ecoLogical Solutions
Environmental Consultants



August 2026

Buller Plateaux Continuation Project

Terrestrial Ecological Impact Assessment Report

Prepared for Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by:

[redacted]
Ecologist

[redacted]
Ecologist

[redacted]
Ecologist

[redacted]
Ecologist

[redacted]
Ecologist

[redacted]
Ecologist

[redacted]
Ecologist (Lizards only)

Reviewed by:

[redacted]
Terrestrial Ecology Team Leader

Status: Final **Issued:** 7 August 2026

Recommended Citation: Ecological Solutions Limited. 2026. Buller Plateaux Continuation Project: Terrestrial Ecological Impact Assessment Report. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 98 pages + appendices.

Ecological solutions

tauranga office
115 the strand, tauranga 3141
po box 13507
p: 07 577 1700

auckland office
building 4/195 main highway,
ellerslie, Auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

nelson office
p: 021 172 2091

www.ecologicalsolutions.co.nz

Executive Summary

Background and Purpose

Bathurst Resources Limited ("Bathurst") are seeking approvals through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('BPCP' or 'the Project'). The BPCP includes five project sub-areas Escarpment Extended ('ESE'), Stockton Mine ('Stockton'), Mt Frederick South ('MFS'), the Upper Waimangaroa Haul Road ('UWHR') and Cypress Mining Area ('Cypress'), collectively covering 2,709ha[1] and referred to as 'the Project Area'. The BPCP aims to enable the ongoing use of the existing infrastructure and mining operations associated with the Stockton Mine and provide access to additional coal mining areas across the Buller Plateaux.

Ecological Solutions Limited have been engaged by Bathurst to describe the ecological values of the Project Area, assess the terrestrial ecological effects of the proposal and make recommendations regarding measures to avoid, remedy, and minimise/mitigate any actual and potential adverse effects on indigenous terrestrial flora and fauna and their habitats. This terrestrial ecological impact assessment will form part of the application documentation supporting the FTAA consenting process for the proposed BPCP.

Specifically, this ecological impact assessment focusses on the conventional drill and blast, load and haul open pit mining areas and the supporting infrastructure including haul roads of the BPCP. Disturbance Areas were supplied as .shp files by Bathurst. To account for edge effects an Indirect Effects Contingency setback was applied (ranging from 10m to 30m) to these Disturbance Areas dependent on the type of vegetation or landcover present within the adjacent Disturbance Area footprint. This provides for a conservative approach in assessing the impacts arising from the Project Where residual adverse effects are identified, a separate assessment and proposal for managing these effects through ecological offsetting, compensation and other positive ecological actions has been prepared by Alliance Ecology Limited (2026a).

Assessments Undertaken

A combination of desktop studies to compile and summarise information from database searches, previous published and unpublished ecological surveys and reports, and field surveys has been used to identify and assist in describing the terrestrial ecological features of the Project Area. Specifically, the assessments undertaken have included:

- Surveying and mapping of vegetation types across 10,129 hectares (ha) of the Buller Plateaux using ordination, multivariate analysis and classification of 152 vegetation plots and 45,690 aerial images to discriminate and map different vegetation types. Walkthrough surveys were also used to ground truth the mapping and inform the vegetation and habitat descriptions for the Project Area.
- Identifying natural inland wetlands, naturally uncommon ecosystems and the location of any 'Threatened' or 'At Risk' plant species, including bryophytes and lichens.
- Bird surveys to confirm the presence and relative abundance of birds and identify any 'Threatened' or 'At Risk' bird species within the Project Area and surrounds. Surveys for birds used a variety of methods including five-minute bird counts (5MBC), standard call count surveys for roroa (great spotted kiwi, *Apteryx maxima*) and acoustic recorder surveys for both diurnal and nocturnal birds.
- Surveys for roroa across the Buller Plateaux included the use of acoustic recorders,

[1] Project extent is based on the GIS shapefiles released by Bathurst on 4 December 2025.

evening call counts, radio-tracking and trained kiwi dog surveys.

- Identification of potential lizard habitats combined with localised lizard surveys to ascertain the presence of any 'Threatened' or 'At Risk' lizard species. Lizard surveys were undertaken within the Denniston Plateau and Waimangaroa Valley using manual day searching and nocturnal spotlighting.
- Surveys for terrestrial invertebrates relied on a broad sampling effort using multiple sampling methods over a range of vegetation types present across the ESE, MFS and UWHR project sub-areas. The sampling methods used included pitfall trapping, malaise trapping, sweep netting, hand searching and beat sampling.
- Pest mammals have been monitored using tracking tunnels as part of ongoing ecosystem management at some locations on the Buller Plateaux since November 2014. Additional pest monitoring was undertaken in 2024 and 2025 using trail cameras and chew cards (Alliance Ecology Limited 2026b).
- The significance of vegetation and habitats present within the Project Area were assessed against the criteria listed in the Buller District Plan, West Coast Regional Policy Statement (WCRPS) the West Coast Regional Land and Water Plan (RLWP) and the National Policy Statement for Indigenous Biodiversity (NPS-IB). The proposed Te Tai o Poutini Plan (TTPP) does not include criteria for ecological significance.
- A qualitative assessment of the effects on ecological values within the Project Area was undertaken in accordance with the Environment Institute of Australia and New Zealand ('EIANZ') Ecological Impact Assessment Guidelines (Roper-Lindsay et al., 2018). Recommendations for the management of adverse effects through the application of measures to avoid, remedy and minimise/mitigate the effects were also made as part of this assessment. Aspects of the BPCP for which offsetting/compensation would be appropriate were also identified. As noted above, offsetting and compensation are set out in a separate document (Alliance Ecology Limited 2026a).

Findings

- The Project Area includes 12 vegetation types including three forest types, five shrubland types, three low vegetation types (including exotic grassland) and one rocky habitat (sandstone erosion pavement). The Project Area also includes areas of cleared vegetation and open water (current and historic mining infrastructure).
- Five naturally uncommon ecosystems occur within the Project Area including sandstone erosion pavement, tarns, flushes and seeps, boulderfields of acidic rock and pākihi.
- Approximately 55% of the Disturbance Area comprises natural inland wetland.
- No 'Threatened' species of vascular plant have been detected within the Project Area.
- Nine vascular plant species considered 'At Risk' have been recorded within the Project Area. Important habitats for these species were widespread, including other locations on the Buller Plateaux and elsewhere within the Ngakawau Ecological District.
- Fifty-one non-vascular species (40 bryophytes and 11 lichens) considered either 'Threatened' or 'At Risk' have been recorded within the Project Area. In addition, two bryophyte species are new records outside their previously documented distributions.

- The bird fauna is relatively intact, although bird numbers were only moderate - low. Twenty-nine species of birds were recorded within the Project Area, including 21 native species and eight introduced and naturalised species. Nine species considered either 'Threatened' or 'At Risk' have been recorded.
- The Project Area is located within the Westport sub-population of great spotted kiwi/roroa, which is one of four sub-populations making up the national population.
- It is unlikely that either long-tailed or lesser short-tailed bats are present within the Project Area because numerous surveys over many years have failed to detect bats there.
- Three lizards have been detected within and immediately surrounding the Project Area including West Coast green gecko (*Naultinus tuberculatus*, 'Threatened – Nationally Vulnerable'), forest gecko (*Mokopirirakau granulatus* 'At Risk – Declining') and Newman's speckled skink (*Oligosoma* aff. *newmani* "Westland" 'Threatened – Nationally Vulnerable'). The two gecko species present on the Denniston Plateau have unusual colour morphs not seen elsewhere.
- The terrestrial invertebrate community within the Project Area is typical of the wider Buller Plateaux in that it comprises predominantly indigenous taxa, including 'Threatened' and 'At Risk' species and species yet to be described. Five 'Threatened' or 'At Risk' terrestrial invertebrate species are known to be present within or near the Project Area.

Actual and Potential Ecological Effects

Despite the modified environment associated with historic and contemporary mining activities (including the Stockton Mine), the construction of, and operations within, the Project Area have the potential to result in a range of adverse effects on terrestrial ecological values, including wetlands, particularly if not managed appropriately, including:

- Loss, fragmentation, degradation and general disturbance of terrestrial and wetland habitats through staged vegetation clearance and earthworks, including the deposition of overburden.
- Direct mortality or injury to fauna species that may be harmed during vegetation clearance, earthworks activities, blasting and transportation movements.
- The creation of habitat edge effects, altering the composition and health of adjacent vegetation (i.e. habitat degradation), which may affect habitat suitability for flora and fauna and will increase the area's vulnerability to weeds and pests.
- Removal and fragmentation of habitats could affect movement of some poorly mobile species, with possible effects on meta-population dynamics and increased vulnerability to local extinction.
- Disturbance associated with noise, dust, lighting and vibration from mining activities.

The potential adverse ecological effects described above will vary in scale, extent and location and will also vary over time as mining proceeds and rehabilitated land establishes in stages across the Project Area. The extent of vegetation removal is set out in the following table.

Vegetation Type	Total Disturbance area (ha)[2]	Indirect Effects Contingency (ha)	Disturbance area as a % of Mapped Area	Wetland
Forest				
Mountain beech – podocarp – broadleaf forest	5.5	9.1	0.5	No
Southern rātā – mountain beech – podocarp forest	177.1	49.4	7.1	No
Silver beech – mountain beech forest	5.5	0.5	3.4	No
Shrubland				
Mānuka – mountain beech – podocarp shrubland	84.7	13.4	5.8	Yes
Mānuka/Gahnia – wire rush shrubland	9.7	1.1	6.3	Yes
Weedy shrubland	12.5	2.1	7.6	No
Mānuka – tussock – wire rush shrubland	104.2	12.9	11	Yes
Mānuka – mountain flax/wire rush shrubland	3.7	0.3	3	Yes
Low vegetation				
Low pākihi	213.9	23.1	10.3	Yes
Tussock – mountain flax	1.7	0.8	1.5	Yes
Exotic grassland	0.8	0.1	32.8	
Non-vegetated landcover				
Bare rock	63.6	6.3	7.2	
Cleared vegetation	69.8	8.8	19.5	
Water	2.1	0.2	6.6	
Total	**754.2ha**	**128.2ha**		**468.9**

The BPCP Project Area occupies c. 2,709ha[2]. Approximately 1,841ha comprises the existing Stockton Mine footprint and is already mostly disturbed. A further 754ha will be disturbed as part of this proposal and a further c. 128ha would be affected by edge effects. Eleven vegetated habitats would be affected including areas removed and affected by new edges:

- Three indigenous forest types (c. 247ha, 6.6% of indigenous forest within the mapped area, including edge effects).
- Five shrubland types (c. 245ha, 7.4% of shrubland within the mapped area, including edge effects).

[2] The disturbance area is based on shapefiles released by Bathurst Resources Limited on 15 October 2025 and excludes the Waimangaroa Storage Area. The Project area boundary is based on shapefiles released on 4 December 2025. The rehabilitated areas are based on final landform shapefiles released on 5 December 2025. There are minor variations in extent between all three of these shapefiles which account for minor differences in the estimates of extent provided throughout this report.

- Three low vegetation types (c. 240ha., 10.9% of low vegetation within the mapped area, including edge effects).
- 70ha of sandstone erosion pavement (7.8% of the bare rock within the mapped area).

Some of these vegetation types are 'natural inland wetlands' as defined in the National Policy Statement for Freshwater Management 2020 (Ministry for the Environment 2020). Natural inland wetlands occupy approximately c. 469ha of the Disturbance Areas. This represents 55% of the Disturbance Areas and 9.6% of the natural inland wetlands within the mapped area (including edge effects).

In addition to these habitats, two non-vegetated landcover types would be disturbed including 81ha of cleared vegetation (20.8% of the cleared vegetation in the mapped area) and areas of open water which comprises current and historic mine infrastructure such as Lake Brazil.

Effects Management

A comprehensive suite of effects management actions, including avoidance, minimisation and remediation, is proposed.

Avoidance

Mine planning has been iterative and included refinement of the disturbance footprint where possible in order to avoid impacts on high value habitats and associated species. Annual mine planning and environmental controls will avoid some types of effects such as mobilisation of sediment to wetlands.

Minimisation

Annual mine planning and environmental controls and monitoring (e.g., of rehabilitation resources) will minimise some types of effects such those on soil biota. Actions to minimise effects such as those due to dust, noise and accidental spills can be deployed at every level from initial mine planning to final rehabilitation. These matters would be set out in the Annual Mine Plan prepared each year in advance of mining and certified by the local Councils.

Weed control and mammalian pest control will be ongoing, including following mine closure. This will assist in mitigating the effects of weeds and pests on vegetation and fauna and maintain surrounding populations of indigenous flora and fauna to assist in recolonising the mined areas as rehabilitation proceeds. A biosecurity management plan, a weed management plan and a pest control plan have been prepared to direct management to reduce the effects of new organisms, weeds and pests.

Remediation

Mined areas will be progressively rehabilitated as mining proceeds in accordance with a comprehensive site Rehabilitation Management Plan, the Annual Mine Plan and an Annual Rehabilitation Schedule using techniques that have proven effective at the existing Stockton Mine. The Rehabilitation Management Plan incorporates direct transfer of vegetation ('VDT'), planting and creation of habitats for bryophytes, lichens and fauna.

The medium to long term focus of rehabilitation will be to develop self-sustaining ecosystems with similar plant and animal species diversity and functionality to the surrounding (undisturbed) environment. The extent and proportion of vegetation types will be different to the pre-mining situation with fewer, more simple vegetation communities which lack the extensive ecotones and complex mosaic of types characteristic of the pre-mining vegetation. The main ecological drivers of altitude, aspect, drainage, rock cover and slope will remain.

Residual Effects

Of particular note, the residual level of effects (after measures to avoid, minimise, remediate and mitigate have been enacted) was assessed as 'Very High' for 16 attributes. A further 12 attributes had a 'High' level of residual effects and five would have a 'Moderate' level of residual effect as set out in the following table.

Overall level of residual effect	Ecological attribute	Nature of effect
Very high	Southern rātā-mountain beech-podocarp forest	Long term loss of habitat and time lag between removal and replacement with similar habitat
	Mānuka-mountain beech-podocarp shrubland	Long term loss of habitat and time lag between removal and replacement with similar habitat
	Mānuka-tussock-wire rush shrubland	Permanent loss of extent and value
	Pākihi	Permanent loss of extent and value
	Sandstone erosion pavement	Permanent loss
	Tarns	Permanent loss of extent
	'Threatened' and 'At Risk' vascular plants	Long term loss of habitat and removal of individuals associated with vegetation clearance
	'Threatened' and 'At Risk' lichens	Long term loss of habitat and incidental mortality associated with vegetation clearance
	'Threatened' and 'At Risk' lizards	Long term loss of habitat and incidental mortality associated with vegetation clearance
	Lizard habitats	Long term loss of habitat and time lag between removal and replacement with similar habitat
	Powelliphanta patrickensis	Long term loss of habitat and incidental mortality associated with vegetation clearance
	'Threatened' and 'At Risk' invertebrates	Long term loss of habitat and incidental mortality associated with vegetation clearance
High	Mixed beech-podocarp-broadleaved forest	Long term loss of habitat and time lag between removal and replacement with similar habitat
	Silver beech-mountain beech forest	Long term loss of habitat and time lag between removal and replacement with similar habitat
	Mānuka-Gahnia-wire rush shrubland	Long term loss of habitat and time lag between removal and

		replacement with similar habitat
	Flushes and seeps	Permanent loss
	'Threatened', 'At Risk' and locally important or distinctive bryophytes	Long term loss of habitat and incidental mortality associated with vegetation clearance
	'Threatened' and 'At Risk' birds	Long term loss of habitat and incidental mortality associated with vegetation clearance
	Bird habitats	Long term loss and time lag between removal and replacement with similar habitat
	Locally important or distinctive invertebrates	Long term loss of habitat and incidental mortality associated with vegetation clearance
	Invertebrate habitats	Long term loss and time lag between removal and replacement with similar habitat
Moderate	Mānuka-mountain flax/wire rush shrubland	Long term loss and time lag between removal and replacement with similar habitat
	Tussock-mountain flax shrubland	Long term loss of habitat and time lag between removal and replacement with similar habitat
	Boulderfields of acidic rock	Long term loss of habitat and time lag between removal and replacement with similar habitat
	Locally important or distinctive vascular plants	Long term loss of habitat and incidental mortality associated with vegetation clearance
	Locally important or distinctive lichens	Long term loss of habitat

A significant offset and compensation package is proposed to address these residual effects (Alliance Ecology 2026a).

