

Memorandum

To: BOGP Expert Panel
From: Santana Minerals Limited
Date: 17 August 2026
Re: Response to Question 11 of RFI 11 – Spring Annuals

Introduction

Question 11 of RFI 11 comprises two parts:

Part A - The consensus expert position is that the propagation techniques for spring annuals are experimental and likely success unknown (paragraph 15 of the reconvened ecology - terrestrial vegetation JWS). What is a suitable measure of success for rehabilitation of cushion fields and spring annuals?

Part B - If rehabilitation is not successful (after the expiration of a reasonable period during mine operation), what alternative form of compensation will be offered?

Dr Robyn Simcock Senior Researcher Ecology and Soils at Bioeconomy Science Institute Maiangi Taiao is the technical expert for rehabilitation for the BOGP and has addressed Part A of question 11 in the accompanying memorandum.

This memorandum addresses Part B relating to compensation if rehabilitation of cushionfields and spring annuals¹ is not successful.

In the attached memorandum that provides the response to Part A of Question 11, Dr Simcock proposes three success criteria for spring annuals with timeframes ranging from 6 to 10 years, and four success criteria for cushionfield to be assessed at active closure.² These are set out below (with further details and background information set out in the Part 1 response):

Spring Annual Success Criteria

1. *Increase the net number of discrete sub-populations (groups) of Ceratocephala pungens within the landscape managed by MGL over 10 years by establishing new sub-populations of this species in the ecological rehabilitation and habitat enhancement areas (i.e. areas managed by MGL, also referred to as the offset/compensation areas), i.e. outside and/or inside the DDF.*

¹ In this memo Spring annuals collectively refers to *Ceratocephala pungens*, *Myosotis brevis*, *Myosurus minimus* supsp *Novae zealandiae* and *Myosotis antarctica* var *antarctica*

² Active closure means the period of time when all mining activities are completed and rehabilitation activities are in progress (including profiling to final landforms, decommissioning of infrastructure, construction of water treatment facilities and capping of the ELF and TSF).

2. *Develop methods for ex-situ (nursery) propagation and establishment of Ceratocephala pungens over 6 years that result in more than 200 individuals reaching maturity over 2 successive seasons.*
3. *Deliver a net increase in the areas over which subpopulations or groups of Myosurus minimus subsp. novae zealandiae and the two native Myosotis species (M. brevis and M. antarctica var. antarctica) are present within the landscape managed by MGL over 10 years.*

Cushionfield Success Criteria

Mined areas (DDF):

1. *A minimum of 19 ha of cushionfield (14.5 ha if the Come In Time pit is not mined) with a cushionfield condition score of 4 or 5. The cushionfield will include at least 2 ha and up to 5 ha of trials located on the Western ELF constructed early in mine life with the best-performing methods applied more widely to suitable aspects, including the Shepherd's ELF.*
2. *At least 50% of plots with raoulia cover >13% or cover class 3 or higher (6 to 25% cover) and at least 20% of plots with raoulia cover class 4 or higher (26 to 50% cover).*

Managed areas:

1. *Increase in net area of cushionfield of more than 10% prior to closure.*
2. *Increase in cushionfield condition score, with significant reduction in plots with cushionfield condition scores < 2 on a 5-point scale where 5 is high-quality cushionfield.*

Delivery of outcomes for both spring annuals and cushionfields are an integral part of the broader Ardgour Restoration Area Management Plan, Applied Research Plan for Conservation Management, Rehabilitation and Expansion of Cushionfield (Cushionfield ARP) and Landscape and Ecological Rehabilitation Management Plan (LERMP) outcomes.

Background

The first component of the Cushionfield ARP is to “Define (map) the present extent and record the composition of the present cushionfields across the managed landscape using ground-based surveys and drone captured aerial photography (managed landscape scale)”.

The first question posed in the Spring Annual research component of the Cushionfield ARP (Appendix 3) is “what is the environmental niche extent of these spring annuals?”

