ cameras in strategic locations for further monitoring.

Possum outcomes:

- Maintain the possum population at a level that minimises their negative impacts while balancing potential bait or trap avoidance in population. This means the possum population will be maintained at or below:
  - 6% Relative Trap Catch (RTC) or Chew Crad Index (CCI) across entire Ardgour Restoration Area as measured on an annual basis
  - no LMUs with greater than 8% RTC or CCI as measured on an annual basis
- Aerial 1080 every 3 years – this will have benefits in terms of control of other species such as carnivores too ~~but will need to be coordinated with farming activities and adjacent landowners~~.
- ~~If aerial 1080 is found to not be an option, then target control around LMUs 1, 2 & 4 initially, then expand to LMU 3, using bait stations around margins and through areas where required – this could be quite efficient as there is good track access.~~

Lagomorph (rabbit and hare) outcomes:

The main concern is the impact lagomorphs might have on enrichment planting, but these will be relatively limited spatially (cf. large scale planting in rehabilitation area) and can be protected in other ways (guards). Also, some ongoing rabbit browsing is desirable for cushionfields (LMU 5). It is unclear how rabbits might impact any spring-annual ~~plantings~~establishment, but it is not yet known if/when/where ~~these~~ plantings will be undertaken (assessment of this depends on the outcomes of the *Applied Research Programme for Cushionfield and Spring Annuals*).

[21] Accepting that when an incursion occurs, densities will be above zero until control is implemented.

- ~~Rabbit~~ Plant guards will be used around ~~vulnerable~~ all ~~species~~plantings, even where rabbit netting is used ~~(kōwhai, podocarps etc)~~.
- Otherwise monitoring of impacts and targeted control as required based on adaptive management.

Carnivore outcomes:

The focus here is on increasing populations of seed dispersing native birds (touhua, korimako, tuī) which will take time.

- Aerial 1080 every 3 years
- Mustelid and cat control using kill traps focused on LMUs1 and 2 in the short term, and LMU 3 in the longer-term with the objective of reducing densities of these carnivorous predators to allow seed dispersing birds to breed and increase in numbers.

However, it is important to note that the abundance of these native seed dispersing birds is also dependent on having suitable food resources and sufficient habitat to sustain them (which is the focus of the restoration planting described in Section 4~~3~~.5). For this reason it is not proposed to start carnivore control until Year 3.

Mice outcomes:

Mice are not necessarily an issue in of themselves for the Ardgour Restoration Area unless populations substantially increase after removal of higher-level carnivores when they may impact on invertebrates or native plant seeds.

- ~~If~~ Based on appropriate monitoring, if there is evidence of mice numbers increasing ~~,~~ ~~then establish monitoring and if required~~ undertake localized ~~trapping~~ management using current best practice control methods.

Year five goals:

To manage exotic mammals to levels that do not threaten restoration plantings, natural regeneration and key fauna. The key for animal pest management is to ensure that management is on-track to meeting the 35-year outcomes for the Ardgour Restoration Area.~~:~~

Management actions:

Year 1 onwards – commence annual ungulate control across all the Ardgour Restoration Area.

Year 1 onwards – undertake additional pig control when pig rooting sign indicates it is required.

Year 1 onwards – undertake rodent monitoring in LMU1 and 2 to assess numbers.

Year 1 – liaise with adjacent landowners prior to undertaking a 1080 operation across the Ardgour Restoration Area in Year 2.

Year 2 – undertake 1080 operation.

Year 3 – commence carnivore control in LMUs 1 and 2.

Year 4 onwards – continue carnivore control in LMUs 1 and 2.

Year 5 – repeat 1080 operation.

53.8 Plant pest management

Pest plant control is essential because invasive species compete with and displace native vegetation, thereby reducing restoration success. The Ardgour Restoration Area currently has very low densities of plant pests and the objective of management is to ~~maintain~~ further improve this situation. Control efforts must target several growth forms, each posing distinct threats to restoration objectives. The key lifeforms are as follows:

- Trees and shrubs such as wilding conifers, elderberry, buddleia, hawthorn, gorse, and broom actively invade ~~low-growing~~ native vegetation, outcompeting and displacing indigenous species through rapid growth and resource monopolisation.
- Exotic lianes such as *Clematis* species can establish within native woody vegetation and smother the canopy, reducing light availability and ultimately killing host plants.
- Exotic grasses and herbs compete directly with restoration plantings for nutrients, water, and space, while also preventing natural regeneration of native woody species in open habitats by creating dense ground cover that inhibits seedling establishment.

- A range of perennial herbs and shrubs can invade cushionfields and shade out native species, including rare spring annuals.

The following notes summarise management requirements for the key plant pest species present in the Ardgour Restoration Area. Actual control methods are outlined in the *Biosecurity and Plant Pest Management Plan*.

Woody plant pests:

Target species for whom the aim is to ensure that there are no mature breeding individuals in the Ardgour Restoration Area include:

- Elderberry and buddleia (currently rare, but present in the Dry Creek ~~below the Ardgour Restoration Area~~catchment).
- Wilding conifers (currently rare, but seed may still be present from mature trees that were killed in the 1990s~~.~~).
- Hawthorn (currently absent but present in the wider landscape).
- Climbing species (also called lianes or vines) such as *Clematis*[22] species (recorded from Dry Creek and present in the wider landscape).
- Gorse and broom (currently absent but present in the wider landscape).
- Willows and poplars (currently absent but present in the wider landscape)
- Other exotic small trees including buddleia, rowan, and cotoneaster (currently absent but present in the wider landscape).

The management objective is to achieve and maintain no breeding individuals of these species throughout the Ardgour Restoration Area. This can be achieved by:

- Initial search and destroy mission at outset (which should include all these species).
- Ongoing monitoring/vigilance and removal when seen – suggest autumn surveys as deciduous species (and *Clematis*) stand out well then.

[22] *Clematis tangutica* has been recorded in the area while Bruce Jolly has sprayed what he calls old mans' beard from Dry Creek in the past.

- Work with adjacent landowners to remove seed sources (elderberry on Cloudy Peak Station is one example).
- Being aware that there will be a constant influx of these and other weed species (birch, buddleia, Chilean glory vine etc) because of the upwind housing intensification going on in the Upper Clutha basin (Queensberry, Luggate, Wānaka, Hāwea).

Herbaceous plant pests:

Aside ~~from thistles in LMU 5~~from cushionfields (see below), exotic grasses and herbs are primarily an issue for plantings, and their management is discussed under Section 5~~3~~.5 Restoration Planting.

Plant pests in cushionfields (LMU 5):

Cushionfields are treated separately to other vegetation types because they are particularly vulnerable to ~~any over-topping by invasive species~~smothering. The objective of this restoration management plan is to maintain cushionfields in their current condition until the management recommendations from the *Applied Research Programme for Cushionfield and Spring Annuals* have been formulated to guide their long-term management. With reference to plant pests, management over the current five-year period focuses on the following species:

- Although not considered a plant pest across the general Ardgour Restoration Area, sweet brier is an issue in cushionfields where it may invade and cause ecological harm.
- Several annual and perennial exotic herbs including t~~T~~histles, California poppy, hoarhound and blue borage are also considered a plant pest in cushionfields as they have the potential to smother smaller native plants.
- Thyme and stone crop ~~are currently absent~~have not been identified on site to date but there is a need to be vigilant so that they do not establish in cushionfields as they are present nearby.

The management of these species is discussed under LMU 5.

After the initial search and destroy mission across all of the Ardgour Restoration Area in Year 1, it is proposed that ongoing woody weed control is undertaken on a rotational basis

focusing on LMUs 1, 4, 5 and 6 in the first year and LMUs 2 and 3 in the second year, and then control in different mine rehabilitation zones in subsequent years, with a maximum time between control in any one area being five years.

Year five goals:

1. The Ardgour Restoration Area is kept free of mature fruiting specimens of all known woody weeds (trees, shrubs, lianes) except sweet brier (but see (3) below).
2. Herbaceous weeds (grasses and forbs) do not limit the success of restoration plantings.
3. Cushionfields (LMU5) are kept free of woody weeds, primarily sweet brier, ~~as well as thistles,~~while thyme and stonecrop are eradicated should they establish.

~~3.~~ The key for plant pest management is to ensure that management is on-track to meeting the 35-year outcomes for the Ardgour Restoration Area.

Management actions:

Year 1 – survey Ardgour Restoration Area for all woody weeds (trees, shrubs, lianes), mapping their locations and removing at the same time.

Year 1 onwards – remove sweet brier, ~~and~~ thistles and other species, if they start forming dense swards, from cushionfield vegetation in LMU 5.

Year 1 onwards – eliminate thyme or stonecrop from cushionfield vegetation in LMU 5 should they be recorded there.

Year 2 onwards – undertake annual surveys and control on a rolling three-year basis as described above.

Year 2 onwards – control herbaceous weeds when planting new native plants through spray or manual removal.

Year 3 – map adjacent areas (as much as possible) for wood plant pests that have the potential to spread into the Ardgour Restoration Area (e.g. elderberry) and discuss control with landowners.

Year 4 – remove adjacent elderberry where permission has been granted.

~~5~~3.9 Ardgour Rise Road Corridor

A new public road (Ardgour Rise) will be constructed in Year 1 to replace Thomson Gorge Road to Thomsons Saddle where it will rejoin the existing road. The new road alignment will initially follow a new alignment and then follow the existing farm track (Figure 2). This road will primarily pass through LMU 5 (cushionfields with some exotic pasture) and higher up through LMU 7 (short tussock grassland). This section focuses on the potential interaction between the road and its users, and the Ardgour Restoration Area.

The main ways that this road, and its users, can potentially interact with the Ardgour Restoration Area are through:

- Vehicles leaving the road and damaging vegetation, especially cushionfields.
- Accidental or deliberate fire starting from the road and spreading through the area.
- Spread of weed seeds from vehicles (and horses if they use it) up the road.

Year five goals:

The Ardgour Rise Road and those using it are not having an adverse impact on the Ardgour Restoration Area.

Management actions:

~~**Year 1** – placing signage at regular intervals along the road informing visitors about the need to keep to the formed road and not to light fires.~~

Year 1 – placing signage at stopping points along the road informing visitors about the objectives of Ardgour Restoration Area management, including the need to not light fires.

Year 1 – ensure that any tracks leaving the Ardgour Rise Road have no entry signs and /or have chains across preventing access.

Year 1 onwards – monitor impact of road users on the Ardgour Restoration Area and if adverse impacts are occurring review how road is managed (including potentially installing security cameras).

Year 1 onwards – being vigilant for new weeds establishing along the side of the Ardgour Rise Road and removing them before the set seed.

~~53~~.10 Species specific management

While this management plan focuses primarily on ecosystem enhancement, the biodiversity uplift that occurs from this will also benefit a wide range of individual plant and animal species including several that are ranked nationally or regionally as threatened and at risk. In addition, there are plans for species specific management relating to:

- Lizards – it is proposed to release lizards from areas disturbed by mining into parts of the Ardgour Restoration Area. This is discussed in detail in the *Lizard Management Plan*. In addition, LMU 8 will be managed as a long-term predator exclusion area for the benefit of lizards (see *Lizard Management Plan*).
- Invertebrates - it is proposed to release invertebrates from areas disturbed by mining into parts of the Ardgour Restoration Area. This is discussed in detail in the *Invertebrate Management Plan*.
- Spring annuals and related cushionfield plants – arising from the results of the *Applied Research Programme for Cushionfield and Spring Annuals*, proactive management of nationally threatened and at-risk spring annual and related plants will be undertaken within cushionfield ecosystems in LMU 5.

As the primary goal of restoration management in the Ardgour Restoration Area is for expansion and development of native woody vegetation, it is expected that the areas of open habitat (especially pasture and tussock grassland) will decrease over time. While this will result in an increase in the abundance of shrubland and forest plants and their associated fauna, including birds, it will also result in a reduction in the area of habitat available for plants and fauna associated with open habitats. However, management for a more extensive and diverse woody ecosystems will not compromise naturally open habitats associated with rock bluffs and tors, or ~~with~~ cushionfields. These are the primary habitats for most threatened and at-risk species. There will still be substantial areas of pasture (especially in LMU 5) and short tussock grassland (especially in LMU 7) that is maintained throughout the 35-year management period being considered here. Appendices ~~55~~ and ~~66~~ summarise the likely effects of restoration management on known threatened and at risk plant species, and on~~f~~ plant species that are important for fauna in the Ardgour Restoration Area over the next 35 years.

Year five goals:

Restoration management is undertaken in the Ardgour Restoration Area in a manner that complements the goals of the *Lizard* and *Invertebrate Management Plans* and the outcomes from the *Applied Research Programme for Cushionfield and Spring Annuals*.