Glossary

Specific terms

BPCP	Buller Plateaux Continuation Project.
CHF	Coal Handling Facility.
CHPP	Coal Handling and Processing Plant.
CML	Coal Mining Licence.
Coal measures	The term coal measures refers to geological sediments laid down in a depositional environment in which coal can form (Overmars et al. 1998).
Cypress	Cypress Mining Area.
DBEA	Denniston Biodiversity Enhancement Area.
Disturbance Area(s)	Where 'new' disturbance will occur within the Project Area (or Project sub-areas).
DPPA	Denniston Permanent Protection Area.
DT	Direct transfer of sods with non-intact vegetation (e.g., slash, stumps).
EcIA	Ecological Impact Assessment.
EcIAG	Ecological Impact Assessment Guidelines.
Indirect Effects Contingency (areas)	An Indirect Effects Contingency setback applied to the edge of 'Disturbance Areas' to estimate the extent of edge effects (in hectares). Edge effects include alterations in hydrology, light penetration, exposure and the like.
Ecotone	A transitional area between two biological communities.
ED	Ecological District.
Edge effects	Effects on biodiversity at newly created habitat edges brought about by human disturbance (e.g., mining, roads).
EIANZ	Environment Institute of Australia and New Zealand.
ELF	Engineered landforms.
ESE	Escarpment Extended Project sub-area.
FTAA	Fast-track Approvals Act.
in situ	With regards to VDT, retaining biodiversity from the same ecosystem as it originated.
IUCN	International Union for Conservation of Nature.
Mapped Area	The Mapped Area covers approximately 10,129ha mapped using high resolution aerial photographs taken by drone.
MFS	Mount Frederick South Project sub-area.
NAF	Non-acid forming.
Naturally uncommon ecosystems	Naturally uncommon ecosystems (previously referred to as 'historically rare ecosystems') are defined as those which have a (natural) total extent of less than 0.5% of New Zealand's total area (i.e. <134,000 ha, Williams et al. 2007), or those that meet International Union for Conservation of Nature (IUCN) threat assessment criteria taking into account current and historic extent, distribution and ecological function (Holdaway et al. 2012).
NPS-FM	National Policy Statement for Freshwater Management 2020 (Ministry for the Environment 2020).
NPS-IB	National Policy Statement for Indigenous Biodiversity 2023 (Ministry for the Environment 2023).
PAF	Potentially acid forming.
Project Area	The extent of the BPCP.
Project sub-area	The extent of named components of the BPCP (e.g., ESE, MSF, UWHR, Stockton, Cypress).
RLWP	Regional Land and Water Plan.
RMA	Resource Management Act.
SEA	Snail Enhancement Area associated with Cypress Mining Area consents.
Self-sustaining ecosystem	Indigenous plant and animal communities that establish, grow, reproduce, and persist indefinitely in response to the ecological gradients present and underpinned by natural ecological succession without human intervention, management or protection.

SNAs	Significant Natural Areas.
Stockton	Stockton Mine.
TTPP	Proposed Te Tai o Poutini District Plan.
UWHR	Upper Waimangaroa Haul Road Project sub-area.
VDT	Vegetation Direct Transfer.
WAA	Wildlife Act Authority.
WCRPS	West Coast Regional Policy Statement.
WHEA	Wider Habitat Enhancement Area associated with Cypress Mining Area consents.

Table of Contents

1.0 Introduction 1
1.1. Background 1
1.1.1. The Project 1
1.1.2. Proposed Activities 1
1.1.3. Site Rehabilitation 2
1.1.4. Site Closure 2
1.2. Report Scope 3
1.2.1. Purpose 3
1.2.2. Defining the Project Components 3
1.3. Approach 7
2.0 Methods 8
2.1. Information Used 8
2.2. Assessment of Effects Methodology 11
2.2.1. Background 11
2.2.2. Ecological Value 12
2.2.3. Magnitude of Effect 12
2.2.4. Overall Level of Effect 16
3.0 Ecological Context 16
3.1. Buller Plateaux 16
3.2. Coal Measures 16
3.3. Human Induced Vegetation Changes 17
3.4. Naturally Uncommon Ecosystems 18
3.5. Current Ecosystem Management 18
3.6. 'Threatened' and 'At Risk' Plants 19
3.7. 'Threatened' and 'At Risk' Fauna 25
4.0 Terrestrial Vegetation 27
4.1. Vegetation within the Mapped Area 27
4.2. Vegetation within the Disturbance Areas 28
4.3. Wetlands 36
5.0 Bryophytes and Lichens 38
5.1. Background 38
5.2. 'Threatened' and 'At Risk' Species 38
6.0 Terrestrial Fauna 45
6.1. Avifauna 45
6.1.1. Species present 45

6.1.2. 'Threatened' and 'At Risk' Birds 47
6.2. Bats 48
6.3. Lizards 48
6.4. Terrestrial Invertebrates 49
6.4.1. Background 49
6.4.2. Field Surveys 50
6.4.3. Land Snails 50
6.5. Mammalian pests 51
7.0 Ecological Values 52
7.1. Introduction 52
7.2. Vegetation 52
7.3. Bryophytes and Lichens 52
7.4. Avifauna 53
7.5. Lizards 53
7.6. Terrestrial Invertebrates 54
8.0 Ecological Significance Assessment 60
9.0 Assessment of Ecological Effects 64
9.1. Vegetation Clearance 64
9.2. Effects on Fauna 64
9.3. Threatened Environments 65
9.4. Naturally Uncommon Ecosystems 65
9.5. Potential and Actual Adverse Effects 65
9.6. Application of the Mitigation Hierarchy 66
9.7. Introduction 66
9.7.1. Avoidance 66
9.7.2. Minimising Effects 67
9.7.3. Remediating Effects 68
9.8. Magnitude of Effects Assessment 79
9.9. Level of Adverse Effects 89
10.0 Wildlife Act Matters 93
11.0 Conclusion 93
12.0 References 93

Index to Tables

Table 1: 'At Risk' vascular plants known to occur within the Project Area. 20
Table 2: 'Threatened' and 'At Risk' vascular plants known to be or possibly present within the Project Area. 21

Table 3: 'Threatened' and 'At Risk' fauna known to occur within the Project Area. 26
Table 4: Extent of vegetation and land cover types within the Mapped Area, Buller Plateaux and Stockton and Denniston Plateaux. 30
Table 5: Extent of vegetation and landcover types within the Project sub-areas including Proposed Disturbance Area and Indirect Effects Contingency areas. 31
Table 6: Extent of natural inland wetlands within Project sub-area Disturbance Areas (including Indirect Effects Contingency areas). 36
Table 7: 'Threatened' and 'At Risk' bryophytes and lichens present or likely to be present within the Project Area. 40
Table 8: 'Threatened' and 'At Risk' bird species known to occur in the Project Area. 46
Table 9: Summary of terrestrial ecological values within the Project Area. 55
Table 10: Ecological significance of vegetation and habitats within the Project Area. 61
Table 11: Application of the effects management hierarchy to avoid, minimise and remedy adverse effects on ecological values to the extent practicable within and adjoining the Buller Plateaux Continuation Project. 73
Table 12: Overall Magnitude of Effects of the Buller Plateaux Project on vegetation and habitats. 80
Table 13: Overall Magnitude of Effects of the Buller Plateaux Continuation Project for 'Threatened' and 'At Risk' flora and fauna. 84
Table 14: Summary of the level of effect of the Buller Plateaux Continuation Project after measures to avoid, minimise or remedy effects have been implemented. 90

Index to Figures

Figure 1: The Mapped Area and Project sub-areas (collectively 'the Project Area') of the Buller Plateaux Continuation Project. 5
Figure 2: The Project Area, Mapped Area, Buller Plateaux and Ngakawau Ecological District. 15
Figure 3: Distribution of vegetation and land cover types within the Mapped Area. 29
Figure 4: Vegetation and landcover types within the Stockton Disturbance Area and Indirect Effects Contingency area. 32
Figure 5: Vegetation and landcover types within the MFS Disturbance Area and Indirect Effects Contingency area. 33
Figure 6: Vegetation and landcover types within the ESE Disturbance Area and Indirect Effects Contingency area. 34
Figure 7: Vegetation and landcover types within the UWHR Disturbance Area and Indirect Effects Contingency area. 35
Figure 8: Natural Inland Wetlands within the Disturbance Area and Indirect Effects Contingency area. 37

Appendices

Appendix A – Buller Plateaux Contextual Study (Ecological Solutions Limited 2026a)

Appendix B – Buller Plateaux Vegetation Mapping (Ecological Solutions Limited 2026b)

Appendix C – Buller Plateaux Continuation Project: Escarpment Extended Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026c)

Appendix D – Buller Plateaux Continuation Project: Mt Frederick South Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026d)

Appendix E – Buller Plateaux Continuation Project: Stockton Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026e)

Appendix F – Buller Plateaux Continuation Project: Upper Waimangaroa Haul Road Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026f)

Appendix G – Technical Evaluation to Accompany an Application for a Wildlife Act Authorisation the Project (Ecological Solutions Limited 2026g)

Appendix H – Assessment of Rehabilitation Outcomes (Ecological Solutions Limited 2026h)

Appendix I – Upper Waimangaroa Haul Road Wildlife Mitigation – Literature Review (Ecological Solutions Limited 2026i)

Appendix J – Upper Waimangaroa Haul Road (UWHR) Options Assessment (Ecological Solutions Limited 2026j)

Appendix K – Conservation Prioritisation at the Buller Plateaux (Ecological Solutions Limited 2026k)

1.0 Introduction

1.1. Background

1.1.1. The Project

Bathurst Resources Limited (including its subsidiary companies BT Mining Ltd, Bathurst Coal Ltd, and Buller Coal Ltd) (collectively referred to here as 'Bathurst') is seeking approvals through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('BPCP', or 'the Project'). The purpose of the FTAA is to facilitate the delivery of infrastructure and development projects with significant regional or national benefits.

The purpose of the Project is to obtain the necessary approvals to enable the ongoing use of the existing infrastructure and mining operations associated with the Stockton Mine and provide access to additional coal mining areas across the Buller Plateaux.

The Project Area includes parts of both the Denniston and Stockton Plateaux, collectively referred to here as 'the Buller Plateaux' and is located northeast of Westport. The Project is a complex proposal which seeks to enable a mix of ongoing and new mining activities and is described in detail in the project description prepared by Bathurst Resources Limited (2025).

As shown in Bathurst Resources Limited (2025), the Project Area has been divided into five project sub-areas for the purpose of the FTAA application:

- Stockton (including the Ngakawau Coal Handling Facility and Aerial Ropeway, 'Stockton').
- Cypress Mining Area ('Cypress').
- Mount Frederick South ('MFS').
- Escarpment Extended ('ESE').
- Upper Waimangaroa Haul Road ('UWHR').

1.1.2. Proposed Activities

Bathurst proposes to continue its mining operations on the Buller Plateaux across the five project sub-areas, with coal mining anticipated to cease in Fiscal Year (FY) 2042. Mine rehabilitation, monitoring, and maintenance will be progressively undertaken during this period with rehabilitation anticipated to be completed by approximately FY 2046, assuming commencement of new consents by 1 April 2027 (Bathurst Resources Limited 2025).

Mining will be by conventional drill and blast, load and haul open pit mining and will be a 24 hours per day and 7 days per week (24/7) operation using existing coal handling infrastructure where possible. In general, lighting will be provided around amenities areas, parking areas, and fixed infrastructure to provide for safe access to and from and operation of the facilities on a 24/7 basis (Bathurst Resources Limited 2025).

Each of the five project sub-areas and the activities involved at each location are set out in more detail in the Assessment of Environmental Effects accompanying the application (Mitchell Daysh Limited 2026). To summarise, mining occurs at various locations to achieve the necessary blend requirements and the coal is trucked to the Coal Handling and Processing Plant ('CHPP') at Stockton Mine. At the CHPP, the coal is washed and blended prior to transportation to Ngakawau via the 7.4 kilometre (km) 2–5 haul road and 2.3km aerial ropeway to the Ngakawau Coal Handling Facility.

Four primary infrastructure areas will be established at the ESE Project sub-area to support the mining operations, including a gatehouse/administration office area, a central infrastructure area, a coal haulage infrastructure area [redacted]

Access to the MFS Project sub-area would be via the UWHR from Cypress pit and a proposed southern access road. A small semi-permanent staff crib room with toilets and potable water source will be located at the MFS Project sub-area to minimise the requirement for travel back to the main Stockton bath house for breaks. There will also be a coal transfer stockpile and water management infrastructure.

The UWHR will link the ESE and MFS Project sub-areas with Stockton and Cypress. Coal from ESE and MFS will be transported along this haul road to Stockton for processing and blending and transport to the Ngakawau Coal Handling Facility ('CHF'). The UWHR is 19km long, and where possible, the selected alignment uses existing access roads and previously cleared areas. Approximately 4km of the UWHR traverses previously un-disturbed ground (Bathurst Resources Limited 2025).

1.1.3. Site Rehabilitation

The objective of the BPCP rehabilitation programme is to leave the sites safe and geotechnically stable post-mining, incorporate landforms that are sympathetic to surrounding landscapes, and to encourage an indigenous, self-sustaining, and diverse vegetation cover and ecosystem. A self-sustaining ecosystem is defined as indigenous plant and animal communities that establish, grow, reproduce, and persist indefinitely in response to the ecological gradients present and underpinned by natural ecological succession without human intervention, management or protection. These ecosystems maintain their own biodiversity, nutrient cycles, and resilience against natural disturbances (including weeds) and function as self-regulating, low-maintenance, or wild environments. Rehabilitation will be completed progressively, using techniques which have already proven successful for rehabilitation at the Stockton Mine and as set out in the site-specific Rehabilitation Management Plan (BPCP-ENV-PLN-002, Bathurst Resources Limited 2026a). Rehabilitation will optimise the use of natural material, including vegetation (for VDT), rock, topsoil and slash material as set out in that plan.

Weed management is a significant element of Bathurst's operations and is important for ensuring the site's closure and regulatory certification. The BPCP site-specific Weed Management Plan (BPCP-ENV-PLN-008) provides for weed management across the Project Area and immediate surrounds as well as the Blackburn Pākihi weed control area (Bathurst Resources Limited 2026b).

1.1.4. Site Closure

The proposed final closure outcome for the BPCP will involve the development of constructed landforms that integrate with the surrounding natural landscape of the Buller Plateaux. This will be achieved through naturalising the appearance of slopes followed by revegetation using native species and the inclusion of rockfield and other features as appropriate.

The proposed final landform for the Project Area will include 1,909ha of total rehabilitation[3] including:

- 1,577.9ha of native ecosystem.

[3] Based on GIS files of final landform released by Bathurst 5 December 2025, noting these do not include the extent of 'undisturbed' landform for the UWHR Project sub-area.

- 103.8ha of rehabilitated highwalls.
- 87.8ha of wetlands/tarns.
- 139.8ha of rockfield rehabilitation.

In addition to the rehabilitated areas, 565.9ha will remain post-mining as 'natural ground' (undisturbed area) and a further c. 171.8ha will remain as infrastructure including:

- 65ha of water infrastructure.
- 14ha of sumps.
- 93ha of built infrastructure (including the retained roading network).

1.2. Report Scope

1.2.1. Purpose

This terrestrial ecological impact assessment (EcIA) is intended to inform the FTAA application for all relevant approvals that Bathurst is seeking under the FTAA and includes:

- The approach and methods used to undertake the EcIA, which is set out in Section 2.0, with the reports describing the surveys undertaken to identify the specific terrestrial ecological features within each of the project sub-areas provided in the relevant appendices.
- The ecological context within which the project areas are located is described in Section 3.0.
- Sections 4.0–6.0 describe the vascular vegetation, non-vascular vegetation (bryophytes and lichens) and terrestrial fauna respectively.
- The ecological values present are identified and quantified in Section 7.0.
- The ecological significance of the vegetation and habitats for indigenous fauna is assessed in Section 8.0.
- The magnitude of actual and potential adverse effects due to the proposed construction and mining operations and recommendations to avoid, minimise and remedy those adverse effects are set out in Section 9.0. Section 9 also identifies residual effects which cannot be avoided, minimised or remedied and for which offsetting and/or compensation are proposed.
- Matters relating to the Wildlife Act Authority application are set out in Section 10.0.
- Section 11.0 provides a conclusion.