The first step in the spring annual program recognises that the national database of knowledge for spring annuals relies on small, opportunistic surveys using inconsistent methodology collected over decades. Except for Rogers et al 2002³, no systematic, broadscale survey had been undertaken of these species until the 2025 BOGP survey when nearly 900 hectares were surveyed. Unsurprisingly the broadscale systematic survey has identified substantially more

³ Rogers et al 2002, [Ecology and conservation status of three “spring annual” herbs in dryland ecosystems of New Zealand](#), New Zealand Journal of Botany ([Ecology and conservation status of three “spring annual” herbs in dryland ecosystems of New Zealand](#))

and larger populations in more diverse habitats. A similar, larger survey to be undertaken by MGL in 2026 will assist to further expand the current understanding of population, habitat and areal extent for spring annuals.

The 2024 spring annual survey⁴ was undertaken as part of the BOGP baseline survey and provided an indication of where spring annuals could be found in the ecological study area. The focus of the survey effort was on the DDF. However, the survey also included suitable habitat on Ardgour Station where small populations of mostly *Myosotis brevis* and *Myosotis antarctica* subsp *antarctica* were found across the Station. Access to Ardgour station was delayed at the request of the landowner until November that year due to lambing. This impacted the habitat diversity and total count of species as many of the populations recorded were senescing and many individuals were likely to have blown away by the time of the survey.

The 2025 survey⁵ was undertaken earlier in the season in late September with a further survey in late October. It found significantly more populations, in better condition (earlier in the lifecycle), across a wider range of habitats for all four species. At the request of the landowner access to Ardgour Station in 2025 was again restricted due to lambing, except for the most western faces of the hill country where no lambing occurred due to the exposed nature of the slopes. The restriction of access on Ardgour Station also applied to Shepherds Creek which limited the extent of the survey over part of the DDF.

However, results from the 2025 survey across Bendigo Station including the DDF south of Ardgour Station, Kanuka shrublands (DOC reserve, and other properties), cushionfields, terraces between vineyards, and the western faces of Ardgour Station showed that there are likely to be hundreds of hectares of Ardgour Station where the spring annuals could be found during the 2026 survey.

The majority of suitable habitat in the DDF was surveyed either in 2024 or 2025. All of the DDF was assessed for potential habitat and surveyed if botanists who are experienced in spring annual surveys realistically expected to find spring annuals. In 2025, on accessible areas of the DDF, the survey deliberately included areas not surveyed in 2024 (i.e. higher elevation and dry spurs) as a methodology check. Areas not surveyed in the DDF were generally south or south east facing, or had a thick cover of scrub (olearia, matagourie), tussock or improved pasture. Kanuka woodland, where *Myosotis* species and *Myosurus minimus* are often found are not present on the DDF. Interestingly spring annuals were found on the western faces of Ardgour Station hill country that were mapped as exotic grassland.

The 2025 survey:

- increased the known population of *Ceratocephala pungens* by 20 times and showed that nearly 60% of the known population is outside the DDF.

⁴ Milner Z, Nicol D, Kroos H 2025. Bendigo-Ophir Gold Project. Vegetation values assessment. RMA Ecology Limited Report number 2352. Prepared for Matakanui Gold Limited.

⁵ Walker S, Brownstein G, Simcock R, 2025. Results of a survey of spring annual herb species on Bendigo and Ardgour Stations, 2025 (updated). Bioeconomy Science Institute. Prepared for Matakanui Gold Limited.

- doubled the known population of *Myosotis brevis* and showed that 79% is outside the DDF.
- Showed that 75% of *Myosurus minimus* subsp. *novae-zelandiae* population is outside of the DDF (national population of *M. minimus* not previously recorded prior to this survey).

2025 survey data	National popn	Outside DDF (%)	DDF (inc CIT pit) (%)	CIT pit (%)	DDF – CIT (%)
<i>Ceratocephala pungens</i>	13,150 (100%)	7910 (60%)	5,220 (40%)	2,725 (19%)	2,725 (21%)
<i>Myosotis brevis</i>	79,115 (100%)	62,605 (79%)	16,605 (21%)	6,895 (9%)	9710 (12%)
<i>Myosurus minimus</i> subsp. <i>novae-zelandiae</i>	153,130 (100%)	114,600 (75%)	38,530 (25%)	35,635 (23%)	2,895 (2%)