Management actions:

Year 1 onwards – regularly review the outcomes of the management actions in this plan against the *Lizard* and *Invertebrate Management Plans*.

Year 1 onwards – update management actions relating to LMU 5 to reflect the outcomes of the *Applied Research Programme for Cushionfield and Spring Annuals* when completed.

~~53~~.11 Fire management

Fire is perhaps the single biggest risk to the success of the restoration management proposed for the Ardgour Restoration Area. For fire to occur, three conditions need to be met – presence of sufficient biomass to burn, dry conditions to promote burning and an ignition source. The restoration management being undertaken in the Ardgour Restoration Area will create more biomass and increasingly dry summers will create conditions for fire. Ignition sources are most likely to come from either ~~adjacent farming operations (burn offs) or from~~ people traversing through the area (accidental or deliberate fires) or adjacent farming operations (burn offs). Public access up the new Ardgour Rise Road is seen as a major risk to the success of the Ardgour restoration project.

Several approaches can be used to reduce fire risk including maintaining low biomass vegetation and using grazing to keep exotic grassland ~~to keep~~ biomass low, especially along the Ardgour Rise Road alignment, liaising with adjacent landowners to limit or exclude burn-offs on land adjacent to the Ardgour Restoration Area, and erecting educational signs highlighting fire risk at any stopping points on the new road alignment. All three approaches will be used here.

Should fire occur and damage part of the Ardgour Restoration Area, then additional work will be required to both repair the damage and to ensure that the 35-year outcomes are still able to be met. This will likely require additional resources and will necessitate a revision to the operative five-year management plan (see Section 7).

Year five goals:

Fire has not compromised the restoration outcomes from the management work undertaken here.

Management actions:

Year 1 – erect educational signs highlighting fire risk at stopping points on the Ardgour Rise Road.

Year 1 onwards – graze LMU's 5, 6 and 7 to maintain in an herbaceous state to reduce the chance of fire spreading from the Ardgour Rise Road.

Year 1 onwards – liaise with adjacent landowners to limit or exclude burn-offs on adjacent land.

Year 1 onwards – if a fire does occur, fully review operative five-year management plan and update to reflect changes in circumstances (Section 7).

~~5~~3.12 Biodiversity outcome monitoring

Biodiversity outcome monitoring is key for demonstrating the biodiversity uplift that management of the Ardgour Restoration Area is aiming for is occurring. Biodiversity outcome monitoring is different to monitoring management inputs (such as plants established or pest animals killed) and is discussed in the *Biodiversity Outcome Monitoring Plan* (BOMP). For successful biodiversity outcome monitoring, a good baseline needs to be established at the outset of the restoration management and reassessments of the different biodiversity variables undertaken at regular intervals. Biodiversity outcome monitoring is important to both assess progress against consent conditions and to help inform management. A central thesis of this management plan is for management to be adaptive – depending on the results of outcome monitoring, management may need to be adapted and changed so that the desired 35-year outcomes are achieved.

The following methods will be used to assess how the biodiversity outcomes from the management described in this plan are tracking towards the 35-year outcome targets:

Outcome 1: The area of vegetation that meets the definition of Native Dominant Scrubland has increased from 22 to 32 ha in LMU1, 82 to 123 ha in LMU 2 and 0 to 8 ha in LMU3 over 35-years from the commencement of management described in this plan.

Monitoring will be based on spatial mapping using remote sensing, with appropriate ground truthing, at the outset of the project (2026). See also BOMP.

Outcome 2: The diversity of native trees, shrub and liane species in existing native scrubland has increased so that on average there are at least five native woody species (comprising at least two tree, two shrub and one liane species) in monitoring transects in LMUs 1 and 2.

Monitoring will be based on a minimum of 20 random transects (100 m long with three 5m radius circular plots every 50 m) through the areas of native scrubland in LMU1 and 2. These need to be measured (at new random locations) every five years, starting in 2026.

Outcome 3: For non-woody areas of LMUs 1, 2 and 3 (excluding cushionfields), at least 30% of this area has native woody vegetation regenerating.

Monitoring will be based on spatial mapping using remote sensing, with appropriate ground truthing, at the outset of the project (2026). See also BOMP.

Outcome 4: The average annual abundance of native seed dispersing birds (tauhou, korimako and tuī) is at least 50% greater in native dominant scrubland and 25% greater in mixed scrubland in LMUs 1, 2 and 3 than they were in the 2023 and 2024 bird surveys in these areas.

Monitoring will be based on bird counts at the permanent monitoring sites as discussed in the BOMP.

Outcome 5: There is evidence of natural dispersal of native species within the areas of native woody vegetation in LMU 1 and 2 as evidenced by the presence of unplanted individuals of native shrubland and forest species (fern, herb, woody) (excluding matagouri, scented tree daisy and mingimingi) in at least 50% of vegetation monitoring transects.
Monitoring will be based on vegetation monitoring at the permanent monitoring sites as discussed in the BOMP.
Outcome 6: Kōwhai seedlings are establishing naturally in proximity (within 100 m) to at least five of the nine kōwhai groves that are currently present in the Ardgour Restoration Area).

Monitoring will be based on surveys of the kōwhai groves, undertaken at five year intervals starting in year 1.

Outcome 7: Survival of planted mataī and tōtara on alluvial surfaces in LMU 4 is >50% and surviving plants are >5m tall.

Monitoring will involve tagging all planted mataī and tōtara and measuring success and growth at five-year intervals.

Outcome 8: The extent of cushionfields in LMU 5 is the same as mapped through the *Applied Research Programme for conservation management, rehabilitation and expansion of cushionfield*. The number of individuals of the four key Nationally Threatened and At-Risk cushionfield plant species present within monitored populations shows an increasing or at least stable population in comparison to 2026 base line numbers (allowing for annual variation of ± 25%).

Monitoring will be based on spatial mapping using remote sensing, with appropriate ground truthing, at the outset of the project (2026). See also BOMP. Spring annuals will be assessed based on the results and recommendations of the *Applied Research Programme for Conservation Management, Rehabilitation and Expansion of Cushionfield*.

One challenge with the biodiversity outcome monitoring proposed here is that it is only able to assess change at the measurement sites through time. Ideally some form of before-after control-impact (BACI) design would be used where control or reference sites are used to compare change in the Ardgour Restoration Area (the impact site) against. However, finding statistically comparable control sites is challenging as it is not possible to predict how the Ardgour Restoration Area would be managed in the future without restoration. Adjacent sites such as in the Dry Creek Conservation Area are not comparable as they are subject to zero grazing, while adjacent farms may not be subject to the same management inputs as might occur within the Ardgour Restoration Area. For these reasons control sites are not being used. Possible future trajectories of biodiversity change in the Ardgour Restoration Area are discussed further in Appendix 1.

Year five goals:

Biodiversity outcome monitoring is informing management.

Management actions:

Year 1 – vegetation pattern across all of the Ardgour Restoration Area will be spatially mapping using remote sensing, with appropriate ground truthing, to better refine the current extent of the different vegetation types present with a particular focus on native dominated scrubland and cushionfields.

Year 1 – baseline biodiversity condition is established.

Year 2 onwards – biodiversity outcome parameters are monitored at appropriate intervals.

~~53~~.13 Management monitoring~~Photo-monitoring~~

In addition to biodiversity outcome monitoring, both photo-monitoring and monitoring of management inputs will also be undertaken to help inform management planning (see Section 7). Photo-points are ~~not part of outcome monitoring but are a~~an ~~very~~ informative tool for management and for long-term advocacy. Panoramic photos-points (which can involve a panorama of approximately 2-5 images) ~~should~~ will be established to cover all the LMUs within the Ardgour Restoration Area and focus on areas where management is driving change. At least 20 photo points will be established in accordance with the following guidelines:

- Permanently mark photo-points – this ensures photos are always taken from the same place – best done using a metal standard driven into the ground.
- Have original photos on hand when repeating photos – essential to ensure that the same view is photographed each time (e.g. angle, inclusion of key features etc). Having a camera with the ability to zoom is helpful to make sure that the area captured in the image is the same each year.
- Take photos at the same time of year – photos are best taken in early summer (November-December) after the spring growth flush but before vegetation starts to brown-off through the heat and dry of summer. This reduces seasonality differences.
- Develop a series of photos over several years – a single unusual season can result in misleading results so building up a sequence of images over several years avoids this.

Monitoring of management inputs will also be undertaken. Records will be kept of species, number and location (GPS) of plant and animal pests killed. In addition, condition and height monitoring will be undertaken for plantings as follows:

- All podocarp (mataī and tōtara) plantings in LMU4 and all plants established in the kōwhai clusters will be tagged at planting and their heights and condition scored annually for the first five years after planting, and then every five years thereafter.
- In addition, a random sample of enrichment plantings will be tagged and their heights and condition monitored annually for the first five years after planting, and then every five years thereafter.
- All of the above information will be summarised annually and used as part of the annual management planning that is described in Section 6.

Year five goals:

~~Photo-points~~A range of monitoring tools are being used to track management across the Ardgour Restoration Area and feed into annual management planning.

Management actions:

Year 1 – At least 20 photo-points have been established across the Ardgour Restoration Area.

Year 1 onwards - species, number and location (GPS) of plant and animal pests killed is recorded.

Year 1 onwards – Management monitoring is summarized annually as part of the annual management planning.

Year 2 onwards – tag and measure condition and height of subset of plants in LMU1 and 2.

Year 3 – Repeat photo-points to obtain a good baseline.

Year 3 or 4 onwards - tag and measure condition and height of plantings in kōwhai clusters.

Year 4 onwards – tag and measure condition and height of podocarp plantings in LMU4.

Year 5 – Repeat photo-points at 2-3 year intervals thereafter.

~~4.~~6. LAND MANAGEMENT UNITS

~~6~~4.1 Introduction

This section discusses the site-specific management approach that treats different parts of the Ardgour Restoration Area as unique LMUs. Each LMU has been distinguished based on restoration management goals (potential vegetation) and management requirements (Figure 2). Some LMUs are large while others are small, but each has a unique set of values and management requirements. For each LMU, management goals (biodiversity enhancement, turf management, livestock grazing etc), associated constraints and risks that may impede achieving these goals, and the corresponding management actions required for implementation are identified. Biodiversity outcome monitoring is discussed in a separate *Biodiversity Outcome Monitoring Plan*.

A key part of realising the restoration outcomes within the proposed LMUs is the interaction between livestock farming, fire controls and ecological restoration with the local (catchment by catchment) environmental conditions. This means that some LMUs are not suitable for ecology-based restoration works, at least in this first five-year management period, and instead the focus will be on maintaining existing values (for example within cushionfields) or letting long-run ecological processes occur naturally (for example, on extremely dry north-facing catchments).

~~6~~4.2 LMU 1 – Broad Gully shrublands

This LMU (217 ha) encompasses several gullies in the western part of the property and consists of three discrete areas centered on the following paddocks:

- Top Airstrip.
- South Branch, Broad Gully South, Broad Gully North and Top Broad Gully.
- Blue Drum and Broad Gully North.

Slopes are mainly south facing, although some north facing slopes and gully bottoms are also included. The LMU is mainly located between 400-700 m elevation, and the vegetation is largely mapped as ‘Mixed tussock shrubland and exotic grassland’ (112 ha), ‘Exotic pasture’ (38 ha), ‘Native dominated tussockland’ (33 ha) and ‘Native dominated scrubland’ (22 ha).

The Broad Gully and Upper Dry Creek shrublands (LMU 1 and LMU 2) are the primary target for biodiversity uplift in the first five years of management (and comprise about 30% of the Ardgour Restoration Area). The key management interventions planned in this management period include removal of livestock, control of feral animals, control of key weeds and enrichment planting. As a result of this management, it is expected that these shrublands (especially those mapped as 'Native dominated scrubland') will start developing into a more species-rich and life-form diverse state with concurrent enhancement of native fauna. In addition, it is expected that areas mapped as 'Mixed tussock shrubland and exotic grassland' will have an increase in native woody species cover, while natural infilling of grassy areas (Exotic pasture') with native woody species will occur especially on south facing slopes.

These changes will be initiated in this first management period, although active management input will be required for many years after that. It will take time for restoration management to result in the anticipated uplift, although the trajectory of change will increase with time.

Year five goals:

As a result of restoration management these shrublands are:

1. Starting to become more diverse both in terms of species and life-forms.
2. Infilling of pasture areas by native woody species has started.
3. Tauhou numbers are stable and there is evidence for korimako and/or tuī visiting these areas.

Management actions:

Year 1 – identify initial planting areas.

Year 1 – contract nursery to raise plants for this LMU (in conjunction with plant propagation for other LMUs – see Section ~~3~~5.5).