This assessment has relied on the completion of some of the technical workstreams associated with the Project (e.g., noise, dust, traffic, lighting, sewage disposal) which are required to inform an ecological impact assessment. A separate aquatic ecological effects report has been prepared by Earth Sciences New Zealand. The reports relevant to these matters are cited in this document where required.

1.2.2. Defining the Project Components

This EcIA uses the terms 'Mapped Area', 'Project Area', 'Project sub-area' and 'Disturbance Area' as defined below:

Mapped Area

The Mapped Area covers approximately 10,129ha mapped using high resolution aerial photographs taken by drone and based on 152 vegetation plots separated as to type via multivariate statistics and ordination. This workstream is described in Ecological Solutions Limited (2026b). The Mapped Area includes mainly high elevation coal measures vegetation, including the Denniston and Stockton plateaux, Te Kuha, Mt William, part of the Waimangaroa Valley, and areas to the north and east of Stockton Mine as shown in Figure 1. The Mapped Area includes and surrounds the Project Area, but the existing Stockton Mine (including parts of the 2–5 Haul Road), the Ngakawau Rail Loadout, and the aerial ropeway were deliberately excluded from the mapping. The Mapped Area excludes Stockton Mine because the rehabilitated vegetation at Stockton (particularly the planted areas) was repeatedly misclassified by the algorithms (generally with older vegetation being classified as a mature forest type) leading to inaccuracies.

Project Area and sub-areas

The Project Area and Project sub-areas are identified above, discussed within the body of this report and shown in Figure 1 including:

- Stockton Project sub-area (including, for the purposes of obtaining the relevant Wildlife Act Authorities, the Cypress Mining Area, as noted below). The Stockton Project sub-area does not include the existing Stockton Mine footprint where activities will be completed prior to obtaining the consents under the FTAA.
- Mount Frederick South Project sub-area (MFS).
- Escarpment Extended Project sub-area (ESE, including the Waimangaroa Storage Area).
- The Upper Waimangaroa Haul Road Project sub-area (UWHR).

These Project sub-areas represent the proposed and/or existing consent boundaries anticipated by the proposed activities as follows:[4]

- The Stockton Project sub-area comprises 1,825ha and includes the current mine as well as four small, separate Disturbance Areas to the north and east of Stockton Mine and post-2027 rehabilitation of areas within Stockton Mine. It does not include the Cypress consented area.
- The MFS Project sub-area includes access from the Waimangaroa River and comprises 216ha.
- The ESE Project sub-area occupies 584.7ha of the Denniston Plateau, plus a further 1.5ha at the Waimangaroa Storage Area.
- The UWHR sub-area connects Cypress Mining Area (at Stockton Mine) to the Denniston Plateau near the former Cascade Mine and covers approximately 82ha. This is a conservative estimate which allows for final route selection within a 100m wide envelope. Alternative route options have been considered and ruled out and only the route proposed for the true left of the Waimangaroa River is considered here.

[4] Extents (ha) in this section are calculated from GIS shapefiles released 4 December 2025. Where the Disturbance Area adjoins natural vegetation, these extents include the Indirect Effects Contingency. Where the Disturbance Area adjoins already disturbed ground, no Indirect Effects Contingency has been included.

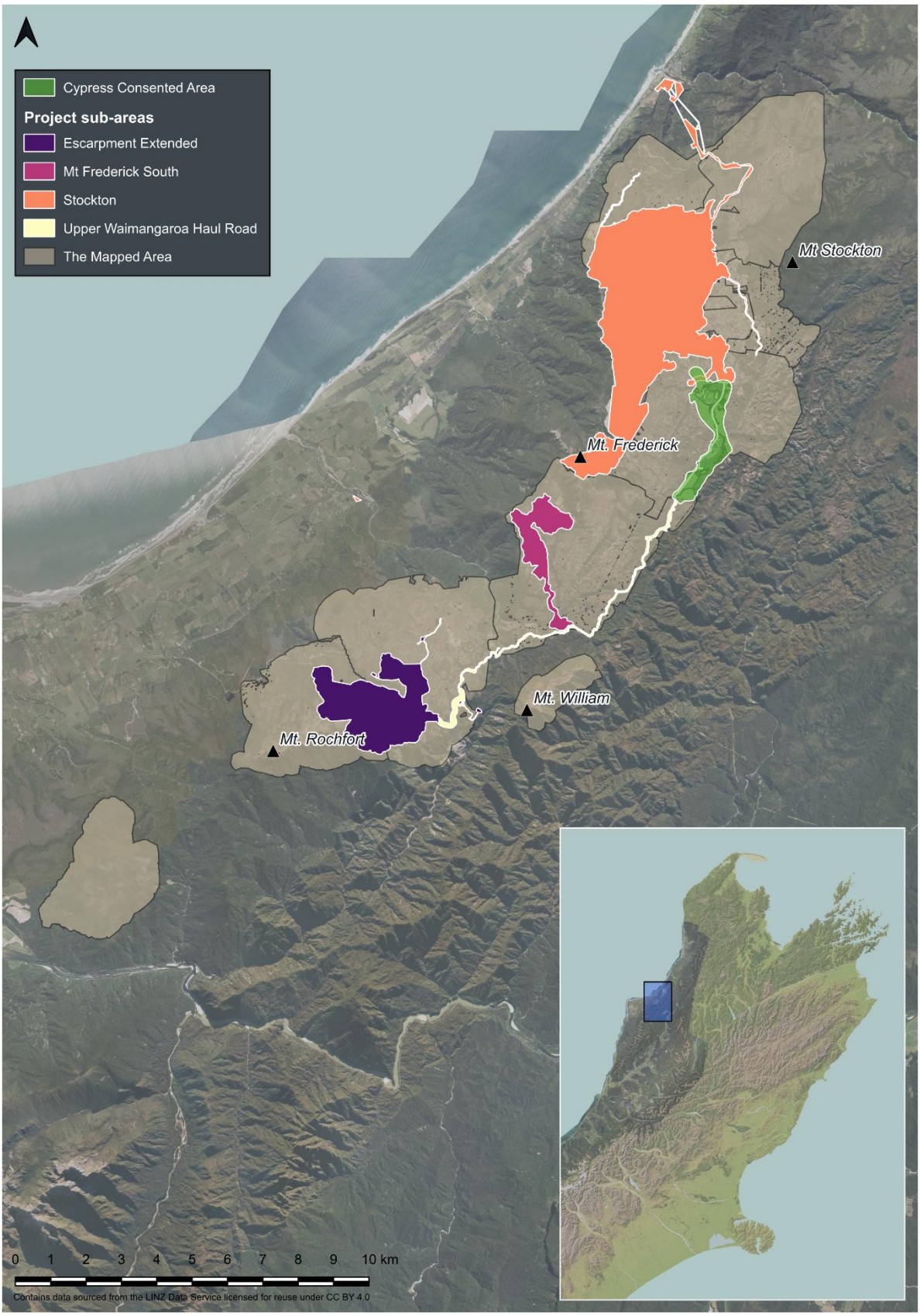


Figure 1: The Mapped Area and Project sub-areas (collectively 'the Project Area') of the Buller Plateaux Continuation Project.

- The Cypress Mining Area (consent boundary shown in Figure 1) has existing resource consents, but the relevant Wildlife Act Authorities expire in 2027. Matters relevant to the Wildlife Act (1953) are discussed in Section 10.0. A variation to the existing Cypress resource consent conditions is included within the FTAA.

Where the term 'Project Area' is used, it refers to all the Project sub-areas collectively.

Disturbance Areas

Disturbance Areas[5] within each Project sub-area reflect where 'new' disturbance will occur (for example: mining, mining infrastructure, roading, buildings). With the exception of Stockton, the Disturbance Areas set out here include what Bathurst has defined as both 'new' and 'existing' disturbance. This is because 'existing' disturbance includes underground mining which has not necessarily affected surface vegetation (i.e., the disturbance proposed as part of the BPCP would still remove vegetation). The amount of disturbance as a result of the project is c. 754ha including:

- 31ha at the Stockton Project sub-area;
- 175ha at the MFS Project sub-area;
- 503ha at the ESE Project sub-area (with no additional disturbance at the Waimangaroa Storage Area); and
- 45ha at the UWHR Project sub-area.

Bathurst have applied 'buffers' to each of the Disturbance Areas. Together, the Disturbance Area and the buffer comprise the proposed consented area (Project Area).

Indirect Effects Contingency

There is the potential for edge effects occurring beyond the actual Disturbance Areas. Edge effects can arise from changes in microhabitat conditions at newly created edges, including alterations in hydrology, wind and moisture levels, and light exposure, all of which can affect the survival of species that use edges. Bryophytes (and some lichens) are particularly sensitive to these types of environmental changes compared to vascular plants, due to their unique structure and physiology.

An Indirect Effects Contingency setback was applied to each of the Disturbance Areas to account for edge effects based on the type of vegetation or land cover present within the Disturbance Area footprint. Note that these Indirect Effects Contingency areas are not additional to the buffer applied to Disturbance Areas described above, and mostly overlap the area between the Disturbance area and Project Area boundary. The width of the Indirect Effects Contingency applied was as follows:

- For tall and short forest, the Indirect Effects Contingency was determined by doubling the average canopy height and rounding to the nearest 10m. A setback of 30m was applied to tall forest (average canopy height 15.3m) and 20m to short forest (average canopy height 6.6m).
- For shrubland and low vegetation (average canopy heights of 2.0m and 0.5m, respectively), an Indirect Effects Contingency of 10m was applied. Although these vegetation types contained plants adapted to edge conditions, a conservative setback of 10m was applied since hydrological changes may be more important than other edge effects and may extend further beyond the newly exposed edge

[5] Note that the disturbance areas for MFS, UWHR and ESE are not consistent with the affected areas calculated here because existing disturbance includes underground mining, which has not necessarily affected the surface vegetation. Extents (ha) calculated here are based on the GIS Shapefiles released 15 October 2025.

(Simcock et al. 2022).

- No Indirect Effects Contingency was applied where cleared vegetation was already present at the Disturbance Area boundary, because edge effects already exist at those locations.

The vegetation and habitats within the Indirect Effects Contingency areas (i.e., affected by edge effects) have been considered as 'loss' in the magnitude of effects assessment, even though they will not be removed, as explained in Section 2.2.

1.3. Approach

There are currently a matrix of existing authorisations applying to parts of the Project Area (including coal mining licences, mining permits, and resource consents), with varying expiry dates and conditions. There are also historic activities authorised by historical approvals, existing use rights, and ongoing impacts resulting from historic mining in the area, which include:

a) Historic activities that are completed and part of the legal existing environment.

b) Activities which are permitted by the relevant planning instruments.

c) Activities which have been authorised by CMLs and resource consents that are likely to be implemented in the future.

d) Linked to (c) above, rehabilitation and offset/compensation requirements which need to be implemented through the existing consent/CML conditions.

These authorisations and associated historical and ongoing activities define the existing environment against which the Project's effects have been assessed. This approach is different from assessing the environment which is currently physically present at the site.

With respect to the assessment of the effects of land use activities, mining activities have affected the existing environment. Some of these areas, excluding parts of the Stockton CML, Escarpment Mine, Cypress Mine, and No 2 South, have already undergone rehabilitation to the standards approved under the CML. For parts of the Project Area, the environment is therefore not a pristine, untouched environment, but includes a modified (albeit rehabilitated in some areas) environment. Specifically, the existing environment includes:

a) On the Stockton Plateau, a rehabilitated mine site, parts of which have already been rehabilitated to the extent required by the existing CML. This is generally consistent with how the environment would remain if additional consents under this application were not granted.

b) On the Denniston Plateau there is evidence of historic mining and residential activities and ongoing recreational vehicle (4WD) use and associated changes to the landscape and vegetation. Since the majority of the existing consents for the Escarpment Mine have expired and the application for their renewal has been limited to care and maintenance only, the existing environment reflects the current mine disturbance footprint.

c) At the Cypress and No 2 South mining areas, active working mines which will transition from open cast pits to rehabilitated landforms over time, with full rehabilitation in place by the expiry of the current consents in 2040 (Cypress) and 2046 (No 2 South).

d) Across the Project Area, all historic mining activities which took place prior to the Coal Mines Act 1979 and the RMA approvals being required. This includes historic

underground mining, historic buildings, the aerial ropeway, and the underground fire at the Millerton Mine which has been burning since 1926.

e) Buildings currently located in the Project Area which were authorised by the CML.

f) To some extent, the activities within those buildings, such as noise or lighting, where existing use rights exist.

g) Any activities permitted by the relevant planning documents.

All residual effects (for example changes in vegetation type or composition at rehabilitated sites cf natural sites) resulting from the carrying out of the consented and approved activities and CMLs, following rehabilitation, will form part of the existing environment.

The FTAA requires the assessment of effects to consider any cumulative effects which arise over time or in combination with other effects. This means that if a consented activity has adverse effects and the proposed activity also has an adverse effect, which would add to the existing effects, then assessments must have regard to the combined effects of both activities. This assessment therefore considers the potential effects of mining being undertaken simultaneously across both the Denniston and Stockton Plateaux, including any:

a) Activities for which consent is sought;

b) Already consented activities within the Project Area at Cypress Mining Areas; and

c) Already consented activities occurring outside of the Project Area.

2.0 Methods

2.1. Information Used

Identifying and describing the terrestrial ecological features of the Project sub-areas has involved a combination of desktop studies to compile and summarise information from previous published and unpublished ecological surveys and reports, gap analysis of this material and targeted field surveys to address any identified gaps. This information was supplemented by database searches where applicable. By way of example, specific field surveys of invertebrates were undertaken at the different Project sub-areas and informed by previous surveys from elsewhere across the Buller Plateaux to provide context. With respect to vegetation, broad scale vegetation mapping was undertaken across the Mapped Area which included plots within the Project sub-areas to provide information about vegetation and habitat types.

The specific reports used to inform this assessment are:

- Buller Plateaux Contextual Study (Ecological Solutions Limited 2026a, provided as Appendix A 'the contextual study').

  The contextual study presents information compiled from over 50 surveys of flora and fauna undertaken within the Ngakawau Ecological District including the Upper Waimangaroa valley and the Buller Plateaux, mostly since 1990. Key word searches of Bathurst's bibliographic database in Papers, Google and Google Scholar were used to locate these studies. Information was also collated from databases such as the Department of Conservation, eBird and the Global Biodiversity Information Facility.

- Buller Plateaux Vegetation Mapping (Ecological Solutions Limited 2026b, provided as Appendix B).

The Buller Plateaux Vegetation Mapping report sets out the mapping of terrestrial and wetland vegetation covering c. 10,129ha of the Buller Plateaux and surrounds (referred to as 'The Mapped Area'). Vegetation and landcover was mapped and described using 152 10m x 10m vegetation plots collected between 2008 and 2024 across both the Stockton and Denniston Plateaux, combined with ordination and multivariate analysis as well as classification of 45,690 aerial photographs of the Mapped Area collected between July 2019 and January 2024.

- Buller Plateaux Continuation Project Escarpment Extended Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026c provided as Appendix C).

  The Escarpment Extended Project sub-area report summarises information collected during surveys of flora and fauna relevant to the ESE Project sub-area. This includes information from vegetation surveys (69 plots), bryophyte surveys (9 plots), bird surveys (five-minute birds counts (5MBCs) at 120 locations biennially (twice per year) since 2011), roroa call count surveys (19 listening stations, biannually (every two years) since 2013), lizard surveys (five days manual and nocturnal searching on the Denniston Plateau and Waimangaroa Valley), terrestrial invertebrate surveys (excluding snails, 11 sampling sites surveyed in 2024, each comprising three pitfall traps, one malaise trap, sweep netting, beat sampling, and hand searching) and mammalian pest monitoring (tracking tunnels, chew cards).

- Buller Plateaux Continuation Project Mt Frederick South Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026d, provided as Appendix D).