Table 1: 2025 Spring annual survey population data⁶

Parts of Shepherds Creek valley are currently recognised as important habitat for spring annuals, some of which overlap with the DDF. The DDF has also been subject to the most survey effort at the “best time” within each survey period. In both the 2024 and 2025 survey periods the DDF was the initial focus, with some areas of the DDF being surveyed twice in 2025. In 2024 the survey was at the end of the season when plants were rapidly drying off and difficult to identify. While it was only a few days later that the areas further north on Ardgour Station were surveyed, due to the seasonal nature of the species there would have been fewer discoverable plants. This is evidenced by the much higher population counts in the 2025 survey which was undertaken several weeks earlier than the 2024 survey.

Each survey improves the understanding of the ecology of spring annuals, including their distribution, habitat preferences, and the timing of germination, flowering, and seed set. This information supports the success of the applied research plan and mine site rehabilitation using cushionfields and spring annuals.

Success Criteria drive Adaptive Management

Progress towards achieving the success criteria for spring annuals and cushionfields will be reviewed at the appropriate midpoint for each component of the Cushionfield ARP (i.e. Year 3 or 5) and at end of the Cushionfield ARP (Year 10, active closure) with the ecological management program progressively adapted in response to the outcomes realised. These ecological

⁶ Compiled from various documents including Table 2 in Walker S, Brownstein G, Simcock R, 2025. Results of a survey of spring annual herb species on Bendigo and Ardgour Stations, 2025 (updated); Part of the national population data is drawn from: Ewans, R. (2025, December 2). Summary: *Ceratocephala pungens* (Ref. OIAD-5832). Department of Conservation, Part of the national population data is drawn from: Prebble, J. M., Symonds, V. V., Tate, J. A., & Meudt, H. M. (2022). Taxonomic revision of the southern hemisphere pygmy forget-me-not group (*Myosotis*; Boraginaceae) based on morphological, population genetic and climate-edaphic niche modelling data. *Australian Systematic Botany*, 35(1), 63–94.

outcomes and review processes as set out in the ARP are also reflected in the proposed consent conditions.

The success criteria for spring annuals and cushionfields relate to both mined areas (being the DDF) and managed areas (being the Mine Regeneration Zones (MRZ) and the Ardgour Restoration Area (ARA) where offsetting and compensation activities are proposed).

Cushionfields are known to naturally expand into areas that have been substantially affected by fire and over grazing. They retreat when either:

- a) grazing pressure is reduced and taller plant species establish, or
- b) they are ploughed and fertilised to enable agricultural and /or property outcomes including establishment of pasture, vineyards or other disturbance.

Spring annuals potentially expand and retreat in tandem with cushionfield, although less is understood about spring annuals. Ecological outcomes are proposed to be delivered in managed areas by implementing actions that result in effects similar to overgrazing combined with removal or prevention of smothering weeds.

Based on the technical advice received, it is considered highly likely that the success criteria can be achieved within the proposed timeframes or that demonstrable progress will be made toward achieving them. However, if the required interim programme reviews indicate that the success criteria for spring annuals and cushionfields are unlikely to be met within the proposed timeframes, then MGL will in the first instance consider whether an amended programme of work needs to be implemented on-site (which may include additional research) for one or all aspects of the Cushionfield ARP. Examples of this could include expanding the programme works into broader areas of the MRZ's or the ARA or intensifying the treatments. The format and quantum of the work would be developed in collaboration with the Peer Review Panel, Central Otago District Council (CODC) and Otago Regional Council (ORC) who will also provide input to the Cushionfield ARP reviews (i.e. at the midpoint and end of the programmes). This adaptive management approach could be implemented several times throughout the life of the Cushionfield ARP if necessary.

If some of the success criteria are not fully achieved within the proposed timeframes compensation will be proposed as set out below.

These compensation measures will be reflected in the updated consent conditions in *D.03 - Schedule One - Common Conditions to the Central Otago District Council and Otago Regional Council Resource Consents* that will be provided to the Panel on 28 August 2026.