Year 3 onwards – establish enrichment plantings aiming for at least 1000 fully-hardened off plants per year (see Appendix ~~4~~4.2).

Year 3 onwards – monitor enrichment plantings.

~~6~~4.3 LMU2 – Upper Dry Creek shrublands

This LMU (168 ha) is in the very upper part of Dry Creek comprising the Upper Dry Creek paddock. The best developed shrubland (Native dominated scrubland') is on southwest facing slopes to the east of the creek, but small areas occur along the creek and on the lower east facing hill slopes These shrublands extend from 600-1000 m elevation and are the highest in the Ardgour Restoration Area. 'Native dominated scrubland' (82 ha) is the dominant vegetation type, but 'Mixed tussock shrubland and grassland' (62 ha) and 'Native dominated tussockland' (21 ha) are present in the eastern part of this paddock and included within this LMU because of their potential to develop into a more native state and because it would be difficult and have little advantage to fence this area out. There ~~is~~ are also quite extensive rock bluffs present within this LMU. However, the large area of 'Native dominated tussockland' at the very top of this paddock has been included in LMU 7.

This area is treated separately to LMU 1 (Broad Gully shrublands) because it occurs in a different part of the Ardgour Restoration Area and is located at higher elevations. However, these LMUs together are the primary target for biodiversity uplift in the first five years of this restoration project. Through appropriate restoration management (removal of livestock, control of feral animals, control of key weeds and enrichment planting) it is expected that these shrublands (especially those mapped as 'Native dominated scrubland') will develop into a more species-rich and life-form diverse state with concurrent enhancement of native fauna. In addition, it is expected that areas mapped as 'Mixed tussock shrubland and exotic grassland' will have an increase in native woody species cover, while natural infilling of grassy areas with native woody species will occur especially on south facing slopes.

These changes will be initiated in this first management period, although active management input will be required for many years after that. It will take time for restoration management to result in the anticipated uplift, although the trajectory of change will increase with time.

Year five goals:

As a result of restoration management these shrublands are:

1. Starting to become more diverse both in terms of species and life-forms.
2. Infilling of pasture areas by native woody species has started.

3. Tauhou numbers are stable and there is evidence of korimako and/or tuī visiting these areas.

Management actions:

Year 1 – identify initial planting areas.

Year 1 – contract nursery to raise plants for this LMU (in conjunction with plant propagation for other LMUs – see Section ~~3~~5.5).

Year 3 onwards – establish enrichment plantings aiming for at least 3000 fully-hardened off plants per year (see Appendix 4.2).

Year 3 onwards – monitor enrichment plantings.

~~6~~4.4 LMU3 – Lower and Middle Dry Creek shrublands

This LMU (299 ha) comprises the Lower and Middle Dry Creek paddocks and has been separated from LMU 2 (Upper Dry Creek shrublands) because of the absence of 'Native dominated scrubland' and proportionally greater areas of and 'Mixed tussock shrubland and exotic grassland' (120 ha), Mixed scrubland' (84 ha) and 'Native dominated tussockland' (60 ha). Rock outcrops are also present, as are areas of 'Mixed depleted herbfield (cushionfield) and grassland' (35 ha). However, because of the topography (difficult to fence) and the more remote location of this LMU, it is challenging from a management perspective to try and treat these different vegetation types separately. The one exception to this is 'Native dominated tussockland' at the very top of these paddocks which has been included in LMU 7. LMU 3 extends from 500-900 m elevation and slopes are predominantly north-facing, although there are smaller areas of south facing slopes.

This LMU has long-term potential to develop into a more native woody state. However, aside from some work focusing on kōwhai which is present in this LMU, management in the first five years will focus largely on establishing baseline monitoring and managing plant and animal pests. More active restorative management is proposed for subsequent five-year periods.

Year five goals:

In five years', time the goals for native biodiversity in this LMU are:

The extent and composition of native shrubland is similar to what it was at the start of the implementation of this management plan.

Management actions:

Year 1 onwards – continue to graze this LMU in a similar manner to what is being done currently but only using sheep (no cattle).

Year 1 onwards – better map the areas of cushionfields within this LMU as part of the *Applied Research Programme for Cushionfield and Spring Annuals*.

Year 1 onwards – no vegetation clearance and liaise with adjacent landowner/manager to ensure that any vegetation clearance in adjacent areas (Wongs and across Dry Stream on Cloudy Peak Station) is undertaken in a manner that minimises risk on this LMU (e.g. from herbicide spray drift or fire).

64.5 LMU 4 – Alluvial valley flats

This is a small (8 ha) but distinctive LMU in South Branch, North Face Upper and Broad Gully South and is adjacent to LMU 1. It comprises the flat alluvial terraces in the base of the streams that drain out of Broad Gully South and Top Airstrip (Figure 5). Most of the area is at the eastern end of Broad Gully South extending down into South Branch and North Face Upper. However, there are also some alluvial flats higher up Broad Gully South. This LMU is flat to gently sloping and lies below 520 m elevation. The vegetation is largely mapped as 'Mixed tussock shrubland and grassland' (6 ha). It is proposed to allow sheep to graze until planting to help reduce the grass growth that will occur with livestock exclusion.

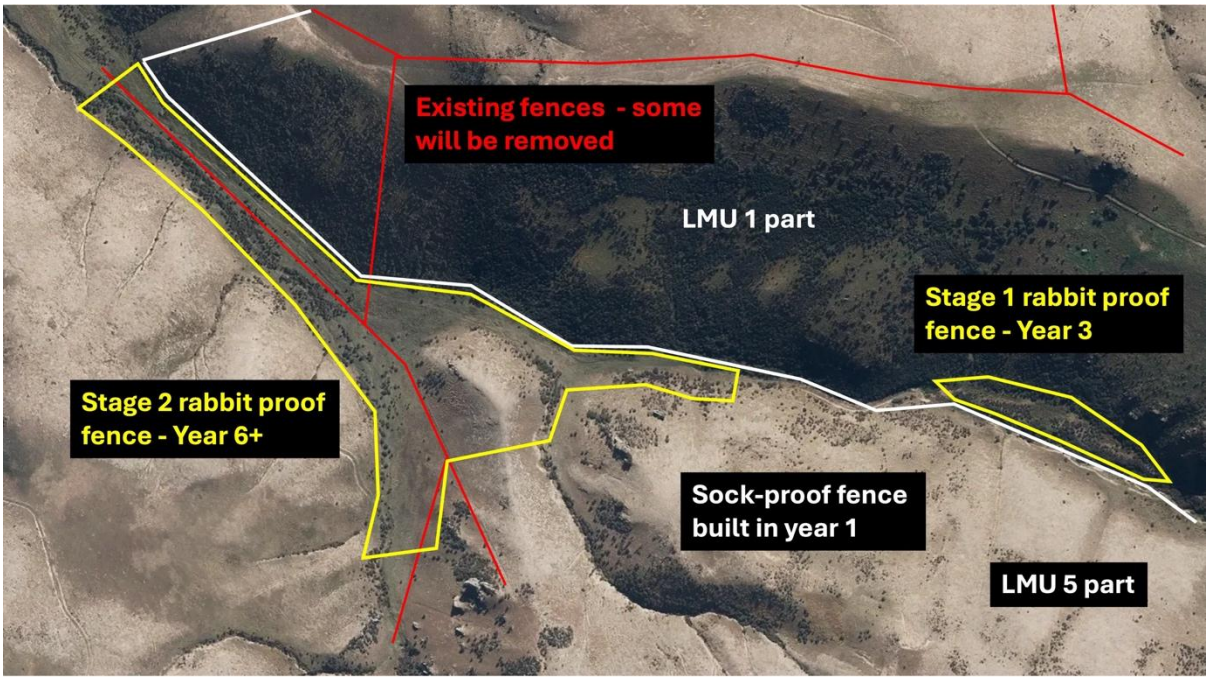

Figure 5. *LMU 4 proposed boundaries (yellow). Existing fences (red) and new fences (white) to enclose LMU1 and LMU 4.*

Year five goals:

In five years', time the goals for native biodiversity in this LMU are:

The first stage of restoration of alluvial podocarp-broadleaved forest has commenced.

Management actions:

Year 1 – clearly identify where sites are with the best soils for alluvial forest establishment (including undertaking some soil analyses – nutrients, water holding capacity etc).

Year 1 – work with grazier (considering stock movement and water requirements) in planning fencing (see Section ~~3~~4.4).

Year 1 – contract nursery to raise plants for this LMU (in conjunction with plant propagation for LMUs1 and 2 – see Section ~~3~~4.5 and Appendix 4.4).

Year 4 onwards – undertake fencing as required for the next years planting (see Section ~~3~~4.2).

Year 4 onwards – establish 0.25 ha of plantings (ca. 2000 plants) annually.

Year 4 onwards – monitor plantings.

64.6 LMU 5 – Cushionfields

This is a distinctive LMU that occurs widely across the lower parts of the Ardgour Restoration Area (261 ha). The vegetation is a mix of 'Mixed depleted herbfield (cushionfield) and grassland' (139 ha) and 'Exotic pasture' (71 ha). The largest areas of cushionfield occur in Karearea, North Face Upper, Top Airstrip, Broad Gully South, Broad Gully North and Blue Drum. However, cushion fields also occur in other paddocks (e.g. Lower Dry Creek) but are of less spatial extent. This LMU is located on moderate to steep northwest to northeast facing slopes and predominantly at lower elevations (<700 m).

This is a critical LMU as it supports 12 Nationally Threatened and At-Risk plant species (see Vegetation Values Assessment report) that are also present within the mine footprint[23]. As cushionfields will be adversely affected by mine development within the footprint, proactive management of this LMU and its cushionfields is therefore essential to offset this impact. Developing a better understanding of the cushionfield vegetation type is the subject of the *Applied Research Programme for Cushionfield and Spring Annuals*. This programme of work is designed to better understand the extent and composition of cushionfields, current pressures they are facing and, where appropriate, enhance them, the results of which will inform the management discussed here (see Table 31).

[23] The exception may be *Daucus glochidiatus* which has not been recorded from the mine footprint but is present on Ardgour.

***Table 3~~1~~**. Components of Applied Research Programme for Cushionfield and Spring Annuals that relate to cushionfields.*

Component 1: Map cushionfield across the managed landscape to define distribution and confirm success criteria for condition (dominance and health) of key cushionfield species using ground-based surveys and testing drone-captured aerial photography; **Component 2**: Identify current pressures on cushionfield and best current (i.e. farmer-led) management outcomes for cushionfield vegetation; **Component 3**: Identify areas where cushionfield could be most likely enhanced (including a range of typical co-occurring herbaceous and woody species) and develop a range of practical extensive and intensive interventions.

It is difficult to accurately delineate cushionfields within this LMU as cushionfields are located within a mosaic with 'Exotic pasture' and would, in many instances, be difficult to fence off. Furthermore, fencing livestock out of cushionfields is likely to have undesirable biodiversity outcomes as sheep (along with rabbit browse) are required to prevent dominance by exotic plant species. It is therefore proposed that until the *Applied Research Programme for Cushionfield and Spring Annuals* has been completed, no active management of the LMU will be undertaken aside from restricting the impact of any new pressures as much as is practicable. This includes no further fertilizer or seed application, no new tracking (except for the Ardgour Rise Road), no cattle grazing and targeted weed control primarily focusing on sweet brier and thistles and other herbaceous weeds as required.

This LMU also acts as a firebreak to protect areas that are being managed towards a more diverse woody condition

Year five goals:

At the end of this 5-year management period, restoration management will have resulted in:

- The condition of the mapped cushionfields is at least the same as ~~it is in 2026~~mapped through the *Applied Research Programme for conservation management, rehabilitation and expansion of cushionfield*.

- The research and survey work of the *Applied Research Programme for Cushionfield and Spring Annuals* is being supported, and if completed, implementation of the management recommendations has commenced.

Management actions:

Year 1 onwards – support the *Applied Research Programme for Cushionfield and Spring Annuals*.

Year 1 onwards – continue to graze with sheep at current stocking rates.

Year 1 onwards – no fertilizer or seed application.

Year 1 onwards – maintain compliance with Otago RPMP requirements for rabbits (see Section ~~35~~.7).

Year 1 onwards – remove all sweet brier and thistles and other herbaceous weeds where required (see Section ~~35~~.8).

Year 1 onwards – implement management as recommended from the results of the *Applied Research Programme for Cushionfield and Spring Annuals*.

~~6~~4.7 LMU 6 – Exotic pasture

This LMU (114 ha) is restricted to parts of Kowhai Lane, Lower Airstrip and North Face, much of which has been cultivated in the past. Grazing will be sheep only. One of the key roles of this LMU is to act as a fire break to protect the areas that are being actively regenerated into a native woody condition.