  The Mt Frederick South Project sub-area report summarises information collected during surveys of flora and fauna relevant to the MFS Project sub-area. This includes vegetation surveys (10 plots), bryophyte surveys (10 plots), bird surveys (5MBCs undertaken in 2019 at 25 locations and 12 acoustic recorders deployed between 27 January and 8 February 2024), and terrestrial invertebrate surveys (excluding snails. 18 sites sampled in 2023 (12 which were within the MFS Project sub-area), each comprising three pitfall traps, one malaise trap, sweep netting, beat sampling, and hand searching).

- Buller Plateaux Continuation Project Sub-Area Baseline Ecological surveys for the Stockton Project sub-area (Ecological Solutions Limited 2026e, provided as Appendix E).

  The Stockton Project sub-area report summarises information collected during surveys of flora and fauna relevant to the Stockton Project sub-area. This includes vegetation surveys (five plots located to the north of the Stockton Project sub-area, and walkthrough surveys undertaken in 2023), bird surveys (observations made during site walkovers) and mammalian pest monitoring stations (tracking tunnels, chew cards).

- Buller Plateaux Continuation Project Upper Waimangaroa Haul Road Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026f, provided as Appendix F).

  The UWHR Project sub-area report summarises information collected from surveys of flora and fauna relevant to the UWHR Project sub-area. Information compiled is from vegetation surveys (four plots), bryophyte surveys (walk through survey along the true-left of the Waimangaroa River conducted in 2020), bird surveys (5MBCs undertaken in February 2019 and March 2020 at 34 locations along the UWHR and surrounds), lizard surveys (five days manual and nocturnal searching on the Denniston Plateau and Waimangaroa Valley during February and March 2020) and terrestrial invertebrate surveys (excluding snails, 10 sites sampled in the vicinity of, but not within, the UWHR Project Area in 2024, each comprising three pitfall traps,

one malaise trap, sweep netting, beat sampling, and hand searching).

- Technical Evaluation to Accompany an Application for a Wildlife Act Authorisation (Ecological Solutions Limited 2026g, provided as Appendix G).

  The BPCP Wildlife Act Authorisation Technical Report summarises the information required for the application to obtain a Wildlife Act Authorisation (WAA) in accordance with the requirements set out in Cause 2(1) of Schedule 7 of the Fast Track Application Act 2024. The technical information identifies the protected wildlife affected and includes a brief description of the actions to be carried out, the associated effects on protected wildlife, the protection measures to be implemented via species specific management plans and the identification of areas where the activities will be carried out.

- Assessment of Rehabilitation Outcomes (Ecological Solutions Limited 2026h, provided as Appendix H 'the rehabilitation outcomes report').

  The rehabilitation outcomes report sets out the findings of vegetation and fauna surveys at sites rehabilitated using planting or vegetation direct transfer and at non-remediated sites (disturbed and not rehabilitated) to assist in understanding how rehabilitated sites are performing with respect to variables relevant to mine closure (e.g., indigenous dominance, species occupancy, vegetation cover). The report briefly summarises the history of rehabilitation at Stockton Mine, including research trials undertaken since 1990, and current rehabilitation practice and provides recommendations with respect to improving rehabilitation outcomes.

  The rehabilitation outcomes report reports the findings of vascular vegetation surveys (21 10m x 10m vegetation plots within rehabilitated and non-remediated vegetation, 32 5m x 5m plots at historic drill sites and surveys of vegetation surrounding 12 constructed and six natural tarns sampled in October and November 2023), bryophyte surveys (39 5m x 5m plots), birds (46 5MBC stations sampled in February 2021 and March 2024), roroa surveys (nine transects surveyed in February and March 2021 using a certified protected species conservation dog, two trail cameras and acoustic recorders), lizard surveys (100 artificial cover objects deployed in 2019 at five VDT sites), soil invertebrate surveys (28 soil invertebrate samples, 39 terrestrial invertebrate samples each comprising one malaise and three pitfall traps as well as beat sampling and sweep netting) and macroinvertebrate sampling (18 kicknet samples from within natural and constructed tarns) undertaken in 2024.

- Upper Waimangaroa Haul Road Wildlife Mitigation – Literature Review (Ecological Solutions Limited 2026i, provided as Appendix I).

  The Upper Waimangaroa Haul Road literature review considers local and international literature relating to methods to reduce the adverse effects of roading on wildlife in the context of the species present and likely traffic considerations for the UWHR.

- Upper Waimangaroa Haul Road (UWHR) Options Assessment (Ecological Solutions Limited 2026j, provided as Appendix J).

  The UWHR options assessment considers the relative ecological impacts of two alternative potential routes for the Upper Waimangaroa Haul Road in order to identify a preferred route. For this assessment a scoring system was developed using four different attributes applied to the aerial extent of vegetation and habitat types present within each respective route to provide a quantitative score for each option which was then compared.

- Conservation Prioritisation at the Buller Plateaux (Ecological Solutions Limited

2026k, provided as Appendix K 'the conservation prioritisation report').

The conservation prioritisation report uses Zonation 5 software informed by the ecological data collected in the reports set out above to identify and rank the relative conservation value of different areas within the Mapped Area. This identifies relatively higher value and lower value areas for conservation to be used to inform conservation and land use planning decisions.

Using this combination of field and desktop information, an ecological impact assessment was then undertaken using a modified version of the Environment Institute of Australia and New Zealand ('EIANZ') Ecological Impact Assessment Guidelines ('EcIAG') (Roper-Lindsay et al. 2018) developed specifically for this Project. The details of, and rationale for, the modification to the guidelines are set out in Section 2.2.3.

2.2. Assessment of Effects Methodology

2.2.1. Background

The EIANZ guidelines provide a standardised stepwise approach to evaluate the level of ecological effect and also provide insight into the management of effects through avoidance, remediation and mitigation as well as providing a recommended threshold at which biodiversity offsetting and/or compensation should apply. The guidelines have been designed to allow for expert judgement and the consideration of implications under New Zealand's Wildlife Act 1953.

Assessments of ecological value and significance are best undertaken for an area (rather than, for example, an isolated vegetation community) and for all aspects of biological and physical diversity (rather than only for vegetation for example) especially in heterogenous landscapes like those within the Project Area.

Disaggregating and assessing individual vegetation and habitat types in isolation can elevate the risk of overlooking or undervaluing ecological linkages, sequences and connectivity and the broader ecological context of a site. Many ecological functions and values arise not from individual components, but from the way these components interact as a cohesive whole. To summarise, assessments of ecological value for an area or site are necessary to:

- Ensure that the ecological context for each vegetation or habitat type is appropriately considered. Terrestrial vegetation communities and habitats function as dynamic, interconnected systems.
- Ensure that ecotone, edge or transitional habitats are appropriately considered: Ecotones often support high biodiversity (for example, containing species from both adjoining vegetation communities, and species which are not suited to the conditions found in the core of either of those vegetation communities) and play important roles in ecosystem function.
- Address limitations inherent to vegetation mapping. The mapped vegetation boundaries and the granularity of classification applied to the Mapped Area reflect gradual gradients mapped coarsely, rather than obvious ecological divisions. The Buller Plateaux contains a complex mosaic of vegetation types, with each mapped vegetation unit containing special features and characteristics of other communities within it. For example, wetland communities include a range of species from upland species to obligate wetland species depending on local variations in drainage, topography, altitude and exposure.

Despite the interconnectedness of the habitats present, valuing individual vegetation

communities and habitat types is critical to an assessment of effects because different vegetation types have different, and in many cases distinct, ecological values. Moreover, the EIANZ approach is important when developing offset or compensation modelling and provides transparency, process and rigour around the type and quantum of residual effects management to adequately manage effects for activities at the site.

The ecological values associated with each vegetation/habitat type, particular species and/or particular groups of similar species within the Project Area were assessed as set out below and with an understanding of site/area specific variance in ecological context and pattern across the Project Area boundary.

2.2.2. Ecological Value

Values were assigned to terrestrial ecological features following the approach outlined in the Ecological Impact Assessment guidelines ('EcIAG' Roper-Lindsay et al. 2018). The EcIAG outline a standardised approach for assessing ecological values. The approach involves assessing four matters including representativeness, rarity/distinctiveness, diversity and pattern and ecological context with consideration of the attributes outlined in Table 4 and 7 of the EcIAG. Overall value is assigned to an ecological feature based on the following scoring system:

- Very High – Area rates 'High' for three or all of the four assessment matters. Likely to be nationally important and recognised as such.
- High – Area rates 'High' for two of the assessment matters, 'Moderate' and 'Low' for the remainder, or area rates 'High' for one of the assessment matters, 'Moderate' for the remainder. Likely to be regionally important and recognised as such.
- Moderate – Area rates 'High' for one matter, 'Moderate' and 'Low' for the remainder, or area rates 'Moderate' for two or more assessment matters and 'Low' or 'Very Low' for the remainder. Likely to be important at the level of the Ecological District.
- Low – Area rates 'Low' or 'Very Low' for majority of assessment matters and 'Moderate' for one. Limited ecological value other than as local habitat for tolerant native species.
- Negligible – Area rates 'Very Low' for three matters and 'Moderate', 'Low' or 'Very Low' for remainder.

2.2.3. Magnitude of Effect

Magnitude of effects on vegetation and landcover types

The EcIAG recommend assessment at the scale of the ecological district, but acknowledges there are situations where this scale is inappropriate. The EIANZ approach includes consideration of the proportion of habitat affected at the scale considered (e.g. the proportion of the relevant ecological district removed by a particular proposal). Given the limited extent of Brunner coal measures and the Buller Plateaux, assessment at the ED scale would underestimate the scale of effects with respect to this proposal.

Considering the proportion of a particular habitat, even at the smaller scale of the Mapped Area, could also underestimate the scale of effects when large areas (hundreds of hectares) are involved.

To assist in meaningfully defining the magnitude of effect we have undertaken an assessment of the magnitude of effects with consideration of effects on identified vegetation and landcover types and associated values at three different scales (shown in Figure 2):

- Areal extent of the affected vegetation or landcover type. Conservatively we have included both the Disturbance Area and Indirect Effects Contingency in the estimate of loss (noting that edge effects within the Indirect Effects Contingency would degrade vegetation, but not necessarily remove it);
- Proportion of the affected vegetation or landcover type within the Mapped Area;
- Proportion of the affected vegetation or landcover type within the Ngakawau ED.

The magnitude of effects was considered in the context of several factors including:

- The scale of impacts (i.e., extent of impact relative to the Buller Plateaux, Mapped Area or the ecological district).
- The extent or proportion of habitat loss (e.g., the proportion of habitat loss relative to the contiguous habitat that remains) within the Mapped Area and the Ngakawau ED.
- The duration of impacts (e.g., permanent, long term (more than five years) or temporary (less than five years)).

The intensity of the unmitigated effect (i.e., the extent to which habitat loss within the project footprint is to be complete or partial). The scale used in relation to areal extent was developed collaboratively by [redacted](Ecological Solutions Limited) and [redacted] (Alliance Ecology Limited) to be consistent with the existing EIANZ EcIAG. The scale used was as follows:[6]

- <1ha affected – negligible magnitude of effect. A very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation and/or having a negligible effect on the known population or range of the element/feature.
- 1–5ha affected – low magnitude of effect. Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; and/or having a minor effect on the known population or range of the element/feature.
- 5–25ha affected – moderate magnitude of effect. Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; and/or loss of a moderate proportion of the known population or range of the element/feature.
- 25–125ha affected – high magnitude of effect. Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; and/or loss of a high proportion of the known population or range of the element/feature.
- >125ha affected – very high magnitude of effect. Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; and/or loss of a very high proportion of the known population or range of the element/feature.

Beyond describing the magnitude of effect in terms of the effect on the known population or

[6] This scale was not applied to exotic grassland or cleared vegetation since neither of these are natural landcover types and neither reflects the native ecosystems present or expected to be present in this setting. The effect of vegetation removal has already (historically) occurred, and the removal of these habitats as they are, from a botanical perspective approximates to a 'no change' situation.

range of the element/feature (as above), EIANZ leave to professional judgement the determination as to what proportion of the element/feature affected equates to the different magnitudes of effect. In relation to the proportion of the ecological values present within the Mapped Area and Ngakawau ED affected by the BPCP, the scale used here was[7]:

- <1% affected – negligible magnitude of effect.
- 1–5% affected – low magnitude of effect.
- 5–20% affected – moderate magnitude of effect.
- 20–50% affected – high magnitude of effect.
- >50% affected – very high magnitude of effect.

Determining the overall 'magnitude of effect'

The 'overall magnitude of effect' adopted with respect to vegetation and habitat types was the most conservative (highest) of the three scales used. This was typically the magnitude of effect at the 'areal extent' scale.

Remediation activities (in the form of site rehabilitation, set out in Section 9.7.3 and in the Rehabilitation Management Plan for the Project. BPCP-ENV-PLN-002) were considered when assessing the 'overall magnitude of effects' for removal of vegetation and habitat types, however, given the uncertainty with respect to the specific location and extent of Vegetation Direct Transfer (VDT), and the substantial time lag between vegetation removal and establishment of ecologically similar vegetation (i.e., the time taken for plantings to mature), taking account of remediation actions resulted in no material change in the level of effect.

Magnitude of effects on specific species

The 'magnitude of effect' on species was also assessed at three different scales:

- Areal extent of affected area (project scale).
- Proportion of the Mapped Area.
- Proportion of the Ngakawau ED.

This assessment took a more traditional approach, aligning with the EIANZ guidelines, and was informed by a number of matters including (but not limited to) distribution/range, abundance, relative abundance/density at the site compared with other sites, relative importance of the site regionally and nationally for the species being considered.

Determining the overall 'magnitude of effect'

The overall magnitude of effect with respect to particular species was informed by the matters above and also considered the effectiveness of mitigation and remediation actions (but not offsetting and compensation actions) for those species. Thus, the "overall magnitude of effect' was reached via professional opinion informed by the synthesis of desktop investigations, field survey, background/contextual information, local and national experience, familiarity and understanding of the project and other relevant matters.

[7] This scale was not applied to exotic grassland or cleared vegetation as both of these are un-natural landcover types that don't reflect the native ecosystems present in this setting. The effect of vegetation removal has already (historically) occurred, and the removal of these habitats as they are, from a botanical perspective, approximates to a 'no change' situation.

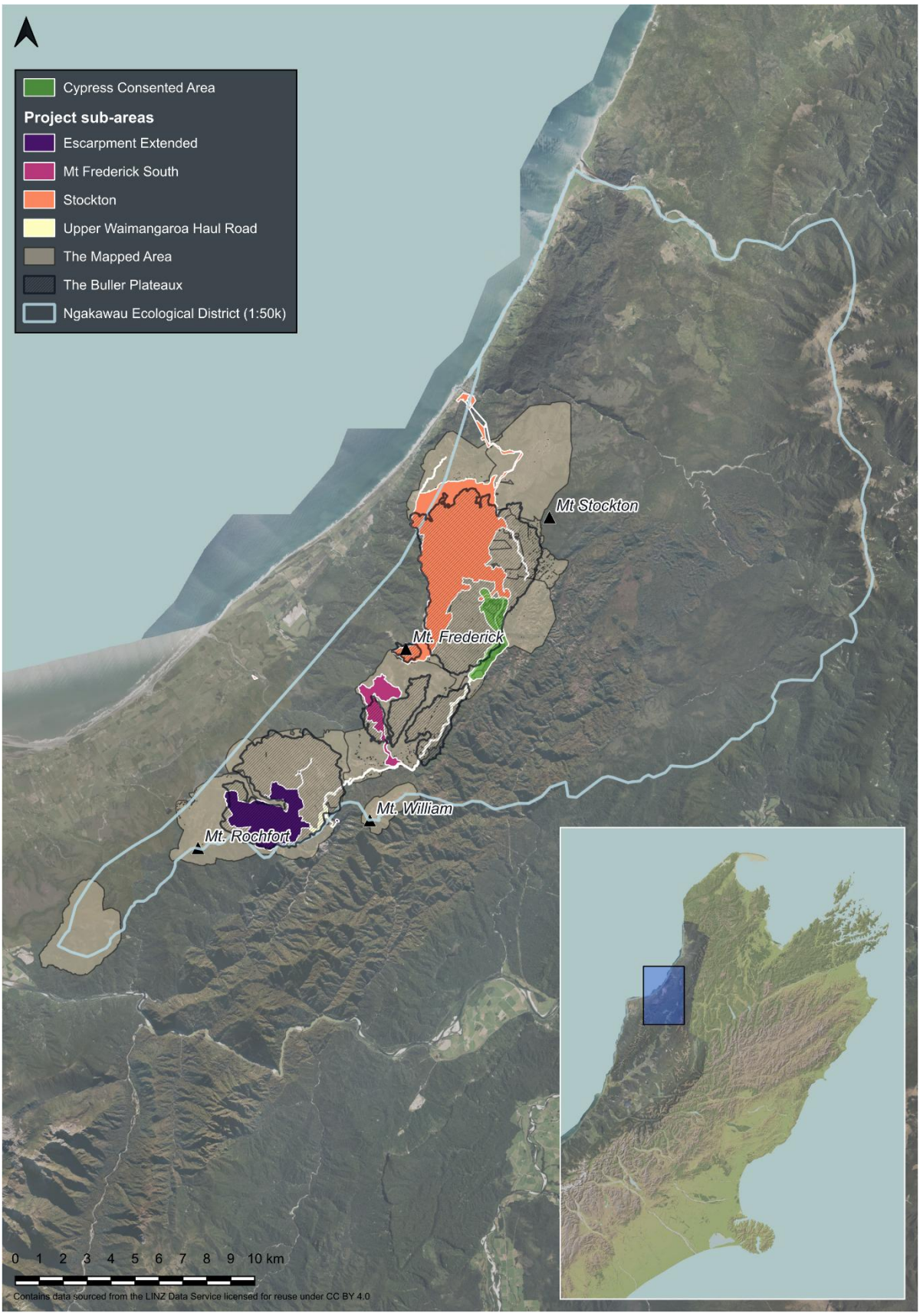


Figure 2: The Project Area, Mapped Area, Buller Plateaux and Ngakawau Ecological District.