Compensation Measures

The type and quantum of compensation proposed should reflect both the magnitude of the shortfall between the outcomes achieved and the success criteria at the relevant assessment timeframe (i.e. 6 or 10 years for spring annuals and during the active closure phase for cushionfields), and the trend towards achieving those success criteria

1. **Compensation at the conclusion of the Cushionfield ARP:** If the success criteria for spring annuals and/or cushionfields have not been achieved by the completion of the Cushionfield ARP (i.e. after 10 years for spring annuals and at active mine closure for cushionfields), one of the following actions will apply:
 - (a) Where the final Cushionfield ARP report demonstrates that sufficient progress has been made towards achieving the success criteria, but additional time is required to fully achieve them, the existing programme of works may continue, or a revised programme of works may be developed and implemented to maintain progress towards the success criteria. MGL proposes that "sufficient progress" be defined as achievement of at least 80% of the success criteria. However, where the 80% threshold has not been met, the Peer Review Panel, CODC and/or ORC may determine, based on the findings of the final Cushionfield ARP report, whether the programme should continue or be revised.
 - (b) Where the final Cushionfield ARP report demonstrates that insufficient progress has been made towards achieving the success criteria, despite implementation of revised programmes of work during the Cushionfield ARP, or where achievement of the success criteria is determined to be impracticable or unachievable, alternative programmes of work will be developed to address the remaining gap between the outcomes achieved and the success criteria. MGL proposes that achievement of less than 80% of the success criteria constitutes insufficient progress. These alternative programmes of work may be implemented within the BOGP Consent Area or elsewhere, as appropriate, to achieve equivalent ecological outcomes, in consultation with the Peer Review Panel, CODC and ORC.
2. **Compensation for cushionfield within the DDF at the conclusion of the Cushionfield ARP:** If, at active mine closure (Year 10), less than 80% of the cushionfield success criteria have been achieved within the DDF, indicating insufficient progress, alternative programmes of work may be developed in consultation with the Peer Review Panel, CODC and ORC to address the shortfall. Such programmes may include the establishment of alternative rehabilitation objectives for areas where cushionfield rehabilitation has not been successful, including rehabilitation to an alternative vegetation type.
3. **Financial compensation for cushionfields:** If, by passive mine closure⁷, the cushionfield success criteria have not been achieved and are considered unlikely to be achieved, as determined in consultation with the Peer Review Panel, CODC and ORC, MGL will identify and secure suitable cushionfield habitat outside its managed areas through purchase and protection under an enduring legal mechanism.

The area secured will be at least equivalent to:

⁷ Passive closure (or post-closure) is defined as the period of time when final site closure arrangements are in place and the active WTP (or PTS) continues to operate, with ongoing site monitoring to ensure it is a long-term stable landform.

(a) the area of mined land for which the cushionfield success criteria have not been achieved; and

(b) the area of managed land for which the cushionfield success criteria have not been achieved.

Compensation will be required where the cushionfield success criteria have not been met for either habitat extent (area) or condition score. The quantum of compensation will be based on the net loss of cushionfield area and/or condition, as measured against the baseline mapping and condition assessment established in Component 1 of the Cushionfield ARP.

4. **Financial compensation for spring annuals:** If, by passive mine closure, the success criteria for spring annuals have not been achieved and are considered unlikely to be achieved, as agreed by the Peer Review Panel, CODC and ORC, MGL will identify and secure suitable spring annual habitat outside its managed areas through purchase and protection under an enduring legal mechanism.

For the purposes of this provision, a failure to achieve the success criteria may be evidenced by:

(a) a net reduction in the number of discrete sub-populations (groups) of *Ceratocephala pungens*; and/or

(b) a net reduction in the area occupied by sub-populations of *Myosurus minimus* subsp. *novae-zelandiae*, *Myosotis brevis*, or *Myosotis antarctica* var. *antarctica* within areas managed by MGL.

The quantum of compensation will be at least equivalent to the residual shortfall in:

(a) the number of discrete sub-populations (groups) of *Ceratocephala pungens*; and/or

(b) the area occupied by sub-populations of *Myosurus minimus* subsp. *novae-zelandiae*, *Myosotis brevis*, and *Myosotis antarctica* var. *antarctica*,

relative to the applicable spring annual success criteria.