Year five goals:

In five-years' time it is intended that:

Livestock grazing (sheep only) has been maintained in a manner that is consistent with the biodiversity objectives of this management plan.

Management actions:

Year 1 – develop a leasing arrangement that allows for sheep grazing.

Year 1 – ensure all paddocks have stock water prior to the new predator proof fencing being completed (LMU 8).

64.8 LMU 7 – Short tussock grassland

This LMU (158 ha) is located in the Top Broad Gully, the upper part of Top Airstrip and along the northeastern side of the ridge crest in Lower, Middle and Upper Dry Creek. The vegetation is largely mapped as 'Native dominated tussockland' (93 ha). This LMU occurs on generally gentle slopes and above about 700 m.

'Native dominated tussockland' is an induced vegetation type but it does have several values. It contains at least one Nationally Threatened plant species (*Carmichaelia crassicaulis* subsp. *crassicaulis*) and some of its constituent species (e.g. taramea) provide habitat for native invertebrates and reptiles, including some Threatened and At-Risk species. As a short stature, largely herbaceous, vegetation type it also acts as a fire break.

Complete removal of livestock grazing will see a gradual shift to a woodier state, which is likely to be an objective for some or all this LMU in the long-term (and will be discussed in later iterations of this five-year management plan). However, in the short-term (and for the duration of this five-year management period), limited sheep grazing can help maintain the short tussock grassland and if not grazed at too high a density, sheep can maintain the values that this LMU contains including for the Threatened moth *Sporophyla oenospora* where some fertilizer application may be required to maintain its habitat. Ongoing grazing of this area is also important to maintain it in an herbaceous state so that it can act as a fire break. It is therefore proposed to continue to manage this area with sheep grazing.

There is also the opportunity for enhancement of short tussock grasslands through planting of native short tussocks (hard, silver and blue tussock), and taramea, as part of the offset for loss of these species within the mine footprint. Potential sites for this include the upper part of Top Broad Gully, and the highest parts of Middle and Upper Dry Creek.

The longer-term management of the upper part of this LMU will likely be similar to that applied to the Upper Shepherds Creek Paddock outside the mine footprint (MRZ-A see the *Landscape and Ecology Rehabilitation Management Plan*). Any decision to undertake tussock and taramea enrichment in LMU 7 will be made in conjunction with management initiatives being undertaken in MRZ-A.

Year five goals:

In five-years' time it is intended that:

The composition and structure of the 'Native dominated tussockland' vegetation in this LMU is in a similar state to what it is currently, although there may have been some enrichment planting of short tussocks.

Management actions:

Year 1 onwards – work with grazier to finalise optimal grazing, but focus is on sheep only for limited periods of time (Section 5~~3~~.4)

Year 1 onwards – explore and implement short-tussock and taramea enrichment planting if deemed necessary as part of the offset for loss of these species within the mine footprint.

Year 5 – based on outcome monitoring, reevaluate the need for future management including grazing and potential for expansion of native woody vegetation.

6~~4~~.9 LMU 8 – Ardgour predator free sanctuary

This LMU (38 ha) will be primarily located in the Karearea paddock but also includes small parts of the adjacent paddocks (Kowhai Lane, Lower Airstrip, North Face Upper, Hut Block). While this LMU lies within the Ardgour Restoration Area, its management is described in a separate plan – *Ardgour Pest Exclusion Fence Management Plan* – and is not further discussed here.

~~5.~~7. MANAGEMENT REVIEW AND REPORTING

~~7~~5.1 Introduction

This section outlines the management system that will be established to oversee and review the restorative management that is undertaken in the Ardgour Restoration Area. In particular, this section outlines the process for annual reviews of the workplan and five-year reviews of the management plan.

~~7~~5.2 Management plan review

Review of management work each year and production of the next annual management plan, as well as review and production of five-year management plans, shall be undertaken as follows:

- A suitably qualified expert(s) will be engaged to assist with management plan review.
- Annual workplan plan review will be based on both monitoring of management activities and outcome monitoring. This review will be undertaken in August/September each year, with the suitably qualified expert(s) meeting with project management to confirm the next years workplan based on the review's results.
- Review of this five-year management plan review will be based primarily on outcome monitoring. This review will be undertaken in August/September of Year 5, with the suitably qualified expert(s) then meeting with project management to confirm the new five-year management plan based on this review.

A key part of the five-yearly reviews will involve addressing contingency actions should outcome monitoring (Section 5.12) suggest that the eight biodiversity outcomes are not being met. It is difficult to predict what contingency actions might be required but could include additional planting, more intensive animal pest control and changes to livestock grazing regimes.

In addition, project management will need to liaise with the grazier at least every six months to discuss farming opportunities and constraints and how they relate to the restorative management planned here.

Should the Ardgour Restoration Area be impacted by fire then it is essential that the five-year management plan is fully reviewed and a new iteration of it produced. Depending on the severit and extent of the fire, their may be a requirement for a substantial increase in resources for restoration in order to achieve the 35-year outcomes.

~~5.3~~7.3 Compliance monitoring and reporting

An annual Ardgour Restoration Area compliance report will be prepared by MGL and provided to ~~Otago Regional Council~~ORC/CODC/DOC by 30 November each year. Each annual report will report on progress with the proposed conservation actions within the Ardgour Restoration Area.

The report will include:

- Verification that livestock have been excluded and/or that their numbers have been reduced to target stock density ~~levels~~ , specific stock types and/or stated timings in the Ardgour Restoration Area;
- A summary of native planting undertaken including species, numbers, timing, locations and representative photos;
- A summary of all mammalian pest and ecological weed management activities undertaken during the year, including corresponding results, dates and methods for each control activity;
- A summary of any adaptive management or contingency responses during the year where thresholds for control targets have not been achieved;
- Any challenges or issues encountered with livestock management, habitat relocation, mammalian pest or ecological weed management, or monitoring, along with how these difficulties were overcome or if they remain ongoing; and
- Any new tools, technologies and methods deemed likely to improve the efficiency and effectiveness of livestock management, vegetation enhancement and habitat relocation, mammalian pest, or ecological weed management, which should be incorporated into the following years' pest management practices if suitable.

A five-yearly Ardgour Restoration Area summary compliance report will be prepared by MGL and provided to ~~Otago Regional Council~~ORC/CODC/DOC on the completion of each five-year work plan.

7.4 Long-term management

All the restorative management described in this plan will in 35-years' time lead to a substantial biodiversity uplift within the Ardgour Restoration Area. The Ardgour Restoration Area at 1263 ha will become the largest area of protected land, at a comparable attitude (500-800 m elevation), in the ca, 88,500 ha Dunstan Ecological District, and it will be the only area that is subject to active biodiversity management. The only comparable areas are Bendigo Scenic Reserve (627 ha), Cluden Creek Conservation Area (420 ha) and Cloudy Peak Conservation Area (220 ha), and none of these are subject to amount of active biodiversity management proposed here.

However, at the end of 35 years, the biodiversity uplift achieved will require ongoing management. While placing some form of protective title on the Ardgour Restoration Area (e.g. a protective covenant or gazettal under the Reserves Act) is important, this, in of itself, is insufficient to guarantee the sustainability of the biodiversity gains[24]. It is therefore proposed that over the life of the consent, that funding will be set aside in some form of a non-wasting endowment fund[25] to guarantee ongoing biodiversity management. This is discussed further in Consent Conditions xxxx.

[24] Norton D 1988. Managing for the long term. Forest and Bird Magazine, 32-34.

[25] Norton DA, Warburton B 2015. The potential for biodiversity offsetting to fund effective invasive species control. *Conservation Biology* 29: 5-11.

~~6.~~8. CONCLUSION

The Ardgour Restoration Area Management Plan sets out the goals and operational approach to undertaking restorative management within the 1263 ha Ardgour Restoration Area over the first five-year management period. Management is based on the division of the area into eight unique land management units (LMUs). Each LMU is distinguished based on restoration management goals (potential ecosystem composition) and management requirements. The LMUs are:

- LMU 1 – Broad Gully shrublands
- LMU 2 – Upper Dry Creek shrublands
- LMU 3 – Lower and Middle Dry Creek shrublands
- LMU 4 – Alluvial valley flats
- LMU 5 – Cushionfields
- LMU 6 – Exotic pasture
- LMU 7 – Short tussock grassland
- LMU 8 – Ardgour predator free sanctuary

The expected condition of native biodiversity in the Ardgour Restoration Area (the biodiversity uplift that is achieved) in 35-years' time is then summarized, with a focus on ecosystems. In summary these outcomes relate to:

1. Increase in native dominated shrubland.
2. Increase in the diversity of native tree, shrub and liane species.
3. Expansion of native woody vegetation regenerating in non-woody areas.
4. Increase in annual abundance of native seed dispersing birds (tauhou, korimako and tuī).
5. Evidence of natural dispersal of native species within the areas of native woody vegetation.
6. Natural establishment of kōwhai seedlings.
7. Planted mataī and tōtara have >50% survival.
8. Cushionfield extent has been maintained.

Five-year restoration management goals (and their associated management actions by year) are then outlined representing the stepping-stones towards achieving the 35-year

outcomes. These goals and management actions are split into those that apply across the whole of the Ardgour Restoration Area (property wide management) and those that relate to the individual land management units.

The property wide management goals and actions relate to:

- Fencing
- Track establishment and management
- Grazing and fertiliser
- Restoration planting
- Wetlands
- Mammalian pest management
- Plant pest management
- Ardgour Rise road corridor
- Species specific management
- Fire management
- Biodiversity outcome monitoring
- ~~Photo~~Operational~~-~~ monitoring

These goals and management actions then guide the restoration management that will be implemented over the five-year period of this management plan. Management work will be reviewed on annual and five-year cycles, with a new management plan produced for the next five-year period. A suitably qualified expert(s) will be engaged to assist with management plan review. In addition, annual compliance reporting will be undertaken and provided to ~~Otago Regional Council~~ORC/CODC/DOC.

APPENDIX 1 – UNDERLYNG TRAJECTORIES IN BIODIVERSITY CHANGE

In setting the 35-year outcomes for the Ardgour Restoration Area, consideration has been given to the likely trajectories of biodiversity change that might occur in the area in the absence of the management described in this plan. All of the land that forms the Ardgour Restoration Area is currently part of Ardgour Station which is farmed in conjunction with the adjacent Cloudy Peak Station and operated as a sheep and beef property. The property is freehold and farming is a permitted activity under the Central Otago District Plan.

While there were dramatic declines in the extent and condition of native ecosystems and their constituent flora and fauna with both Māori and European settlement, changes in more recent decades (especially the last 50-80 years) have been more complex[26]. These changes have been driven by a range of factors including farm management (livestock browsing, aerial oversowing of pasture species and topdressing with fertiliser, and vegetation clearance by fire, herbicide and root raking/ploughing in accessible areas), spread of competing non-native plants, impacts of invasive browsers and grazers, and predation by introduced mammals. In the wider landscape, changing land use, such as conversion of pastoral farmland to horticulture/viticulture, has also had a major impact on native biodiversity.

Climate change is also likely to be impacting trends in native biodiversity, although our understanding of these effects is limited. Climate change can have both direct effects (e.g. drought or unseasonal frosts) as well as working synergistically with other factors such as invasive species (changing climates facilitating invasion of new exotic species that displace native species)..

Because of the long history of human impacts, the plant communities (and their flora and fauna) present in the Ardgour Restoration Area today are novel[27] in that they were not present in the pre-human landscape. Furthermore, their future extent and composition will

[26] See *Vegetation Values Assessment*, RMA Ecology, and references therein.

[27] See Hobbs RJ et al. 2006. Novel ecosystems: theoretical and management aspects of the new ecological world order. *Global Ecology and Biogeography* 15, 1-7, for a detailed discussion of novel ecosystems including a New Zealand example.

be dependent on the future impacts of farm management, invasive species and climate change.

Under pastoral management, exotic pasture may expand and/or thicken depending on the approach to oversowing and topdressing and how grazing is applied (stock type, duration and timing). Tussock is particularly vulnerable to livestock grazing, especially in dry years, when grazing pressure is high or where cattle are grazed. Grazing pressure, even light grazing, also reduces the establishment of native woody species into grassland as well as understorey recruitment in shrubland areas, especially of palatable native species. Grazing by rabbits and sheep also removes palatable leaves within browse height leaving open understoreys that are more prone to water stress or frost damage. Protective leaf-litter layers are compacted and/or or displaced by livestock, exacerbating water deficits. As well as grazing, cattle also impact shrublands, riparian areas and wetlands through physically breaking vegetation, damaging soil and pugging the ground.