2.2.4. Overall Level of Effect

An overall level of effect assessment was undertaken using the EIANZ matrix approach which weights the assessed ecological values against the overall magnitude of effects as described above. The EIANZ matrix assessment framework allows for effects to be ranked on a gradient from 'negligible' to 'very high' and allows for focused application of offsetting and/or compensation activities and where the overall level of effect warrants it as follows:

- Project effects in the 'Very High adverse' category have very high adverse effects and should be avoided where possible. Where very high adverse effects cannot be avoided, a net biodiversity gain or a 'nature positive' outcome resulting from effects management and other activities associated with the project would be appropriate.
- Project effects in the 'High' and 'Moderate' adverse category represent a level of effect that requires careful assessment and analysis of the individual case. Such an effect could be managed through avoidance, design, or extensive offset or compensation actions. Wherever adverse effects cannot be avoided, no net loss of biodiversity values or a 'nature positive' outcome resulting from effects management and other activities associated with the project would be appropriate.
- Low and Very Low categories should not normally be of concern, although normal design, construction and operational care should be exercised to minimise adverse effects. If effects are assessed taking impact management developed during project design into consideration, then it is essential that any recommended impact management is carried out to ensure 'Low' or 'Very Low' levels of effects.

Confidence in the effects assessment was ranked as

- "High", meaning that there is ample reliable data available to inform that matter.
- "Moderate" meaning that there is some data, but not sufficient to be confident that the level of effect is certain.
- "Low" meaning that there is very little data on which to base an assessment.

3.0 Ecological Context

3.1. Buller Plateaux

The Denniston and Stockton Plateaux have been defined based on their geomorphological features by Mabin (2012) and Templeton and McMorran (2020) respectively. These areas together (i.e. the 3,120ha Stockton and 1,700ha Denniston Plateaux) are referred to here as 'the Buller Plateaux', which covers approximately 4,820ha at six discrete, but closely connected, locations. The Project Area is located mostly on the Buller Plateaux, but extends beyond it at some locations (including at the Ngakawau Coal Handling Facility, the Waimangaroa Storage Area, parts of the MFS Project sub-area and parts of the UWHR Project sub-area).

The Buller Plateaux lies within the Ngakawau ED and North Westland Ecological Region (McEwen 1987). The ecological features and context of the Ngakawau ED and the Buller Plateaux specifically are set out in Ecological Solutions Limited (2026a, provided as Appendix A).

3.2. Coal Measures

The term coal measures is defined and discussed in more detail in Section 3.2 of Ecological Solutions Limited (2026a) (provided as Appendix A). The largest concentration of Brunner

coal measures occurs on the Buller Plateaux, where the acidic geology combines with poor drainage in a cool, wet, and windy environment to create infertile soils, distinctive vegetation communities and exposed gently sloping rock pavements which are known as sandstone erosion pavement or 'sandstone pavement'.

At the Buller Plateaux (4,820ha), Brunner coal measures cover c. 4,661ha (c. 3,013ha at Stockton Plateau and c.1,648ha at Denniston Plateau) where the most extensive vegetation communities on the exposed gently sloping rock pavements are dominated by prostrate shrub and tussock communities. Forests and shrublands comprising species adapted to infertile environments develop in more sheltered locations, or those with deeper soils, such as hill slopes and deeply incised gorges. Stockton Mine has removed 1,124ha of Brunner coal measures from the Buller Plateaux, the BPCP will remove a further 985.7ha, leaving 2,551ha (c. 55%) of Brunner coal measures within the Buller Plateaux.

There was originally c. 11,578ha of Brunner coal measures within the Ngakawau ED. Stockton Mine has removed approximately 1,155ha leaving c. 10,423ha remaining. The BPCP will remove a further 1,315.7ha leaving c. 9,106ha of Brunner coal measures remaining within the Ngakawau ED[8].

3.3. Human Induced Vegetation Changes

Since human arrival the vegetation of the Buller Plateaux has been modified to varying degrees, including by fire. Haast (1861) described the pre-European vegetation of the Denniston Plateau as "dense subalpine scrub and mānuka". Overmars et al. (1998) described a "history of burning of the open coal measures vegetation" with "repeated extensive burning until the 1920s". This repeated burning has replaced shrubland vegetation with open vegetation dominated by tangle fern and wire rush (Townson 1906). Overmars et al. (1998) also considered that the extent of more open vegetation near the peaks of Mt Rochfort, Mt Frederick, Mt Augustus and Mt William had been enlarged by recent fire and that the differences in vegetation patterns between the upper and lower Stockton Plateau was due, at least in part, to the greater intensity of previous burning and recent conversion from forest on the lower slopes. Disturbance from underground mining and associated activities at the surface (buildings, roads and the like) and the presence of underground fires, such as those at Millerton and near Ironbridge (Coalbrookdale), have also disrupted natural vegetation sequences and ecological succession at those locations.

The current network of roads and tracks and the many former settlements across the Buller Plateaux reflects its history of settlement associated with underground mining beginning in the late 1870s and more recently electricity transmission and communications infrastructure. At least 223.5km of roads and tracks have been constructed within the Mapped Area, which excludes Stockton Mine and Cypress mining areas. Stockton Mine and Cypress mining area together occupy approximately 48% of the Buller Plateaux.

At the Denniston Plateau roads and tracks extend from Denniston township in the north to Mt Rochfort in the south-west and cross many of the patches of low vegetation. Some of these tracks are now used for four-wheel driving and other recreational activities contributing to ongoing vegetation disturbance and posing a biosecurity risk. Disturbance associated with the formation and ongoing use of these tracks has contributed to introducing non-native plant species (i.e., exotic species or native species not typically found on the plateaux). Areas of weedy vegetation of various sizes including exotic grassland, weedy shrubland and weedy low pākihi are common around historic settlements, roads, tracks and historic mining areas and are a source of weeds for the surrounding more intact ecosystems.

Largely unmodified areas include the southern Stockton Plateau (in particular the eastern

[8] The Project Area boundary was used in these calculations since this represents the maximum area that could be affected.

part of the Deep Creek catchment), the Upper Waimangaroa valley, and the part of Stockton Plateau between Stockton Mine and Cypress mining area.

3.4. Naturally Uncommon Ecosystems

Naturally uncommon ecosystems are defined as those which have a (natural) total extent of less than 0.5% of New Zealand's total area (i.e. <134,000 ha, Williams et al. 2007), or those that meet International Union for Conservation of Nature (IUCN) threat assessment criteria taking into account current and historic extent, distribution and ecological function (Holdaway et al. 2012). Naturally uncommon ecosystems are discussed in more detail in Section 2.3 of Ecological Solutions Limited (2026a) (provided as Appendix A). There are at least five naturally uncommon ecosystems present within the Buller Plateaux, including:

i) **Boulderfields of acidic rock**

Acidic rock derived from quartz-rich sandstone, present to the north of Mt Rochfort and in the Deep Stream catchment (Wildland Consultants Limited 2010).

ii) **Sandstone erosion pavement**

A key feature of the Buller Plateaux. Characterised by areas of flat to gently sloping quartzose sandstone bare of topsoil, resulting from chemical weathering and erosion of topsoils. Plants occur in areas where soils have accumulated such as cracks and fissures in the rock. Vegetation forms only a relatively minor component of sandstone erosion pavement.

iii) **Tarns**

In the context of the Buller Plateaux, tarns are small ponds embedded within the sandstone erosion pavement landscape often surrounded by pākihi and other low growing vegetation.

iv) **Seepages and flushes**

Seepages and flushes are limited in extent across the Plateau and are present on hillslopes, within gullies and amongst the remaining red tussock vegetation in Happy Valley. These small ecosystems often occur where slope angle changes or impermeable layers (such as pans) raise the water table, causing permanent (seepage) or temporary (flush) soil saturation (Johnson & Gerbeaux 2004).

v) **Pākihi wetlands**

Pākihi wetlands are a type of wet heath characterised by the combination of flat topography, leached, very infertile soil, high rainfall and impeded drainage. Pākihi wetlands support sedgeland, rushland and fernland vegetation (Johnson & Gerbeaux 2004).

3.5. Current Ecosystem Management

The presence and abundance of pest mammals are discussed in more detail in Section 4.6 of Ecological Solutions Limited 2026a, provided as Appendix A. Possums, rodents and stoats have been monitored annually at Denniston between 2014 and 2024 and that monitoring indicates that mice, rats (primarily ship rats), possums and stoats are widespread with density dependent on factors including habitat, season, recent pest control operations and mast seeding events. Almost the entire 4,820ha Buller Plateaux receives ecosystem management funded by Bathurst Resources as required by:

- Escarpment Mine consent conditions (most of which expired in October 2025 but are subject to an application for renewal for care and maintenance purposes only):

  - Denniston Permanent Protection Area (DPPA, 731ha[9]). Management includes weed and animal pest control.
  - Denniston Biodiversity Enhancement Area (DBEA, 4,458ha, the DPPA is within the DBEA). Management includes weed, predator and pest animal control and monitoring.
- Cypress Mining Area consent conditions (expire 2040):
  - Snail Enhancement Area (SEA, 1,879ha). Management includes mammalian pest control (targeting possums and rats) for the protection of *Powelliphanta patrickensis.*
  - Wider Habitat Enhancement Area (WHEA, 8,250ha, the SEA is within the WHEA). Management includes mammalian pest control (targeting possums, rats and stoats) for wider habitat protection and to buffer the snail enhancement area.

These management areas extend beyond the Buller Plateaux to adjoining habitats. Together the DBEA and the WHEA comprise 12,700ha which covers c. 26% of the Ngakawau Ecological District (ED). In addition, 1,000ha further north is managed for kiwi protection (referred to as the 'Oparara kiwi management area') as part of the Cypress Mining Area consents. There has also been ecosystem management further north in Kahurangi National Park (the Heaphy River valley) funded by Bathurst as part of the compensation package for Escarpment Mine.

3.6. 'Threatened' and 'At Risk' Plants

'Threatened' and 'At Risk' vascular plants known to occur within the Buller Plateaux and surrounds are set out in Appendix A of Ecological Solutions Limited (2026a), provided as Appendix A. No 'Threatened' vascular plant species have been recorded within the Project sub-areas to date, but nine species considered to be 'At Risk' by de Lange et al. (2024) have been recorded as shown in Table 1. This includes both 'At Risk – Declining' species such as coal measures tussock (*Chionochloa juncea*) and *Dracophyllum densum*, and 'At Risk – Naturally Uncommon' species such as Travers horopito (*Pseudowintera traversii*), all three of these species are endemic to North-West Nelson and North Westland.

Other plants with localised distributions have also been recorded from within the Project Area, including *Actinotus novae-zelandiae* and *Celmisia dubia.*

Other vascular plants of conservation concern that may be present within the Project Area based on their known distribution and the presence of suitable habitat include:

- The orchids *Calochilus paludosus* ('Threatened – Nationally Vulnerable'), *Caladenia alata* ('At Risk – Declining'), *Pterostylis humilis* and *Townsonia deflexa* (both 'At Risk – Naturally Uncommon').
- *Bulbinella modesta* ('At Risk – Declining').
- Small herbaceous species including *Euphrasia disperma*, *Lobelia fatiscens* and *Schizacme helmsii* (all 'At Risk – Naturally Uncommon').
- The sedges *Carex carsei and Carex dallii* (both 'At Risk – Naturally Uncommon') which have been recorded in red tussock vegetation adjacent to Cypress mining area.

[9] Based on the shapefiles received from Bathurst on 16 December 2025.

'Threatened' and 'At Risk' plants which may be, or are known to be, present in the Project Area are set out in Table 2 along with details about their distribution.

Table 1: 'At Risk' vascular plants known to occur within the Project Area.

Conservation Status	Stockton	MFS	ESE	UWHR
At Risk – Declining				
Coal measures tussock (*Chionochloa juncea*)	Present*	Present	Present	Present
Dracophyllum densum	Possible	Present	Present	Likely
Euphrasia wettsteiniana	Unlikely	Possible	Present	Possible
Red mistletoe (*Peraxilla tetrapetala*)	Unlikely	Possible	Present	Possible
At Risk – Naturally Uncommon				
Astelia subulata	Unlikely	Likely	Present	Unlikely
Brachyglottis traversii	Possible	Likely	Present	Present
Travers horopito (*Pseudowintera traversii*)	Unlikely	Present	Likely	Possible
Sticherus tener	Unlikely	Possible	Present	Unlikely
Sticherus urceolatus	Unlikely	Possible	Present	Unlikely

*'Present' refers to species with at least one confirmed location record within the Project sub-area. 'Unlikely', 'Likely' and 'Possible' refers to species that do not have a location record within the Project sub-area, but may be present there ('likely' and 'possible') because there is suitable habitat, or are 'unlikely' to be present, because of a lack of suitable habitat.

Table 2: 'Threatened' and 'At Risk' vascular plants known to be or possibly present within the Project Area.