Feral ungulates (deer and pigs in this area) are rapidly increasing on both public and private land across New Zealand[28]. These species are having marked impacts on vegetation and, in the case of pigs, soil, even when at low densities. Reinvasion from adjacent land can be rapid after local control because they tend to occur at larger spatial scales than individual management units like farms. Increasing woody vegetation cover (see below) can also provide more cover for these species allowing them to more easily evade control.

Most farm-initiated weed control focuses on species like European broom, gorse and willows, with some recent and effective control of wilding pines in nearby subdivisions. There are, however, several weeds that are present in low densities or in very localised areas are unlikely to be controlled under current pastoral management, and so highly likely to spread. In addition, a number of weed species in the wider landscape have the potential to disperse into the area (especially noting the proliferation of upwind urban intensification). Weed species can smother/outcompete native species.

In cushionfields such weeds include stonecrop, thyme, sweet briar, hemlock, mullein, Californian poppy and thistles amongst others. In scrubland smothering weeds present, or

[28] See Norton DA, Bellingham PJ & Richardson SJ. 2026. Deer in the hadlights: sleepwalking our way to a native forest catastrophe. New Zealand Journal of Ecology 50.

likely to arrive from nearby seed sources include bird-dispersed shrub weeds such as elderberry, hawthorn, boxthorn, cotoneaster, wild plum, cherry and flowering currant, as well as vines (e.g. Chinese clematis and Chilean glory vine), wilding conifers and ground covers like male fern. Some species, such as wilding conifers, change soil biology and chemistry, thereby enhancing recolonisation of their seedlings and reducing the ability for native species to recolonise.

An added complexity to the weed invasion issue is that ongoing grazing by livestock (sheep and cattle) can limit the spread of some invasive exotic plants such as sweet briar and wilding conifers[29]. Removal of livestock grazing may actually speed up invasion processes for these species.

Notwithstanding these factors, the Ardgour Restoration Area does hold a diverse native flora and fauna (including many nationally and regionally at risk and threatened species). This is despite ongoing farm management but acknowledging that management inputs such as cultivation (largely lacking) and vegetation clearance have not been as intensive within the area under consideration here as in other places (e.g. alluvial terraces along the Lindis and Clutha/Mata Au Rivers). Because management inputs have not been high, stocking rates have also not been high. While some native species are clearly in decline (e.g. native brooms and kōwhai), others have been able to hold their own, and some may have become more abundant in recent decades.

As enhancing native woody vegetation is a key biodiversity outcome of this management plan, further consideration of recent trends in shrubland is relevant. Aerial photography shows that shrubland has expanded in in the Ardgour Restoration Aea and the wider landscape in recent decades. This is likely due to range of factors including the history of aerial fertiliser application, changes in livestock management practices (e.g. stock type, rate and timing of grazing), reduced or no burning or herbicide application) and in some cases removal of all farming inputs (e.g in Dry Creek Conservation Area). However, these native woody communities are typically dominated by a subset of relatively common native woody species (primarily matagouri, mingimingi and scented tree daisy) and lack

[29] See Sage, D.J.M., Norton, D.A. & Espie, P.R. 2009. Effect of grazing exclusion on the woody weed *Rosa rubiginosa* in high country short tussock grasslands. *New Zealand Journal of Agricultural Research 52*: 123-128. Ledgard, N.J. & Norton, D.A. 2008. The impact of browsing on wilding conifers in the South Island high country. *New Zealand Journal of Forestry 52(4):* 29-34.

elements that might be considered typical of pre-human woody vegetation (e.g. kōwhai or thin-bark tōtara) as seed sources are scarce or more often, absent. In addition, plant community structures are simple, with most areas lacking lianes. Ongoing herbivory by both domestic livestock and feral ungulates, possums and lagomorphs (rabbits and hares) also limit the ability of any palatable species to establish and allow for succession to a more species and structurally diverse state in these woody communities.

Furthermore, cyclical clearance of regenerating native shrubland is common on hill and high country farms in Central Otago. Shrubland clearance has been used as a farm management tool in this area for many years and is undertaken using aerial herbicide, cattle and cutting/crushing. Fire does not appear to have been used in recent decades in this area but is used elsewhere. Woody vegetation clearance is needed because plants like matagouri respond rapidly to fertiliser addition and can form dense impenetrable thickets that limit both the growth of pasture species and stock access[30]. On some parts of Ardgour Station, sub-catchments leading into Dry Creek have been aerial sprayed in recent years and dieback of woody vegetation across valley floors and sides is evident. While woody vegetation has spread over several decades at a catchment scale, periodic control can re-set the foundation vegetation communities back to exotic grassland and reverse succession to exotic and native woody vegetation by many decades.

A key question then is, while there is evidence for an improvement or at least maintenance of some elements of native biodiversity, especially shrubland, under current farm management over recent decades, will this continue into the future? The Central Otago District Plan is reasonably permissive with regards vegetation clearance, with matagouri exempt from the vegetation clearance rule in the3 district plan. Because of this, many of these woody communities, and their flora and fauna, have little guarantee of permanence, or an enhancement in their condition, under current or potential future farm management practices. This is especially so in the context of an increasing diversity and cover of non-native weeds that are not controlled by most farmers, persistent invasive animals populations and climate change.

[30] Day NJ 2021. The biology and ecology of matagouri (*Discaria toumatou*, Rhamnaceae) and its distribution across New Zealand. Unpublished report prepared for LINZ.

Based on this discussion, it is considered that the restorative management outlined in this management plan will significantly enhance both the extent and quality of native-dominated woody ecosystems over what might be the case without this management. This will result in a significant improvement in native biodiversity, both flora and fauna. This premiss underpins this management plan.

APPENDIX 2~~1~~ - CONSTRAINTS TO ACHIEVING UPLIFT

This Appendix outlines those factors that could limit the success of management in achieving the 35-year restoration outcomes for the Ardgour Restoration Area. Constraints (or risks) to achieving these outcomes are abiotic, biotic, and socio-economic. For each constraint, management responses to address them are briefly summarised.

Abiotic constraints

Climate: The Ardgour environment presents a significant constraint to plant growth because of high summer evapotranspiration, as well as out-of-season frosts. High summer evapotranspiration occurs because of the low precipitation, predominantly north facing aspects and the generally low elevation of the site (and hence higher summer temperatures). A weather Station at Bendigo (500 m a.s.l., NIWA station no. 5242) recorded an average annual rainfall of 445 mm (1955-1979), with a minimum annual rainfall of 281 mm and maximum of 575 mm. Monthly rainfall varied from 24 mm to 46 mm, but with little obvious seasonal variation. The driest and wettest months received 0 mm (June 1964) and 172 mm (September 1970). However, summer dry periods can be particularly challenging due to high temperatures and consequentially high evapotranspiration rates creating drought stress for plants. Unusually early or late frosts also occur in this area[31] and can impact restoration plantings.

Response: *Restoration management can deal with these constraints in several ways. The simplest approach is to focus woody restoration on south facing aspects where summer evapotranspiration is likely to be lower. Other responses can include focusing planting on species (and provenances) with a known ability to tolerate dry conditions, being selective in planting into shady microsites where soil water deficits are likely to be lower, undertaking plantings in both autumn and spring ~~after frosts and before summer soil moisture deficits become prevalent~~, and spreading plantings over several years to minimise the risk of failure due to unexpected weather events ~~during one~~such as a particularly dry summer or ou~~t~~t-of-season frost.*

[31] An example of this was a late frost in 2024 which impacted vineyards and orchards in the Upper Clutha Basin.

Soils: Compounding the limitations associated with high evapotranspiration, 7-800 years of human impacts including repeated fire, rabbit plagues and historic over-grazing, primarily by sheep, will have resulted in substantial soil erosion from exposed areas and its deposition in sheltered areas. As a result, modern soils will have lower water holding capacity than historic soils ~~because~~ where they are shallower and contain less ~~carbon~~organic matter. This in turn means that plants growing in them are more vulnerable to water stress. ~~In addition, soil volumes will be less than in the past~~Shallow soils provide~~,~~ ~~with~~ smaller ~~areas~~ volumes for plant roots to exploit. The flip side of this is that alluvial surfaces are likely to have deeper soils than in the past due to soil accumulation. In addition, sustained stock grazing will have resulted in compacted soils, especially in areas where sheep aggregate, resulting in reduced water infiltration and increased soil temperature.

Response*: While there is no simple management tool to deal with soil loss, focusing on reducing ongoing soil loss by increasing woody biomass will increase soil carbon and in the medium term will ~~hopefully~~ increase soil water holding capacity. Further, the use of mulch can~~, in some situations,~~ both reduce soil moisture stress and build soil organic matter.*

Climate change: There is considerable uncertainty how climates in this area will change, aside from the projected increase in temperatures, as atmospheric CO2 levels continue to increase. However, it would seem likely that rainfall will become more variable, there will be shorter periods of cold temperatures and a greater incidence of extreme rainfall and temperature events. These changes will create challenges for the restoration project, with increased summer moisture stress likely the biggest issue. However, more severe rainfall events could also cause localised severe erosion events.

Response: *The best response to changing climates is to have genetic diversity in plantings, including sourcing a portion of plants from drier areas ~~if possible~~, and spreading plantings over multiple years to reduce risk from individual adverse weather events. In addition, maintaining good ground cover, especially woody vegetation, across the whole site will help reduce the impact of severe rainfall events. This is a potential challenge with management of ~~turf~~ cushionfield communities, but establishment of buffer vegetation downslope of these areas will help reduce water runoff and hence erosion.*

Biotic constraints

Historical biodiversity loss: 7-800 years of human impacts have resulted in a massive change in the species present (both flora and fauna). Most of the species that would have been present in the pre-human ecosystems are now locally, regionally or nationally extinct. This coupled with the raft of non-native species that are now present, and the environmental changes that have occurred and will occur with climate change (see above), means that it is not possible to restore pre-human ecosystems. This is neither a 'good' or 'bad' thing in of itself, it is the reality that restoration needs to be cognizant of – the ecosystems we restore will be novel in the sense that native species will likely occur in combinations that have not occurred in the past and will include exotic species. But notwithstanding this, the priority for restoration is to restore a dominance and diversity of native flora and fauna.

Response: *Restoration goals need to be set within the context of this history.*

Animal pests: One of the major factors that will limit restoration success is browsing, trampling and predation by introduced animals, including domestic livestock (sheep and cattle), feral ungulates (deer, pigs and goats), possums, lagomorphs (rabbits and hares), mustelids (stoats, ferrets and weasels), rodents (rats and mice), cats and hedgehogs. Trampling (mainly by cattle) can irreversibly damage cushionfields and wetlands. Browsing reduces viability and growth rates of both naturally regenerating and planted plants, especially young ones. As directly impacting native species, predation of invertebrate, reptile and bird species influences restoration success as these species play key roles in ecosystem processes such as pollination, seed dispersal and nutrient cycling. However, no grazing may also be an issue in some situations as mammalian grazers can also control invasive exotic plant species that might otherwise suppress native plants.

Response*: Animal pest control will be a central part of restoration management in the Ardgour Restoration Area but will need to be undertaken in a strategic manner to maximise the biodiversity outcomes identified in this plan while not being unrealistic in terms of costs. In addition, livestock grazing will need to be carefully managed as livestock will continue to play an important role at this site (see below).*

Plant pests: Introduced plant species have the potential to limit restoration success. Several invasive woody species are already present, or present in adjacent areas (e.g.

elderberry, buddleia, wilding pines, *Clematis* species), and have the potential to expand their range and displace native vegetation. Unfortunately, because the Ardgour Restoration Area is located down-wind of intensifying urban development in the Upper Clutha Basin, spread of unwanted plants will be an ongoing issue. Sweet brier is also widespread in the Ardgour Restoration Area but is less of an issue for long-term succession to native woody dominance although at the same time this species can displace cushion-field vegetation. Pressure from bird-dispersed weeds will also increase as their numbers increase, with pressure exacerbated by new amenity species attractive to birds (such as rowan and flowering cherries) associated with increasing subdivision. Some exotic grass and herb species can also be competitive and ~~can~~ lead to the loss or poor health of restoration plantings and cushionfield vegetation.

Response: *Potential problem woody weeds are relatively amenable to being controlled from the Ardgour Restoration Area, and key seed sources (e.g. elderberry) on adjacent properties could also be eradicated (where possible) to reduce propagule pressure. Exotic grasses and herbs can be, where required, controlled prior to, and after, establishment of plantings to reduce competition. Regular surveys for new plant pests should also be undertaken, as vigilance is considerably cheaper than controlling a problem species once it has established.*

Mycorrhizal fungi: The development of associations between planted species and mycorrhizal fungi is important for restoration success, especially native mycorrhiza[32]. Mycorrhizal fungi are associated with plant roots and play a key role in nutrient uptake for many native plants. The absence of mycorrhiza is likely to be a limiting factor for restoration plantings.