Species	Distribution	Summary of records on Buller Plateaux	Likelihood of occurring within the Project Area
Confirmed Present			
Astelia subulata	Distribution not well known, but includes Stewart Island, Otago and Buller Plateaux.	At least three unpublished records from Denniston Plateau and Mt William.	Two known locations within the ESE Project sub-area. Easily overlooked due to its small, inconspicuous size, so it may be present elsewhere in low pākihi and tussockland habitats.
Brachyglottis traversii	Distribution not well known, but occurs on the West Coast including Buller Plateaux and Paparoa Range.	Both unpublished and public records from across the Buller Plateaux.	Recorded from low vegetation communities including tussockland, pākihi and sandstone pavement. Present in ESE and UWHR Project sub-areas. Expected to be present elsewhere in the Project Area.
Coal measures tussock (*Chionochloa juncea*)	Occurs only on the Buller Plateaux where it is common in tussock grassland and low pākihi and shrubland habitats.	Abundant records on the Buller Plateaux from a range of sources (public, published, unpublished reports).	Known to be present in low vegetation types (pākihi, tussockland) across all Project sub-areas.
Dracophyllum densum	Occurs only in North-West Nelson in montane to subalpine areas, from near Karamea to Paparoa Range. Locally common where it occurs.	Abundant records on the Buller Plateaux from a range of sources (public, published, unpublished reports).	Present in low, open vegetation (pākihi, tussockland) and sandstone pavement habitats. Known to occur in ESE and MFS project sub-areas but may also occur in Stockton and UWHR.
Euphrasia wettsteiniana	Occurs on the west coast of the South Island, from about Karamea to Lake Brunner. An obligate wetland species occupying herbfield within wet tussockland, and along open channels and pans of cobbles.	Abundant records on the Buller Plateaux from a range of sources (public, published, unpublished reports).	Expected in tussock-flax shrubland and low pākihi vegetation near seepages, streams and tarns. Known to occur at ESE and likely to occur in suitable habitat at UWHR.
Red mistletoe (*Peraxilla tetrapetala*)	Distributed throughout New Zealand primarily in beech forest. Not an uncommon species, but is conservation-dependent.	Seven records from the Buller Plateaux with three known locations – two on the Denniston Plateaux and one in the upper Waimangaroa valley.	Recorded in the ESE Project sub-area and near the UWHR Project sub-area. May be present elsewhere in forest and tall shrubland vegetation groups.
Travers horopito (*Pseudowintera traversii*)	Found only in North-West Nelson and Buller in montane to subalpine forest margins. Buller Plateaux appears to be southern limit of this species distribution.	Both unpublished and public records from across the Buller Plateaux.	Known locations within ESE and MFS Project sub-areas. May be present in other Project sub-areas in suitable habitat – most likely higher altitude Southern rātā-mountain

Species	Distribution	Summary of records on Buller Plateaux	Likelihood of occurring within the Project Area
			beech-podocarp forest and silver beech-mountain beech forest.
Sticherus tener	The Buller Plateaux is one of only two locations where this species is found. The other is Five Fingers Peninsula, Resolution Island (Fiordland), where it is understood to be reasonably common.	Recorded at several sites across the Buller Plateaux in rocky overhangs near waterways, including within the ESE Project sub-area and north of Stockton (where it was planted).	Present within ESE and near Stockton Project sub-areas. Plants may exist elsewhere nearby, but are not expected within the UWHR Project sub-area.
Sticherus urceolatus	The Buller Plateaux is one of only two locations this species is found. The other is Tākaka, North-West Nelson.	Recorded at several sites across the Buller Plateaux in rocky overhangs near waterways, including near Escarpment Mine and north Stockton (where it was planted). Thought to be more abundant at Stockton than *S. tener*.	Present within ESE and near Stockton Project sub-areas. Plants may exist within these Project sub-areas, but are not expected within the UWHR Project sub-area.
Possibly Present			
Bulbinella modesta	Found only on the west coast of the South Island, typically at low elevation in wetland habitats (pākihi, alluvial forest, back swamps).	Two published records – Stockton and Blackburn Pākihi (1998), and open mānuka shrubland habitat near Mine Creek, Stockton (2021). Several records in Blackburn Pākihi in 2025/2026.	A number of plants recorded in the Mine Creek catchment in open habitats (Nichol 2021). Plants may be present in mānuka shrubland habitats within the Project Area, most likely at Stockton because of the lower elevation.
Caladenia alata	Usually coastal-lowland, rarely montane. Clay pans, skeletal soils, peat bog margins. Most plants recorded from Northland. Public records (iNaturalist) show South Island distribution only in Tasman. Biologically sparse.	One published record from Denniston (1998).	Habitat is present but this species typically occurs at lower altitude. Not expected to be present given the lack of records relative to the reasonably intensive survey effort across the Buller Plateaux.
Bearded orchid (*Calochilus paludosus*)	Usually montane-lowland. Northland, Coromandel, BOP, Waikato, NW Nelson, Buller. Known population in lowland areas near Westport. Clay, peat, pākihi habitats. Biologically sparse.	Two published records - Denniston Plateau (1980), Mt Frederick and Rome stream, Stockton (1998). Mānuka scrub previously burnt. Recent (2025) record from Blackburn Pākihi.	Habitat is present but this species typically occurs at lower altitude. Not expected to be present in the Project Area, especially given the lack of recent records relative to the reasonably intensive survey effort across the Buller Plateaux.
Carse's sedge (*Carex carsei*)	Found in the central North Island and throughout the South Island. Subalpine to alpine wetland habitats including bogs, mires	Known only from Cypress Mining Area in the Upper Waimangaroa valley. Occurs in red tussock fen.	May be present in red tussock fen in the UWHR project sub-area.

Species	Distribution	Summary of records on Buller Plateaux	Likelihood of occurring within the Project Area
	and wet forest clearings.		
Dall's sedge (*Carex dallii*)	Found in North-West Nelson, Westland and Otago in montane to subalpine areas. Preferred habitat is damp depressions, swamps and mires in forest and scrub.	Recorded from Denniston Plateau in tussockland and dense mānuka shrubland.	May be present in low pākihi and mānuka shrubland vegetation, most likely occurs in the ESE Project sub-area.
Euphrasia disperma	Disjunct distribution; Ruahine Range in the North Island, North-West Nelson and Westland in the South Island. Found in boggy and muddy habitat from sea level to 1,000m.	Few records from across the Buller Plateaux in cushion bogs, herbfield, and sedgeland habitats. Records include the Upper Waimangaroa Valley. Likely occurs with *E. wettsteiniana*.	May be present in tussock-flax shrubland and low pākihi vegetation groups near seepages, streams and tarns.
Hymenophyllum australe	Sporadic distribution throughout NZ, including North-West Nelson. Found along waterways mainly in shaded, persistently wet sites such as overhangs, gorges and waterfalls.	One record from Denniston (1972).	Unlikely to occur within the Project Area given the lack of recent records relative to survey effort. Although the cryptic nature and often inaccessible habitat mean this species could be overlooked.
Hymenophyllum pluviatile	Sporadic distribution mainly on the west coast of both islands. Favours wet, shaded forest where it is epiphytic, rupestral or terrestrial.	One record from Denniston (2012).	Unlikely to occur within the Project Area given the lack of recent records relative to survey effort.
Dwarf rush (*Juncus pusillus*)	Sporadic distribution throughout the South Island, also found south of the Bay of Plenty in the North Island. Habitat includes open swampy ground in coastal to alpine areas.	One record from Stockton in mānuka shrubland seepage (c. 1998).	Unlikely to occur within the Project Area given the lack of recent records relative to survey effort.
Long-leaved pimelea (*Pimelea longifolia*)	North Island south of Great Barrier Island and Auckland, and in the north-west of the South Island from Marlborough Sounds to Paparoa Ranges. Habitat includes open sites in forest, forest margins and scrub from coastal to montane elevations.	Unpublished records from the Denniston Plateau (1980), Mt William and Mt Frederick (1998) and several public records from the Buller Plateaux and the Waimangaroa Valley. Recorded in tussockland and shrubland habitats.	May be present in pākihi, tussockland and shrubland habitat throughout. One recent public record (2025) within the MFS Project sub-area.
Pterostylis humilis	West Coast of South Island, Central Plateau and Mt Taranaki. Montane to subalpine areas in beech forest and subalpine scrub.	One record from the Denniston Plateau (1980).	Unlikely to occur within the Project Area given the lack of recent records relative to survey effort.
Schizacme helmsii	Found only in North Westland, including the	Very few records from across the Buller	Unlikely to occur within the Project Area

Species	Distribution	Summary of records on Buller Plateaux	Likelihood of occurring within the Project Area
	Buller Plateaux and Paparoa Ranges. Found in wet tussock grassland and cushion bogs.	Plateaux (Denniston, Mt William, Mt Augustus), most recent in 2008. One record at Te Kuha in c. 2013.	given the lack of recent records relative to survey effort. However, this species is easily overlooked and may be present in low pākihi, red tussockland and sandstone pavement.
Townsonia deflexa	Found in the lower half of the North Island and throughout the South Island mainly in beech forest.	Three records across the Buller Plateaux - Mt William (2025) and Denniston Plateau (1980, 2010).	Unlikely to occur within the Project Area given the lack of recent records relative to survey effort. However, this species is easily overlooked and may be present in any of the forest vegetation groups.

3.7. 'Threatened' and 'At Risk' Fauna

The 'Threatened' and 'At Risk' fauna known to occur within the Buller Plateaux are discussed in Section 2.5 of Ecological Solutions Limited (2026a), provided as Appendix A. Seventeen species of fauna considered either 'Threatened' or 'At Risk' have been recorded from within the Project Area as shown in Table 3 including nine birds, three lizards, one species of land snail and four other terrestrial invertebrates.

Nine bird species considered to be 'Threatened' or 'At Risk' by Roberston et al. (2021) have been recorded in the Project Area including:

- Roroa/great spotted kiwi (*Apteryx maxima*) occupy all habitat types, though the most important habitats are on fertile and deep soils such as in the Waimangaroa Valley.
- Long-tailed cuckoo (*Eudynamys taitensis*) occupy forests where their host species (pīpīpi, brown creeper, *Mohoua novaeseelandiae*) are common.
- New Zealand bush falcon (*Falco novaeseelandiae ferox*) occupy large home ranges and are likely to occur anywhere across the plateaux.
- South Island robin (*Petroica australis*) and yellow-crowned kākāriki (*Cyanoramphus auriceps*) primarily occupy forested habitats in gullies and valley slopes.
- Kea (*Nestor notabilis*) are considered to be occasional visitors to the full range of habitat types.
- South Island fernbird (*Poodytes p. punctatus*) occupy dense shrubland and low growing vegetation types, including pākihi.
- New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*) occupy low and open habitats across the plateaux.
- Little shag (*Phalacrocorax sulcirostris*) occupy the water infrastructure (ponds, sumps, dams and the like) which provide the best habitats for shag species.

Three species of lizards have been recorded in the Project Area including, West Coast green gecko (*Naultinus tuberculatus*), forest gecko (*Mokopirirakau granulatus*) and Westland speckled skink (*Oligosoma* aff. *newmani* 'Westland').

Vegetation assemblages across the Ngakawau ED are expected to have high or very high values for invertebrates (Overmars et al. 1998, Ecological Solutions Limited 2026a). Large-bodied invertebrates of note in the Ngakawau ED include alpine grasshoppers (*Sigaus crassicauda*), tree wētā (*Hemideina* spp.), cave wētā (white faced wētā, *Occultastella morgani*) and vagrant spiders (*Uliodon* spp.). Alpine grasshoppers are abundant throughout tussocklands and low vegetation up to 900m above sea level (Kingett Mitchell 1996). Wellington tree wētā (*Hemideina crassidens*) and West Coast bush wētā (*H. broughi*) are present within dense beech – podocarp forests (Overmars et al. 1998).

Table 3: 'Threatened' and 'At Risk' fauna known to occur within the Project Area.

Conservation Status	Stockton	MFS	ESE	UWHR
Threatened – Nationally Critical				
Powelliphanta patrickensis	Not present	Present*	Present	Present
Avatar moth (*Arctesthes avatar*)	Possible	Possible	Present	Possible
Threatened – Nationally Vulnerable				
Roroa (*Apteryx maxima*)	Present	Present	Present	Present
Long-tailed cuckoo (*Eudynamys taitensis*)	Unlikely	Possible	Present	Likely
Kea (*Nestor notabilis)*	Visitor	Visitor	Visitor	Visitor
West Coast green gecko (*Naultinus tuberculatus*)	Likely	Likely	Present	Present
Newman's speckled skink (*Oligosoma newmani*)	Possible	Likely	Present	Likely
Threatened – Nationally Increasing				
New Zealand falcon (*Falco novaeseelandiae)*	Present	Likely	Present	Likely
At Risk – Declining				
South Island robin (*Petroica australis australis*)	Not present	Present	Present	Present
South Island fernbird (*Poodytes punctatus punctatus*)	Present	Present	Present	Present
New Zealand pipit (*Anthus novaeseelandiae)*	Present	Present	Present	Present
Yellow crowned kākāriki (*Cyanoramphus auriceps*)	Not present	Possible	Present	Likely
Forest gecko (*Mokopirirakau granulatus*)	Possible	Likely	Present	Present
At Risk – Naturally Uncommon				
Ichneutica blenheimensis (owlet moth)	Possible	Possible	Present	Possible
Huttonia spp[10].	Likely	Present	Likely	Likely
At Risk – Relict				
Little black shag (*Phalacrocorax sulcirostris*)	Unlikely	Unlikely	Present	Possible
Forest ringlet butterfly (*Dodonidia helmsii*)	Unlikely	Possible	Possible	Possible

*'Present' refers to species with at least one confirmed location record within the Project sub-area. 'Unlikely', 'Likely' and 'Possible' refers to species that do not have a location record within the Project sub-area, but may be present there ('likely' and 'possible') because there is suitable habitat, or are 'unlikely' to be present, because of a lack of suitable habitat. 'Not present' refers to species for which there are no confirmed location records and no suitable habitat within the Project sub-area. 'Visitor' refers to species that are occasionally recorded in habitats present within the Project sub-area, but are not known to be resident.

[10] A spider in the genus *Huttonia* was collected in the MFS Project sub-area. This specimen could not be determined to species, but the genus *Huttonia* includes one 'At Risk' species and several undescribed species. We have assumed here (conservatively) that the individual collected is a member of the 'At Risk' species.

4.0 Terrestrial Vegetation

4.1. Vegetation within the Mapped Area

As set out in Appendix B, Ecological Solutions Limited (2026b) used plot-based surveys combined with multivariate statistics and high-resolution aerial photography captured by drones to identify 13 terrestrial vegetation types and three other land cover types within the Mapped Area as shown in Figure 3.

The vegetation types included:

Three forest types:

- **Mixed beech-podocarp-broadleaf forest**. Characterised by tall (mean height 12.4m; range 3.4–30m), dense, old growth forest.
- **Southern rātā-mountain beech-podocarp forest**. Medium height forest (average height 7.5m; range 3.0–11.2m) commonly associated with gullies dissecting the plateaux.
- **Silver beech-mountain beech forest**. Medium height forest (5.4m; range 4.1 – 6.8 m), found at high elevation sites such as the upper slopes of Mt Frederick and Mt William and in gullies across the Denniston and southern Stockton Plateaux.

Six shrubland types:

- **Mānuka-mountain beech-podocarp shrubland**. A medium stature (mean height 3.9m; range 2.2–6.0m) shrubland with a sparse upper canopy (mean cover score of 5.8%).
- **Mānuka/Gahnia-wire rush shrubland**. A medium stature (mean height 2.8m; range 2.25–4m) shrubland with a moderately dense mānuka canopy, and a ground cover layer dominated by wire rush (*Empodisma minus*) and *Gahnia procera*.
- **Weedy shrubland**. A mixed species shrubland including seven exotic species. Medium stature (mean height 2.01m; range 0.65–4.0m).
- **Mānuka-tussock-wire rush shrubland**. A low to moderate stature (mean height 0.83m; range 0.10–4.0m) shrubland dominated by mānuka. Widespread across the Buller Plateaux and representative of West Coast pākihi and coal measures vegetation.
- **Mānuka-flax/wire rush shrubland**. Similar in structure to Mānuka-tussock-wire rush shrubland, but with mountain flax as a conspicuous sub-dominant species.
- **Leatherwood shrubland**. Visually distinctive low stature (mean height 1m; range 0.8m to 1.2m) shrubland, dominated by leatherwood (*Macrolearia colensoi, Brachyglottis buchananii*) occurring at high elevation.

Four low vegetation types:

- **Low pākihi**. A stunted, pākihi-type vegetation (mean height 0.30m; range 0.07–1.0m) that was typically found on flat areas amongst sandstone erosion pavement.
- **Weedy low pākihi**. Similar to low pākihi, being low stature pākihi vegetation (mean height 0.50m; range 0.09–0.78m) but including exotic heath rush (*Juncus squarrosus*) as a dominant species.
- **Exotic grassland**. Very low stature (mean height 0.31m; range 0.18–0.45m) and dominated by heath rush, along with exotic grasses such as browntop (*Agrostis capillaris*) and Yorkshire fog (*Holcus lanatus*).

- **Tussock-flax shrubland**. Low stature vegetation (mean height 0.93m; range 0.48–1.7m), dominated by tussock species (red tussock, *Chionochloa rubra*; and/or snow tussock*, C. flavescens*) along with mountain flax and wire rush.

As well as non-vegetated landcover types:

- **Bare rock**. Present as sandstone pavement, talus, boulders or any other exposed natural rock.
- **Cleared vegetation**. Cleared vegetation was typically present as roads, tracks or any other areas where vegetation had been cleared.
- **Water**. Water was often associated with historic mining infrastructure (ponds and the like).