Response: *Nursery propagation of seedlings for restoration will include inoculation with appropriate mycorrhiza sourced from natural populations of the target native plant species.*

[32] See for example Williams et al. 2011. Growth and competitiveness of the New Zealand tree species Podocarpus cunninghamii is reduced by ex-agricultural AMF but enhanced by forest AMF. Soil Biology and Biochemistry 43, 339-345.

Time: Because of the abiotic constraints discussed above, native woody species growth, especially to a size that results in flowering and fruiting and the ability to naturally spread within enhancement areas, will be slow. It will also take time for native seed dispersing birds like korimako and tuī to become resident at this site, or visit frequently enough, to act as seed dispersal vectors. As a result, the time required to transition all woody communities to more diverse states (species, lifeforms and stature) will be considerable and certainly, much longer than the life of the mine and its associated consents.

Response: *Being realistic in setting biodiversity outcomes that can be achieved and making sure that funding is available to guarantee long-term management of the Ardgour Restoration Area after the life of the mine (e.g. through some form of non-wasting endowment fund).*

Socio-economic constraints

Farm management: It is proposed that parts of the Ardgour Restoration Area will continue to be grazed both because of the benefits this provides to the restoration project (e.g. reducing fire risk and keeping weeds in check) and because it is not possible to restore the whole property. Farm management does, however, presents a risk to restoration through both stock accessing areas they are supposed to be excluded from, and through other adverse impacts of management (e.g. fertiliser or herbicide being applied to restoration and cushionfield areas or cattle damaging areas).

Response: *Good, regular and transparent communications with the lessee is critical to address this. In addition, paying the lessee to graze the areas that require grazing creates a relationship where the lessee is working for the restoration project, rather than being a passive player or seeing restoration as a hindrance to their farming system. Finally, being clear where fertilizer and seed can be applied, and that cattle are to be fully excluded from the Ardgour Restoration Area which is done in this management plan.*

Fire: For fire to occur, three conditions need to be met – presence of sufficient biomass to burn, dry conditions to promote burning and an ignition source. The restoration management being undertaken in the Ardgour Restoration Area will create more biomass and increasingly dry summers will create conditions for fire. Ignition sources are most likely to come from either adjacent farming operations (burn offs) or from people traversing through the area (accidental or deliberate fires). Public access up the proposed new

alignment of Thomsons Gorge Road (Ardgour Rise) is seen as a major risk to the success of the Ardgour restoration project.

***Response**: Three responses can reduce the risk of fire but never eliminate it: Grazing grassland to keep biomass low, especially along the Ardgour Rise Road alignment. Working with adjacent landowners to limit or exclude burn-offs on land adjacent to the Ardgour Restoration Area. Finally, erecting educational signs highlighting fire risk at any stopping points on the new road alignment should also be done.*

Funding: The success of the Ardgour restoration project is dependent on the availability of sufficient funding to cover the cost of management activities both during the life of the project and after 35 years.

***Response**: Matakanui Gold Ltd. will fund the management work described in this plan for the life of their resource consent. However, some form of non-wasting endowment fund will be required to guarantee ongoing management beyond this time.*

APPENDIX 2 – SUMMARY OF FIVE-YEAR GOALS AND MANAGEMENT ACTIONS

3.2 Fencing

Year five goals:

Fencing has been upgraded or installed to a standard that protects biodiversity values in LMUs 1, 2 and 4.

Management actions:

Year 1 – ensure that the existing fences around LMU 1 and 2 are stock proof.

Year 1 – install new fencing to allow stock exclusion from LMU 1 (but noting that some fencing around LMU 1 might be temporary until LMU 4 fencing has been completed).

Year 2 – as required install additional fences for efficient livestock grazing.

Year 2 – complete fencing of kōwhai clusters across the Ardgour Restoration Area using rabbit netting. These fences should be located at least 25 m from remnant kōwhai trees to allow room for planting and natural regeneration.

Year 3 onwards – fence off LMU 4 as dictated by planting plans for this LMU (see Section 4.5).

3.3 Track establishment and management

Year five goals:

Tracking has been upgraded and new tracks installed to support restoration management.

Management actions:

Year 1 – upgrade existing tracks to 'side-by-side' standard.

Year 1 – install additional tracks ('side-by-side' standard) to provide management access.

Year 2 onwards – maintain tracks.

3.4 Grazing and fertiliser

Year five goals:

~~Sheep have been grazed in a manner that supports biodiversity outcomes.~~

~~Management actions:~~

~~Year 1 – establish a contract grazing arrangement with a grazier that supports the restoration goals of this management plan including sheep grazing only.~~

~~Year 1 – ensure that stock water is available in all grazed areas.~~

~~Year 1 – install additional fences to allow for effective and efficient management of livestock.~~

~~Year 1 onwards – no fertiliser or seed will be applied except where required for restoration management purposes.~~

~~Year 2 onwards – annually review the effectiveness of grazing on biodiversity outcomes.~~

~~3.5 Restoration planting~~

~~Year five goals:~~

- ~~Initial plantings have been undertaken in LMUs 1, 2 and 4.~~
- ~~Kōwhai groves have been rabbit fenced and a start made to planting these.~~
- ~~For difficult to source and/or grow plants such as podocarps, seeds have been collected, and propagation has started.~~

~~Management actions:~~

~~Year 1 – contract a suitably qualified plant propagator (nursery).~~

~~Year 1 onwards – seed collection and propagation.~~

~~Year 1 or 2 – establish a suitable 'hardening off' site as part of the mine infrastructure.~~

~~Year 2 – map all kōwhai trees/groves and plan sites for kōwhai groves (see Appendix 4.3).~~

~~Year 2 or 3 onwards – planting and ongoing maintenance.~~

~~Year 3 or 4 – plant kōwhai at five existing groves and establish at least five new groves (including rabbit fencing).~~

~~Year 3 or 4 onwards – monitor kōwhai plantings.~~

~~Year 4 or 5 – plant kōwhai at four existing groves and establish at least six new groves (including rabbit fencing).~~

~~Year 4 or 5 – commence a programme of enrichment plants with short tussocks and taramea in LMU 7.~~

~~3.6 Wetlands~~

~~Year five goals:~~

~~The composition and condition of the mapped areas of wetland within the Ardgour Restoration Area is similar to what it was on Year 1.~~

~~Management actions:~~

~~Year 1 – ensure new fencing and tracking avoids any wetlands.~~

~~Year 1 – where reticulated water needs to be taken from wetlands, make sure that this does not adversely impact wetlands.~~

~~Year 4 – repeat wetland photo-monitoring.~~

~~3.7 Mammalian pest management~~

~~Year five goals:~~

~~To manage exotic mammals to levels that do not threaten restoration plantings, natural regeneration and key fauna.~~

~~Management actions:~~

~~Year 1 onwards – commence annual ungulate control across all the Ardgour Restoration Area.~~

~~Year 1 onwards – undertake additional pig control when pig rooting sign indicates it is required.~~

~~Year 1 – liaise with adjacent landowners prior to undertaking a 1080 operation across the Ardgour Restoration Area in Year 2.~~

~~Year 2 – undertake 1080 operation.~~

~~Year 3 – commence carnivore control in LMUs 1 and 2.~~

Year 4 onwards – continue carnivore control in LMUs 1 and 2.

Year 5 – repeat 1080 operation.

3.8 Plant pest management

Year five goals:

- The Ardgour Restoration Area is kept free of mature fruiting specimens of all known woody weeds (trees, shrubs, lianes) except sweet brier (but see under (3) below).
- Herbaceous weeds (grasses and forbs) do not limit the success of restoration plantings.
- Cushionfields (LMU5) are kept free of woody weeds, primarily sweet brier, as well as thistles, thyme and stonecrop.

Management actions:

Year 1 – survey Ardgour Restoration Area for all woody weeds (trees, shrubs, lianes), mapping their locations and removing at the same time.

Year 1 onwards – remove sweet brier and thistles, if they start forming dense swards, from cushionfield vegetation in LMU 5.

Year 1 onwards –eliminate thyme or stonecrop from cushionfield vegetation in LMU 5 should they be recorded there.

Year 2 onwards – undertake annual surveys and control on a rolling three-year basis as described above.

Year 2 onwards – control herbaceous weeds when planting new native plants through spray or manual removal.

Year 3 – map adjacent areas (as much as possible) for wood plant pests that have the potential to spread into the Ardgour Restoration Area (e.g. elderberry) and discuss control with landowners.

Year 4 – remove adjacent elderberry where permission has been granted.

3.9 Ardgour Rise Road Corridor

Year five goals:

The Ardgour Rise Road and those using it are not having an adverse impact on the Ardgour Restoration Area.

Management actions:

Year 1 – placing signage at regular intervals along the road informing visitors about the need to keep to the formed road and not to light fires.

Year 1 – placing signage at stopping points along the road informing visitors about the objectives of Ardgour Restoration Area management.

Year 1 – ensure that any tracks leaving the Ardgour Rise Road have no entry signs and/or have chains across preventing access.

Year 1 onwards – monitor impact of road users on the Ardgour Restoration Area and if adverse impacts are occurring review how road is managed (including potentially installing security cameras).

Year 1 onwards – being vigilant for new weeds establishing along the side of the Ardgour Rise Road and removing them.

3.10 Species specific management

Year five goals:

Restoration management is undertaken in the Ardgour Restoration Area in a manner that complements the goals of the *Lizard and Invertebrate Management Plans* and the outcomes from the *Applied Research Programme for Cushionfield and Spring Annuals*.

Management actions:

Year 1 onwards – regularly review the outcomes of the management actions in this plan against the *Lizard and Invertebrate Management Plans*.

Year 1 onwards – update management actions relating to LMU 5 to reflect the outcomes of the *Applied Research Programme for Cushionfield and Spring Annuals* when completed.

3.11 Fire management

Year five goals:

~~Fire has not compromised the restoration outcomes from the management work undertaken here.~~

~~Management actions~~:

~~Year 1 – erect educational signs highlighting fire risk at stopping points on the Ardgour Rise Road.~~

~~Year 1 onwards – graze LMU's 5, 6 and 7 to maintain in an herbaceous state to reduce the chance of fire spreading from the Ardgour Rise Road.~~

~~Year 1 onwards – liaise with adjacent landowners to limit or exclude burn-offs on adjacent land.~~

~~3.12 Biodiversity outcome monitoring~~

~~Year five goals~~:

~~Biodiversity outcome monitoring is informing management.~~

~~Management actions~~:

~~Year 1 – baseline biodiversity condition is established.~~

~~Year 2 onwards – biodiversity outcome parameters are monitored at appropriate intervals.~~

~~3.13 Photo-monitoring~~

~~Year five goals~~:

~~Photo-points are being used to track management across the Ardgour Restoration Area~~

~~Management actions~~:

~~Year 1 – At least 20 photo-points have been established across the Ardgour Restoration Area.~~

~~Year 3 – Repeat photo-points to obtain a good baseline.~~

~~Year 5 – Repeat photo-points at 2-3 year intervals thereafter.~~

~~4.2 LMU 1 – Broad Gully shrublands~~

~~Year five goals~~:

- As a result of restoration management these shrublands are:
- Starting to become more diverse both in terms of species and life-forms.
- Infilling of pasture areas by native woody species has started.
- Tauhou numbers are stable and there is evidence for korimako and/or tuī visiting these areas.

Management actions:

Year 1 – identify initial planting areas.

Year 1 – contract nursery to raise plants for this LMU (in conjunction with plant propagation for other LMUs – see Section 3.5).

Year 3 onwards – establish enrichment plantings aiming for at least 1000 plants per year (see Appendix 4.2).

Year 3 onwards – monitor enrichment plantings.

4.3 LMU2 – Upper Dry Creek shrublands

Year five goals:

- As a result of restoration management these shrublands are:
- Starting to become more diverse both in terms of species and life-forms.
- Infilling of pasture areas by native woody species has started.
- Tauhou numbers are stable and there is evidence of korimako and/or tuī visiting these areas.

Management actions:

Year 1 – identify initial planting areas.

Year 1 – contract nursery to raise plants for this LMU (in conjunction with plant propagation for other LMUs – see Section 3.5).

Year 3 onwards – establish enrichment plantings aiming for at least 3000 plants per year (see Appendix 4.2).

Year 3 onwards – monitor enrichment plantings.

4.4 LMU3 – Lower and Middle Dry Creek shrublands

Year five goals:

- In five years' time the goals for native biodiversity in this LMU are:
- The extent and composition of native shrubland is similar to what it was at the start of the implementation of this management plan.

Management actions:

Year 1 onwards – continue to graze this LMU in a similar manner to what is being done currently but only using sheep (no cattle).

Year 1 onwards – no vegetation clearance and liaise with adjacent landowner/manager to ensure that any vegetation clearance in adjacent areas (Wongs and across Dry Stream on Cloudy Peak Station) is undertaken in a manner that minimises risk on this LMU (e.g. frm herbicide spray drift or fire).

4.5 LMU 4 – Alluvial valley flats

Year five goals:

- In five years' time the goals for native biodiversity in this LMU are:
- The first stage of restoration of alluvial podocarp-broadleaved forest has commenced.

Management actions:

Year 1 – clearly identify where sites are with the best soils for alluvial forest establishment (including undertaking some soil analyses – nutrients, water holding capacity etc).

Year 1 – work with grazier (considering stock movement and water requirements) in planning fencing (see Section 3.4).

Year 1 – contract nursery to raise plants for this LMU (in conjunction with plant propagation for LMUs1 and 2 – see Section 3.5 and Appendix 4.4).

Year 4 onwards – undertake fencing as required for the next years planting (see Section 3.2).

Year 4 onwards – establish 0.25 ha of plantings (ca. 2000 plants) annually.

Year 4 onwards – monitor plantings.

4.6 LMU 5 – Cushionfields

Year five goals:

At the end of this 5-year management period, restoration management will have resulted in:

- The condition of the mapped cushionfields is at least the same as it is in 2026.
- The research and survey work of the *Applied Research Programme for Cushionfield and Spring Annuals* is being supported, and if completed, implementation of the management recommendations has commenced.

Management actions:

Year 1 onwards – support the Applied Research Programme for Cushionfield and Spring Annuals.

Year 1 onwards – continue to graze with sheep at current stocking rates.

Year 1 onwards – no fertiliser or seed application.

Year 1 onwards – maintain compliance with Otago RPMP requirements for rabbits (see Section 3.7).

Year 1 onwards – remove all sweet brier and thistles where required (see Section 3.8).

Year x – implement management as recommended from the results of the Applied Research Programme for Cushionfield and Spring Annuals.

4.7 LMU 6 – Exotic pasture

Year five goals:

In five-years' time it is intended that:

- Livestock grazing (sheep only) has been maintained in a manner that is consistent with the biodiversity objectives of this management plan.

Management actions:

Year 1 – develop a leasing arrangement that allows for sheep grazing.

Year 1 – ensure all paddocks have stock water prior to the new predator proof fencing being completed (LMU 8).

4.8 LMU 7 – Short tussock grassland

***Year five goals*:**

In five-years' time it is intended that:

- The composition and structure of the 'Native dominated tussockland' vegetation in this LMU is in a similar state to what it is currently, although there may have been some enrichment planting of short tussocks.

***Management actions*:**

Year 1 onwards – work with grazier to finalise optimal grazing, but focus is on sheep only for limited periods of time (Section 3.4)

Year 1 onwards – explore and implement short-tussock and taramea enrichment planting if deemed necessary as part of the offset for loss of these species within the mine footprint.

Year 5 – based on outcome monitoring, reevaluate the need for future management including grazing and potential for expansion of native woody vegetation.

APPENDIX 33 - INDICATIVE YEAR-ONE WORK PLAN

Ardgour Restoration Area 2026-2027 work plan

Introduction

The following Work Plan is based on the first five-year Ardgour Restoration Area Management Plan and covers the financial year commencing xx xxxx 2026. Only those management actions that have been allocated to 2026-2027 or are ongoing are listed.

Management plan actions for 2026-2027

Project management

- Review management work against these actions
- Based on this review, prepare work plan for 2027-2028 year

Property wide management

Fencing

- Ensure that the existing fences around LMU 1 and 2 are stock proof.
- Install new fencing to allow stock exclusion from LMU 1 (but noting that some fencing around LMU 1 might be temporary until LMU 4 fencing has been completed).

Track establishment and management

- Upgrade existing tracks to 'side-by-side' standard.
- Install additional tracks ('side-by-side' standard) to provide management access.

Grazing and fertiliser

- Establish a contract grazing arrangement with a grazier that supports the restoration goals of this management plan including sheep grazing only.
- Ensure that stock water is available in all grazed areas.
- Install additional fences to allow for effective and efficient management of livestock.

Restoration plantings

- Contract a suitably qualified plant propagator (nursery).
- Undertake seed collection and propagation.
- Establish a suitable 'hardening off' site as part of the mine infrastructure.

Wetlands

- Ensure new fencing and tracking avoids any wetlands.
- Where reticulated water needs to be taken from wetlands, make sure that this does not adversely impact wetlands.

Mammalian pest control

- Undertake annual ungulate control across all the Ardgour Restoration Area.
- Undertake additional pig control when pig rooting sign indicates it is required.
- Liaise with adjacent landowners prior to undertaking a 1080 operation across the Ardgour Restoration Area in Year 2.

Plant pest management

- Survey Ardgour Restoration Area for all woody weeds (trees, shrubs, lianes), mapping their locations and removing at the same time.
- Remove sweet brier and thistles, if they start forming dense swards, from cushionfield vegetation in LMU 5.
- Eliminate thyme or stonecrop from cushionfield vegetation in LMU 5 should they be recorded there.

Ardgour Rise road corridor

- Place signage at regular intervals along the road informing visitors about the need to keep to the formed road and not to light fires.
- Place signage at stopping points along the road informing visitors about the objectives of Ardgour Restoration Area management.
- Ensure that any tracks leaving the Ardgour Rise Road have no entry signs and/or have chains across preventing access.

- Monitor impact of road users on the Ardgour Restoration Area and if adverse impacts are occurring review how road is managed (including potentially installing security cameras).
- Be vigilant for new weeds establishing along the side of the Ardgour Rise Road and removing them.

Species specific management

- Review the outcomes of the management actions in this plan against the *Lizard and Invertebrate Management Plans*.
- Update management actions relating to LMU 5 to reflect the outcomes of the *Applied Research Programme for Cushionfield and Spring Annuals* when completed.

Fire management

- Erect educational signs highlighting fire risk at stopping points on the Ardgour Rise Road.
- Graze LMU's 5, 6 and 7 to maintain in an herbaceous state to reduce the chance of fire spreading from the Ardgour Rise Road.
- Liaise with adjacent landowners to limit or exclude burn-offs on adjacent land.

Biodiversity outcome monitoring

- Establish baseline biodiversity monitoring.

Photo-monitoring

- Establish at least 20 photo-points.

Land management unit specific actions

LMU 1 Broad Gully shrublands

- Identify initial planting areas.
- Contract nursery to raise plants for this LMU (in conjunction with plant propagation for other LMUs).

LMU 2 Upper Dry Creek shrublands

- Identify initial planting areas.
- Contract nursery to raise plants for this LMU (in conjunction with plant propagation for other LMUs).

LMU 3 Lower and Middle Dey Creek shrublands

- Continue to graze this LMU in a similar manner to what is being done currently but only using sheep (no cattle).
- No vegetation clearance and liaise with adjacent landowner/manager to ensure that any vegetation clearance in adjacent areas (Wongs and across Dry Stream on Cloudy Peak Station) is undertaken in a manner that minimises risk on this LMU (e.g. from herbicide spray drift or fire).

LMU 4 Alluvial valley flats

- Clearly identify where sites are with the best soils for alluvial forest establishment (including undertaking some soil analyses – nutrients, water holding capacity etc).
- Work with grazier (considering stock movement and water requirements) in planning fencing.
- Contract nursery to raise plants for this LMU (in conjunction with plant propagation for LMUs1 and 2).

LMU 5 Cushionfields

- Support the Applied Research Programme for Cushionfield and Spring Annuals.
- Continue to graze with sheep at current stocking rates.
- No fertilizer or seed application.
- Maintain compliance with Otago RPMP requirements for rabbits.

LMU 6 Exotic pasture

- Develop a leasing arrangement that allows for sheep grazing.
- Ensure all paddocks have stock water prior to the new predator proof fencing being completed.

LMU 7 Short tussock grassland

- Work with grazier to finalise optimal grazing, but focus is on sheep only for limited periods of time.
-
- Explore and implement short-tussock and taramea enrichment planting if deemed necessary as part of the offset for loss of these species within the mine footprint.

APPENDIX 44 – RESTORATION PLANTING SPECIES CHOICE

A43.1 Introduction

This appendix provides more detail on restoration planting for the three different types of restoration planting that are proposed for the first five-year planning period (Section 43.5). For each type, the general approach and requirements for planting are first described and then a list of recommended species is included. However, it is important that the approach to planting is adaptative in terms of species choice and planting densities. This is necessary as planting should be informed by success to date and will obviously also be influenced by the availability of planting material (species and numbers).

In consultation with mana whenua, Taoka species and other species important to mana whenua may be incorporated into the lists below.

A43.2 Enrichment of existing native woody vegetation in LMU 1 and 2

This will involve planting clusters of five plants into existing gaps or created gaps (e.g. by cutting ~~a~~ brier rose down). Where exotic grasses or herbs (e.g. hemlock) are present, these will need to be sprayed or removed by hand prior to planting. ~~Except for highly palatable species, guards will not be used, although all plantings will be staked~~.

A palette of plant species for enrichment planting is provided in Table A43.1. The species have been sorted into three broad groups – primary, secondary and minor planting species. Rather than taking a prescriptive approach to planting in terms of species and numbers, an adaptive approach is proposed focusing on the groups below but adjusting based on what plant material is available and experience from previous years' planting. As it is not possible to have any real idea of the likely pre-human species composition of forests and shrublands in this area, these species have been suggested as likely to help the system develop towards a more diverse forest state that can provide good habitat for native fauna which is the. It is recommended that in the first couple of planting years that a broad suite of species is planted (from the list below) as a basis to test their performance.

It is recommended that the ratio of species planted is approximately 5:1 between primary and secondary species, with at least one liane species included in each planting cluster. Minor species will be planted in particular micro-sites that suit them.

Table A43.1. *Recommended plant species for enrichment plantings.*

Species	***Life form***	***Bird food***	***Guards***	***Site notes***
Primary planting species				
Coprosma virescens	Shrub	Fruit		
Cordyline australis (tī kōuka)	Tree	Nectar & fruit		
Olearia lineata (tree daisy)	Tree	-		
Pittosporum tenuifolium (kōhūhū)	Tree	Nectar		
Plagianthus regius (mānatu)	Tree	Nectar		
Pseudopanex crassifolius (horoeka)	Tree	Nectar & fruit	Yes	
Pseudopanex ferox (fierce lancewood)	Tree	Nectar & fruit	Yes	
Sophora microphylla (kōwhai)	Tree	Nectar	Yes	
Secondary planting species				
Carmichaelia kirkii	Liane	Nectar	Yes	
Clematis marata	Liane	Nectar	Yes	
Clematis quadribacteolata	Liane	Nectar	Yes	
Corokia cotoneaster (korokio)	Shrub	Fruit		
Griselinea littoralis (kāpuka)	Tree	Fruit	Yes	Damper
Hoheria angustifolia (narrow-leaved houhere)	Tree	Nectar		
Hoheria lyallii (mountain lacebark)	Tree	-		Higher/damper
Myrsine australis (red matipo)	Tree	Fruit		
Parsonsia capsularis	Liane	Nectar	Yes	
Pseudopanax colensoi (three finger)	Tree	Nectar & fruit	Yes	Damper
Rubus schmidelioides (tātarāmoa)	Liane	Nectar & fruit	Yes	
Scandia geniculata	Liane	Nectar	Yes	
Minor planting species				
Coprosma intertexta	Shrub	Fruit		Open
Coprosma rugosa	Shrub	Fruit		Damper
Fuchsia excorticata (kōtukutuku)	Tree	Nectar & fruit	Yes	Damper
Hebe salicifolia (koromiko)	Shrub	Nectar	Yes	Damper

Species	Life form	Bird food	Guards	Site notes
Olearia avicenniifolia (mountain akeake)	Shrub	-		Higher
Phormium colensoi (whararikī)	Herb	Nectar		Higher/damper
Phyllocladus alpinus	Tree	Fruit		Higher/damper
Podocarpus laetus (thin-barked tōtara)	Tree	Fruit		

For the five years covered by this management plan, it is recommended that the planting goal for LMU 1 is 1000 plants per annum and for LMU 3 3000 plants per annum (most likely in Years 3-5 as it will take time to source and grow plants). It is recommended that plants are established in clusters of at least 5 plants in natural or created gaps in areas that are mapped as 'Native dominant scrubland'. In the next five-year management period, planting can expand as the shrubland also expands.