Each of the vegetation and landcover types identified is described in more detail in Section 4.1.2 of Ecological Solutions Limited (2026b, provided as Appendix B). The extent of each of these vegetation types within the Mapped Area and Project sub-area Disturbance Areas is set out in Table 4 and Table 5 respectively.

Vegetation with common exotic species present (i.e., weedy shrubland, weedy low pākihi and exotic grassland) made up approximately 1.76% (177.7ha) of the Mapped Area. Non-vegetated land cover made up c. 12.6% of the Mapped Area, including 8.7% bare rock (885ha), 3.5% cleared vegetation (358.8ha) and 0.3% water (31.4ha).

4.2. Vegetation within the Disturbance Areas

The extent of each vegetation type within the Disturbance Areas and the Indirect Effects Contingency areas for the Stockton, MFS, ESE and UWHR Project sub-areas are summarised in Table 5. The location and distribution of vegetation and landcover types within each Project sub-area is shown in Figure 4 to Figure 7.

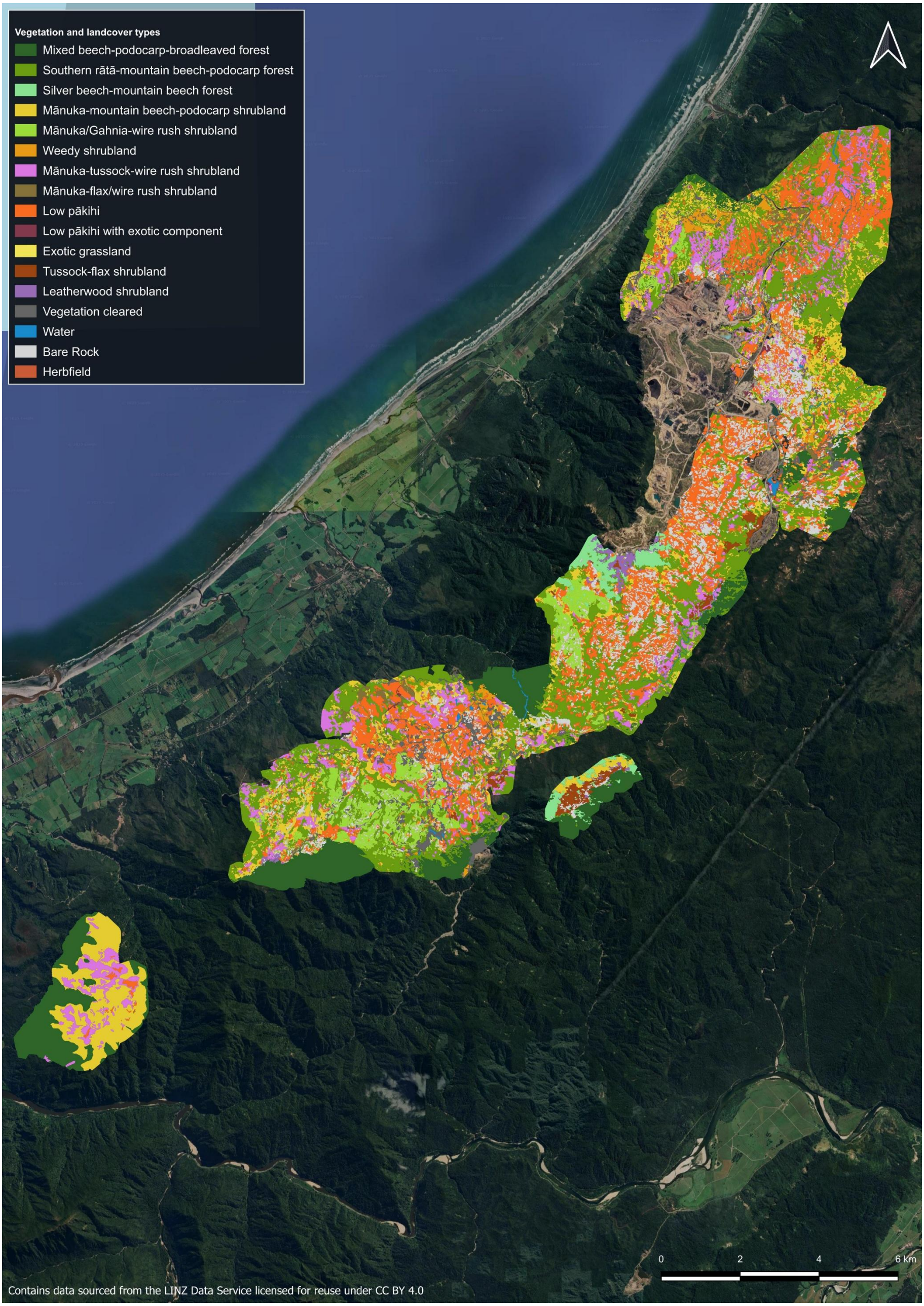


Figure 3: Distribution of vegetation and land cover types within the Mapped Area.

Table 4: Extent of vegetation and land cover types within the Mapped Area, Buller Plateaux and Stockton and Denniston Plateaux.

Vegetation Type	Extent within mapped area (ha)	Percentage of mapped area (%)	Extent (ha) and percentage of the Denniston Plateau (1,734ha)*	Extent (ha) and percentage of the Stockton Plateau (2,170ha)*	Extent (ha) and percentage of the Buller Plateaux (3,904ha)*
Forest					
Mixed beech-podocarp-broadleaved forest	1,107.3	10.9	9.1 (0.5%)	25.6 (1.2%)	34.7 (0.9%)
Southern rātā-mountain beech-podocarp forest	2,485.6	24.5	346.5 (20%)	429.7 (19.8%)	776.1 (19.9%)
Silver beech-mountain beech forest	163.0	1.6	0.0 (0.0%)	2.7 (0.1%)	2.7 (0.07%)
Shrubland					
Mānuka-mountain beech-podocarp shrubland	1,467.8	14.5	161.4 (9.3%)	229.7 (10.6%)	391.1 (10%)
Mānuka/Gahnia-wire rush shrubland	145.1	1.4	22.2 (1.3%)	6.6 (0.3%)	28.9 (0.7%)
Weedy shrubland	163.7	1.6	71.1 (4.1%)	20.7 (1%)	91.8 (2,4%)
Mānuka-tussock-wire rush shrubland	943.0	9.3	250.5 (14.4%)	134.0 (6.2%)	384.6 (9.8%)
Mānuka-mountain flax/wire rush shrubland	120.0	1.2	23.2 (1.3%)	5.6 (0.3%)	28.8 (0.7%)
Leatherwood shrubland	50.1	0.5	0.0 (0.0%)	0.4 (0.02%)	0.4 (0.001%)
Low vegetation					
Low pākihi	2,083.3	20.6	514.0 (29.6%)	712.8 (32.8%)	1,226.8 (32.4%)
Weedy low pākihi	11.5	0.1	2.3 (0.1%)	8.0 (0.4%)	10.3 (0.3%)
Tussock-mountain flax shrubland	110.9	1.1	14.3 (0.8%)	41.5 (1.9%)	55.8 (1.4%)
Exotic grassland	2.5	0.024	1.17 (0.07%)	1.3 (0.06%)	2.5 (0.06%)
Non-vegetated land cover					
Bare Rock	885.0	8.7	145.9 (8.4%)	482.7 (22.2%)	628.9 (16.1%)
Vegetation cleared	358.8	3.5	167.5 (9.7%)	55.8 (2.6%)	223.2 (5.7%)
Water	31.4	0.3	5.5 (0.3%)	13.2 (0.6%)	18.6 (0.5%)
Total	**10,129**	100	1,734.5	2,170.2	3,904.7

*The total extent of the Buller Plateaux (c. 3,905ha) in this table does not equal the total area of the Denniston and Stockton Plateaux identified by Mabin (2012) and Templeton and McMorran (2020) (c. 4,661ha) because the Mapped Area excludes Stockton Mine and Cypress mining area.

Table 5: Extent of vegetation and landcover types within the Project sub-areas including Proposed Disturbance Area[11] and Indirect Effects Contingency areas.

	Stockton			Mount Frederick South			Escarpment Extended			Upper Waimangaroa Haul Road			Total Disturbance (ha)	Total Indirect Effects Contingency (ha)	Total* as a percentage of the vegetation type within the Mapped Area
	Disturbance area	Indirect Effects Contingency	Total	Disturbance area	Indirect Effects Contingency	Total	Disturbance area	Indirect Effects Contingency	Total	Disturbance area	Indirect Effects Contingency	Total			
Forest															
Mixed beech-podocarp-broadleaved forest	0	0	0	0	0	0	0.4	1.0	1.4	5.1	8.1	13.1	**5.5**	**9.1**	**1.3**
Southern rātā-mountain beech-podocarp forest	10.3	7.1	17.3	25.5	8.8	34.3	128.8	15.6	144.4	12.6	18.0	30.5	**177.1**	**49.4**	**9.1**
Silver beech-mountain beech forest	0	0	0	5.5	0.5	6.0	0	0	0	0	0.0	0.0	**5.5**	**0.5**	**3.7**
Shrubland															
Mānuka-mountain beech-podocarp shrubland	7.8	2.6	10.4	34.0	3.9	37.9	39.5	3.4	42.9	3.4	3.5	6.9	**84.7**	**13.4**	**6.7**
Mānuka/Gahnia-wire rush shrubland	0.5	0.4	0.9	0	0	0	8.7	0.7	9.4	0	0.0	0.0	**9.2**	**1.1**	**7.1**
Weedy shrubland	1.1	0.1	1.2	0	0	0	10.5	1.5	12.0	1.0	0.5	1.5	**12.5**	**2.1**	**8.9**
Mānuka-tussock-wire rush shrubland	6.0	3.8	9.7	3.2	0.5	3.7	88.3	3.3	91.6	6.7	5.4	12.1	**104.2**	**12.9**	**12.4**
Mānuka-mountain flax/wire rush shrubland	0.2	0.1	0.3	2.0	0.1	2.0	1.5	0	1.6	0	0.0	0.0	**3.7**	**0.3**	**3.3**
Low vegetation															
Low pākihi	2.4	1.9	4.3	83.4	6.1	89.5	122.1	10.6	132.7	5.9	4.6	10.6	**213.9**	**23.1**	**11.4**
Tussock-mountain flax shrubland	0	0.0	0.0	0.9	0.0	0.9	0.2	0.2	0.4	0.5	0.6	1.1	**1.7**	**0.8**	**2.2**
Exotic grassland	0	0	0	0	0	0	0.8	0.1	0.9	0	0	0	**0.8**	**0.1**	**36.7**
Non-vegetated land cover															
Bare Rock	2.1	0.5	2.6	19.3	1.8	21.1	41.8	3.4	45.2	0.4	0.7	1.1	**63.6**	**6.3**	**7.9**
Cleared vegetation	1.1	4.6	5.7	1.6	0	1.6	58.0	2.9	60.9	9.2	1.3	10.5	**69.8**	**8.8**	**21.9**
Water	0	0	0	0	0	0	2.1	0.1	2.2	0.0	0.2	0.2	**2.1**	**0.2**	**7.4**
Total	**31.3**	**21.1**	**52.4**	**175.4**	**21.6**	**197.0**	**502.8**	**42.6**	**545.4**	**44.8**	**42.8**	**87.6**	**754.2**	**128.2**	

*Total Includes both disturbance and Indirect Effects Contingency areas affected by edge effects.

[11] Based on shapefiles released by Bathurst 15 October 2025 (Disturbance version 14).



Figure 4: Vegetation and landcover types within the Stockton Disturbance Area and Indirect Effects Contingency area.

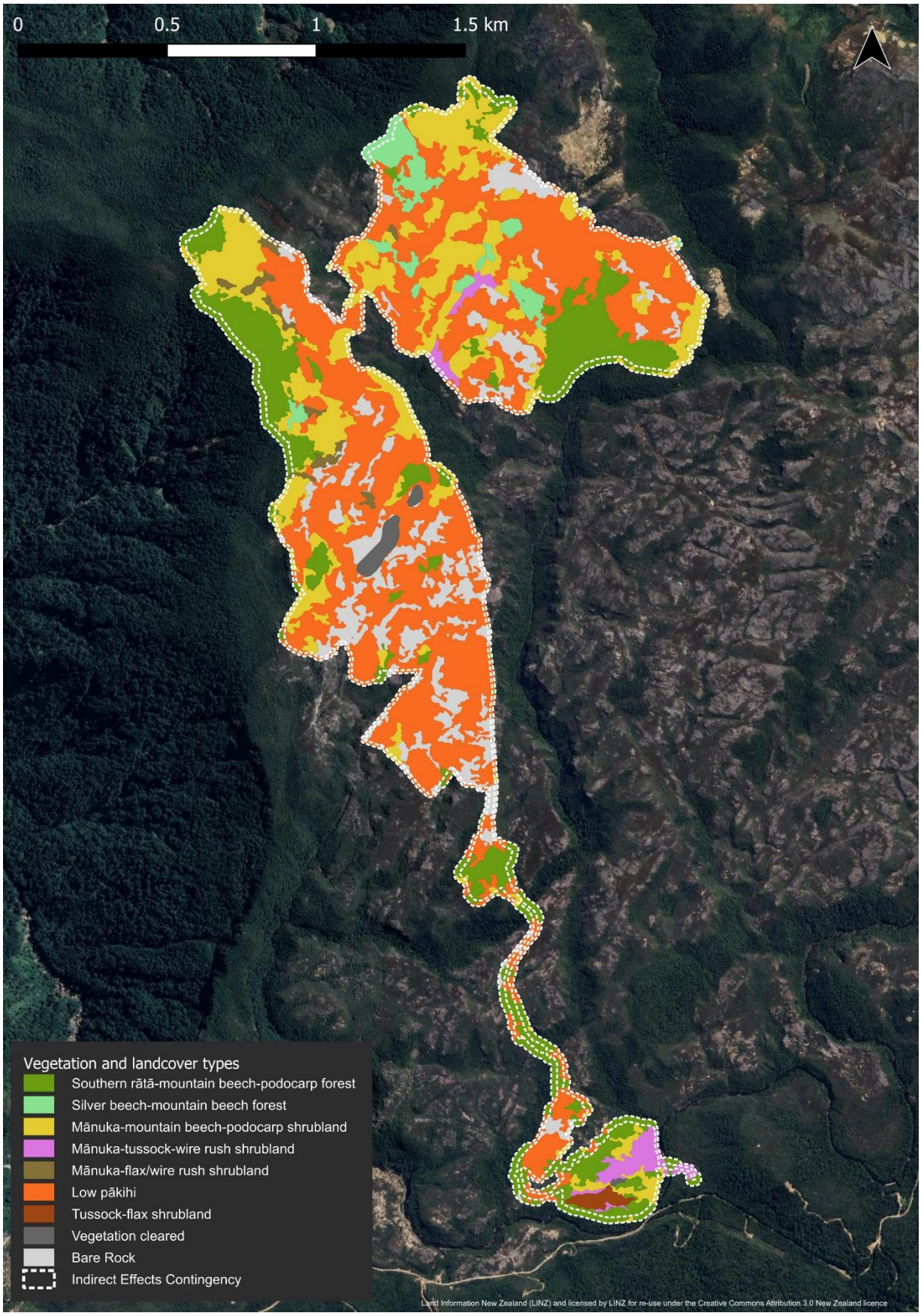


Figure 5: Vegetation and landcover types within the MFS Disturbance Area and Indirect Effects Contingency area.