A43.3 Kōwhai enrichment around existing kōwhai trees

There are currently nine known sites with kōwhai trees[33] in the Ardgour Restoration Area (Figure 6A4.1). Two of these (K5 and K9) have two trees in proximity; the others all comprise solitary trees. These nine sites will be complemented by an additional 11 sites to establish 20 kōwhai clusters in the Ardgour Restoration Area. New clusters will be in LMUs 2, 3, 5 and 7.

[33] All but two have single trees, with the other two having two trees.

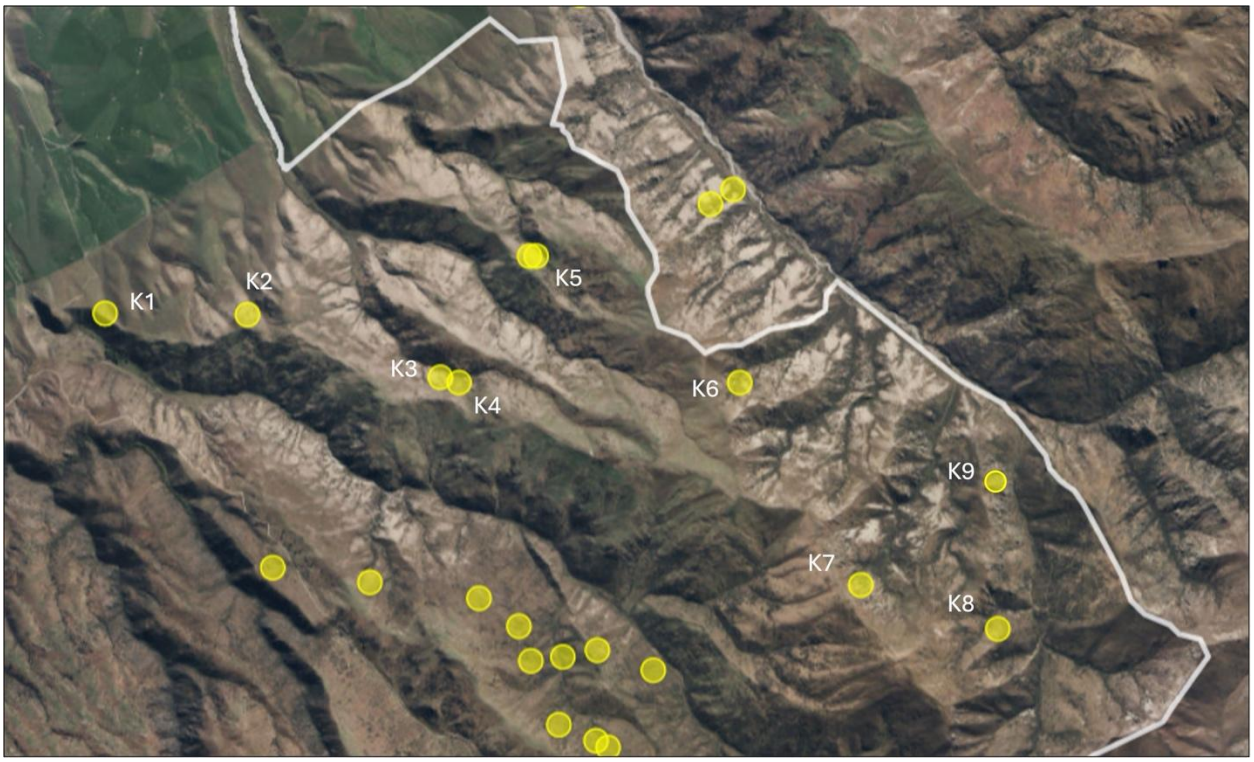

Figure A4.16. *Location of known sites with kōwhai trees in the Ardgour Restoration Area.*

As described in Section 53.2, the nine existing and eleven new kōwhai groves will be rabbit fenced. Fences will be set back at least 20 m from kowhai trees, or for new clusters will be at least 0.5 ha in area. At least 40 kōwhai seedlings will be planted in each of these clusters with the aim to spread them evenly through the fenced area. All seedlings will be staked. In addition, a range of other species (see list below) will also be established in these fenced areas – species choice is based on species that are known to occur in the Ardgour Restoration Area (or have been recorded in the wider area – mountain wineberry) and that provide food resources to birds. It is proposed to plant kōwhai at a 1:5 ratio with the other species. Given that many of the existing kōwhai trees are located on dry north facing sites, it is proposed that all plants are established into large planting holes that are filled with a high organic matter material such as potting mix, or other planting approaches as guided by the planting contractors experience in similar environments. Where plants die, they need to be replaced by further plants in subsequent years.

Kōwhai cluster plant list

Aristotelia fruiticosa (mountain wineberry)	Fruit
Carmachaelia petrei (desert broom)	Nectar
Carmichaelia crassicaule (coral broom)	Nectar
Corokia cotoneaster (korokio)	Fruit
Sophora microphylla (kowhai)	Nectar

A43.4 Restoration of alluvial podocarp dominated forest in LMU 4

These areas will be blanket planted at 1-1.5 m spacing using a mix of thin-barked tōtara and mataī, and angiosperm tree and shrub species. All plants will be staked and have guards. Herbicides will be used to kill pasture grasses prior to planting. Wood chip mulch will be spread around these planting as a tool to both suppress grass and herb regrowth and to hold moisture in the ground. It is proposed to aim to plant 0.5 ha per year (approximately 2000 plants per year) starting in Year 4. The podocarps (mataī and tōtara) will be planted in a 1:5 ratio with angiosperm trees. As with the enrichment planting, it is suggested that species choice for planting is refined as the success of initial plantings is assessed. Where plants die, they need to be replaced by further plants in subsequent years.

Alluvial forest plant list

Podocarp trees

Podocarpus laetus (thin-barked tōtara)	Fruit
Prumnopitys taxifolia (mataī)	Fruit

Angiosperm trees

Coprosma virescens	Fruit
Cordyline australis (tī kōuka)	Fruit
Hoheria angustifolia (narrow-leaved houhere)	Nectar

Olearia lineata (tree daisy)	-
Pittosporum tenuifolium (kōhūhū)	Nectar
Plagianthus regius (mānatu)	Nectar
*Pseudopanex crass*ifolius (horoeka)	Nectar & fruit
Sophora microphylla (kōwhai)	Nectar

APPENDIX 55 – VASCULAR PLANT WINNERS AND LOSERS

The overarching objective for management of the Ardgour Restoration Area is to enhance woody ecosystems while also sustaining indigenous dominated herbfield (cushionfield) ecosystems to compensate for residual adverse effects on native biodiversity because of BOGP activities. As a result of this, there will over the next 35 years be a substantial expansion in the extent, density and diversity of nave woody vegetation as it both expands and develops into a more mature state. This will occur especially in LMUs 1, 2, 3, 4 and 7. Until the *Applied Research Programme for Cushionfield and Spring Annuals* has been completed, the objective for LMU 5 (which primarily comprises a mosaic of exotic pasture and cushionfields), is to maintain this area in its current state. Longer-term, management will focus on sustaining and where appropriate enhancing cushionfields, but there is the opportunity to expand native woody vegetation across exotic pasture areas here too.

As a result of this management, and aside from cushionfield species, there will be a steady increase in shrubland and forest species at the expense of open-habitat species. While it is unlikely that any open-habitat native species will be lost from the Ardgour Restoration Area, some may well decline in abundance as the system shifts to a more woody state.

The following table includes all the national and regionally threatened and at-risk vascular plant species that have been identified within the Ardgour Restoration Area and a summary of the likely change in abundance as a result of management. Threat stays as follows: N-V nationally vulnerable, N-D national declining, N-NU nationally natural uncommon, N-DD nationally data deficient, R-C regionally critical, R-E regionally endangered R-V regionally vulnerable, R-D regionally declining, R-NU regionally natural uncommon, R-DD regionally data-deficient, NT not threatened).

Species that will be enhanced as a result of enrichment planting and woody expansion

Carmichaelia crassicaulis crassicaulis (N-V, R-V)

Carmichaelia monroi (N-D, R-C)

Carmichaelia petriei (N-D, R-D

Coprosma virescens (N-D, R-V)

Olearia bullata (N-NT, A-NU)

Olearia lineata (N-D, R-D)

Olearia odorata (N-D, R-D)

Species that will stay the same as they occur in cushionfield systems

Cheilanthes sieberi sieberi (N-NT, R-NU)

Colobanthus strictus (N-NT, R-D)

Daucus glochidiatus (N-V, R-C)

Epilobium hectorii (N-D, R-D)

Luzula banksiana var. *rhadina* (N-DD, R-NU)

Myosotis brevis (N-V, R-E)

Myosurus minimus novae-zelandiae (N-D, R-E)

Pellaea calidirupium (N-NU, R-NU)

Pimelea aridula aridula (N-D, R-V)

Poa lindsayi (N-NT, R-D)

Poa maniototo (N-D, R-D)

Raoulia australis (N-D, R-D)

Raoulia beauverdii (N-D, R-V)

Raoulia parkii (N-D, R-V)

Rytidosperma maculatum (N-D, R-V)

Rytidosperma pumilum (N-NT, R-D)

Species that may decline as open habitat becomes more woody but are present through the wider landscape

Acaena buchananii (N-D, R-V)

Acaena caesiiglauca (N-NT, R-NT)

Agrostis muscosa (N-NT, R-D)

Carex kaloides (N-D, R-E)

~~*Carmichaelia monroi* (N-D, R-C)~~

Chaerophyllum ramosum (N-DD, R-NT)

Colobanthus brevisepalus (N-D, R-V)

Coprosma brunnea (N-D, R-E)

Cystopteris tasmanica (N-NT, R-NU)

Euchiton traversii (N-NT, R-NU)

Festuca mathewsii subsp. *mathewsii* (N-NT, R-DD)

Geranium aff. *microphyllum* (N-NU, R-NT)

Geranium potentilloides (N-NT, R-DD)

Hypericum involutum (N-D, R-DD)

Isolepis praetextata (N-NT, R-NU)

Juncus distegus (N-NT, R-D)

Olearia cymbifolia (N-NT, R-NU)

Pimelea notia (N-NT, R-NU)

Pimelea prostrata subsp. *prostrata* (N-NT, R-V)

Poa incrassata (N-NU, R-NU)

Rytidosperma buchananii (N-D, R-D)

Rytidosperma corinum (N-DD, R-NT)

Styphelia nana (N-D, R-DD)

Veronica rakaiensis (N-NT, R-NU)

Vittadinia australis (N-NT, R-NU)

APPENDIX 66 – PLANT SPECIES IMPORTANT FOR NATIVE FAUNA

This appendix (Table A66.1) provides a summary of the plant species that are known to be important for lizards and invertebrates and how they might change as a result of the restoration management being undertaken in the Ardgour Restoration Area. The expected change is over 35-years as a result of the management being undertaken in this plan.

Table A66.1. *Expected change in plant species known to be important for lizards and invertebrates.*

Species	Provision for geckos and skinks			Invertebrates	Expected change
	Shelter	Fruit	Pollen/nectar		
Grasses					
Chionochloa spp.	++	-	-	++	absent
Festuca novae-zelandiae	++	-	-	++	similar
Poa cita	++	-	-	++	similar
Poa colensoi	+	-	-	++	similar
Herbs					
Aciphylla aurea	++	-	++	++	similar
Lianes					
Muehlenbeckia axillaris	++	++	-	++	similar
Muehlenbeckia complexa var. complexa	++	++	-	++	increase
Rubus schmidelioides var. subpauperatus	+	++	-	+	increase
Shrubs					
Acrothamnus colensoi	++	++	-	+	similar
Carmaechaelia sp (N)	-	-	-	++	increase
Coprosma brunnea	++	++	-	-	similar
Coprosma cheesemanii	++	++	-	-	similar
Coprosma dumosa	++	++	-	-	similar
Coprosma petriei	-	++	-	-	similar
Coprosma propinqua var. propinqua	++	++	-	-	increase
Coprosma rugosa	++	++	-	-	increase

Species	Provision for geckos and skinks			Invertebrates	Expected change
Coprosma virescens	++	++	-	-	increase
Corokia cotoneaster	+	++	-	+	increase
Discaria toumatou (N)	+	-	-	+	increase
Melicytus alpinus	++	++	-	+	similar
Myrsine divaricata	++	++	-	+	similar
Myrsine nummularia	-	++	-	+	similar
Olearia odorata		-	-	++	increase
Pentachondra pumila	-	++	-	+	similar
Pimelea aridula aridula	-	++	-	+	similar
Pimelea oreophila lepta	-	++	-	+	similar
Pimelea notia	-	++	-	+	similar
Pimelea prostrata subsp. prostrata	-	++	-	+	~~similar~~decrease
Styphelia nana	-	++	-	+	~~similar~~decrease
Styphelia nesophila	-	++	-	+	similar