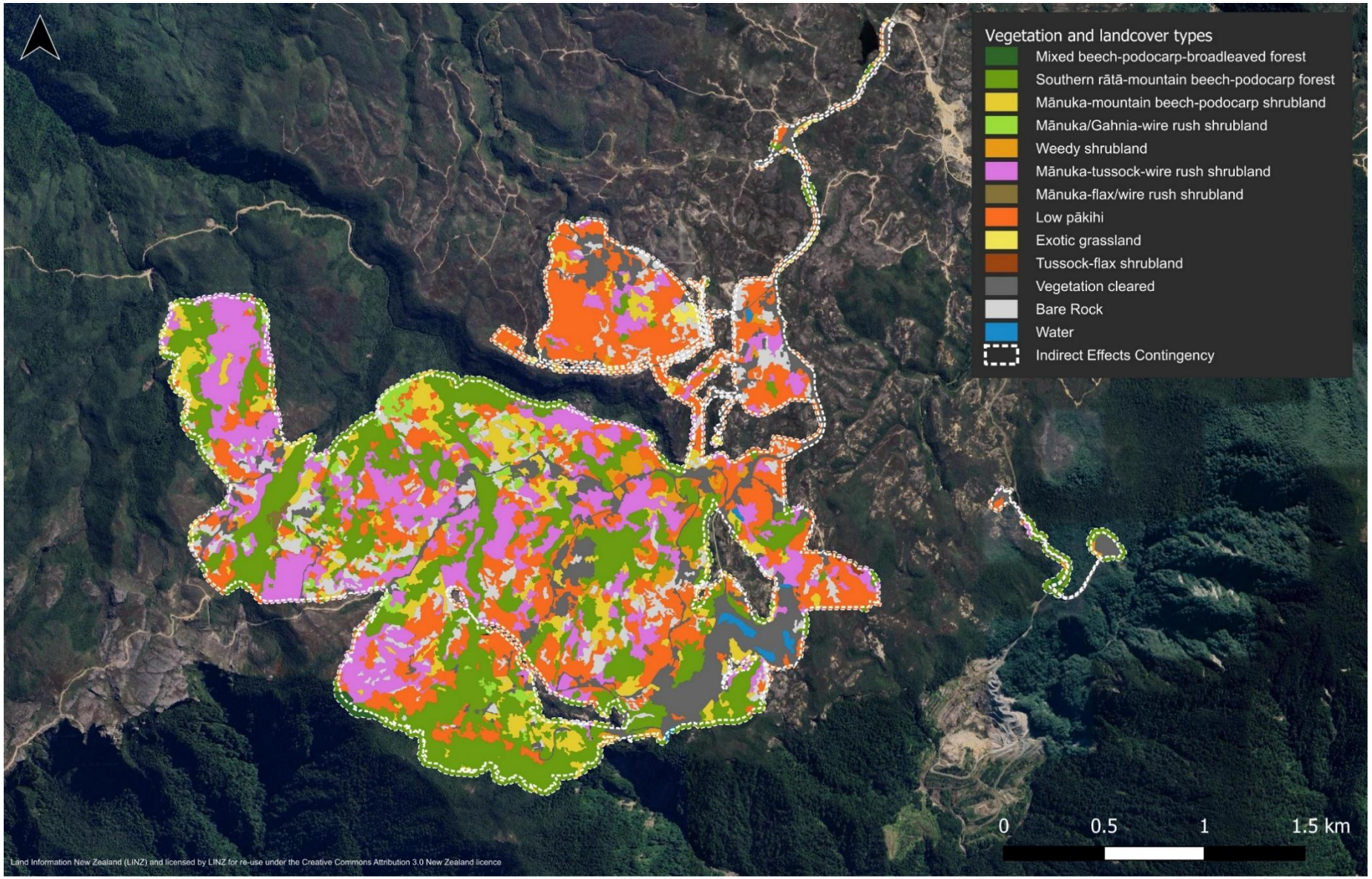


Figure 6: Vegetation and landcover types within the ESE Disturbance Area and Indirect Effects Contingency area.

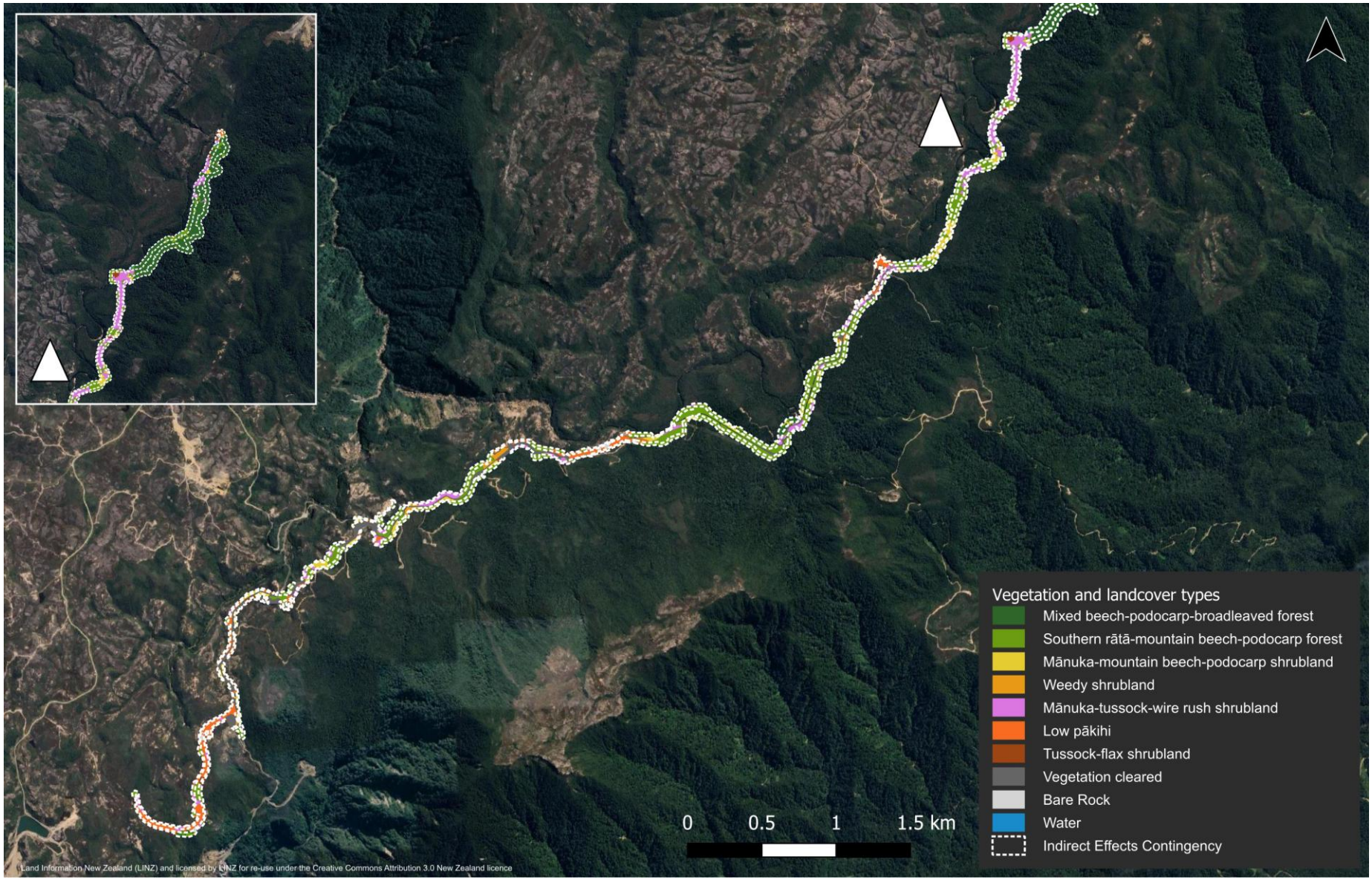


Figure 7: Vegetation and landcover types within the UWHR Disturbance Area and Indirect Effects Contingency area.

4.3. Wetlands

Ecological Solutions Limited (2026b, provided as Appendix B) considered that seven of the 13 vegetation types identified and mapped above met the definition of natural inland wetlands set out in the National Policy Statement for Freshwater Management (2020) including:

- Low pākihi;
- Mānuka-tussock-wire rush shrubland;
- Mānuka-mountain beech-podocarp shrubland;
- Mānuka/Gahnia-wire rush shrubland;
- Mānuka-mountain flax/wire rush shrubland;
- Weedy low pākihi; and
- At least one of the three tussock-flax shrubland sub-types also meets the definition. Ecological Solutions Limited have assumed, conservatively, that all the tussock-flax shrubland areas are wetlands.

Together these areas occupy c. 468.9ha (55.3%) of the BPCP Disturbance Areas. Table 6 sets out the extent of wetland types within each Project sub-area Disturbance Area, as well as the Indirect Effects Contingency area for each Project sub-area. The location and distribution of wetlands within the BPCP Disturbance Areas (and Indirect Effects Contingency areas) are shown in Figure 8.

Table 6: Extent of natural inland wetlands within Project sub-area Disturbance Areas (including Indirect Effects Contingency areas).[12]

Wetland Type	Stockton (ha)		MFS (ha)		ESE (ha)		UWHR (ha)		Total	
	DA	ES	DA	ES	DA	ES	DA	ES	DA	ES
Shrubland										
Mānuka-mountain beech-podocarp shrubland	7.8	2.6	34.0	3.9	39.5	3.4	3.4	3.5	**84.7**	**13.4**
Mānuka/Gahnia-wire rush shrubland	0.5	0.4	0.0	0.0	8.7	0.7	0.0	0.0	**9.2**	**1.1**
Mānuka-tussock-wire rush shrubland	6.0	3.8	3.2	0.5	88.3	3.3	6.7	5.4	**104.2**	**12.9**
Mānuka-mountain flax/wire rush shrubland	0.2	0.1	2.0	0.1	1.5	0.0	0.0	0.0	**3.7**	**0.3**
Low vegetation										
Low pākihi	2.4	1.9	83.4	6.1	122.1	10.6	5.9	4.6	**213.9**	**23.1**
Tussock-mountain flax shrubland	0.0	0.0	0.9	0.0	0.2	0.2	0.5	0.6	**1.7**	**0.8**
Total	**16.8**	**8.8**	**123.5**	**10.6**	**260.5**	**18.1**	**16.5**	**14.1**	**417.3**	**51.6**

[12] Based on Shapefiles released 15 October 2025 (Disturbance version 14).

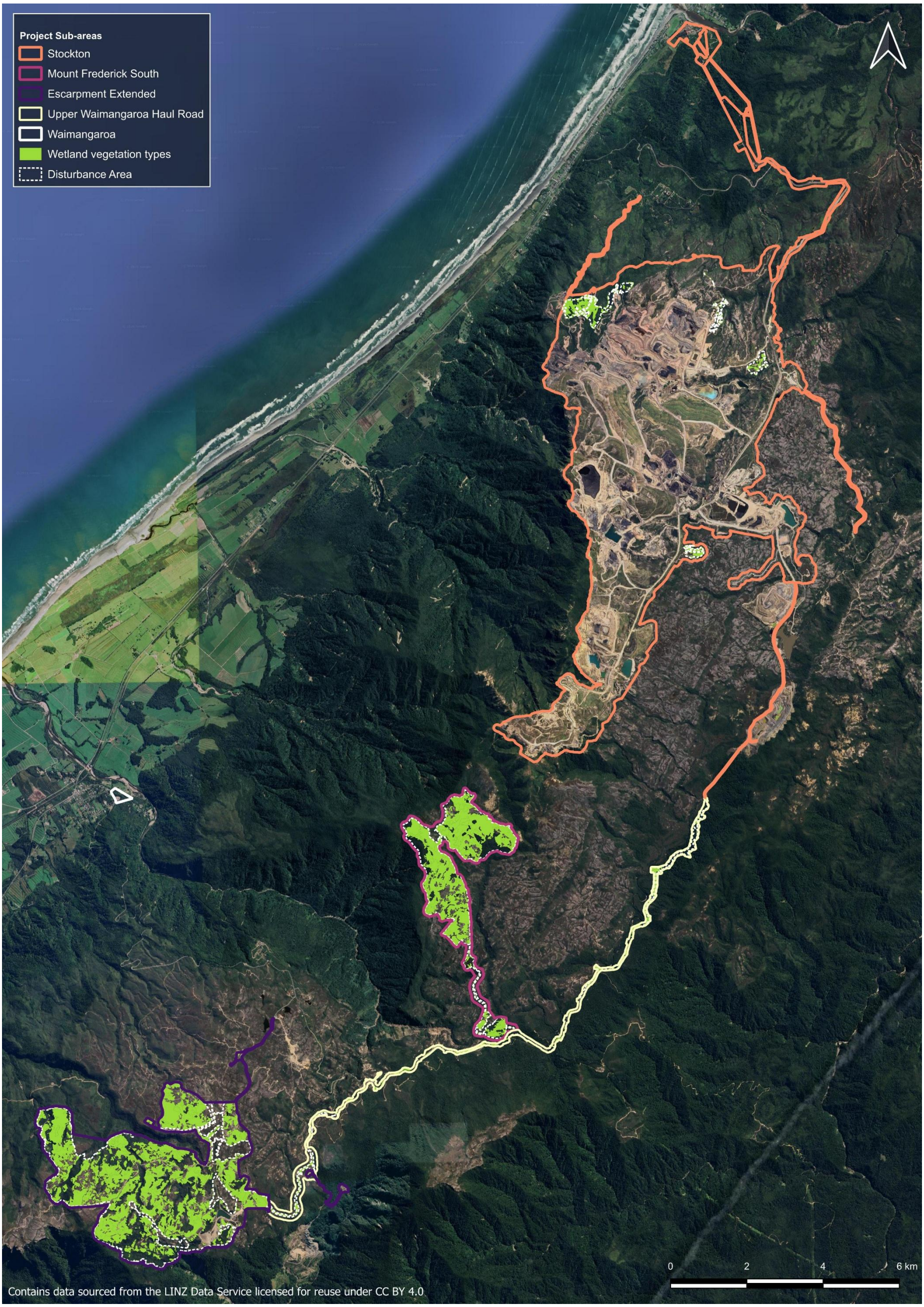


Figure 8: Natural Inland Wetlands within the Disturbance Area and Indirect Effects Contingency area.[13]

[13] Note image shown is based on GIS Shapefiles released 15 December 2025 (Disturbance v14).

5.0 Bryophytes and Lichens

5.1. Background

Bryophytes and lichens are considered in more detail in Ecological Solutions Limited 2026a), provided as Appendix A. The Buller Plateaux supports a high diversity of bryophytes, including at least 51 species regarded as 'Threatened' or 'At Risk' by de Lange et al. (2020) and Michel et al. (2026), as well as several liverwort genera endemic to New Zealand, such as *Herzogianthus*, *Lembidium*, *Megalembidium* and *Pseudolophocolea*.

The vegetation communities known to provide important habitat for bryophytes are widespread throughout the Ngakawau ED, but bryophyte surveys have generally been restricted to areas proposed for development. For that reason, the specific distribution of bryophytes in the Ngakawau ED remains poorly understood. Bryophytes often occupy localised, rare or sparse microhabitats, providing only narrow opportunities for occupancy. The rarity of these habitats can contribute to the perceived scarcity of bryophytes, especially if the species are naturally uncommon or have disjunct distributions as many of them do.

At least 98 species of lichen are known from the Buller Plateaux, including four considered 'Threatened' (one 'Nationally Endangered' and three 'Nationally Vulnerable'), eight 'At Risk' (one 'Declining' and seven 'Naturally Uncommon', and 14 'Data Deficient' (de Lange et al. 2018). The 'Threatened' and 'At Risk' lichens are predominantly found growing on open sandstone pavement, and within low pākihi. Some species considered 'At Risk' such as *Cladia inflata* are colonisers of subalpine grassland habitat.

The data gathered to date with respect to bryophytes and lichens is sufficient to assign ecological value, assess effects and provide for implementation of the effects management hierarchy, particularly with respect to methods to achieve the best outcomes for bryophyte rehabilitation. With respect to rehabilitation, more detail is provided in Ecological Solutions Limited (2026h), provided as Appendix H.

5.2. 'Threatened' and 'At Risk' Species

Forty species of bryophytes and 11 lichens considered 'Threatened' and 'At Risk' by de Lange et al. (2018, 2020) and Michel et al. (2026) are, or may be, present within the Project Area as shown in Table 7. This includes:

- Four considered 'Threatened – Nationally Critical'.
- One considered 'Threatened – Nationally Endangered'.
- Five considered 'Threatened – Nationally Vulnerable'.
- Three considered 'At Risk – Declining.
- 38 considered 'At Risk – Naturally Uncommon'.

A further five bryophytes present within the Project Area footprint are considered 'Data deficient' (i.e., not enough is known to assign a threat ranking) (de Lange et al. 2020).

In addition, two liverwort species are new records for these species within New Zealand. These two species have not yet been included in a threat status assessment.

Important vegetation and habitat types where bryophytes of conservation concern are most frequently recorded include:

- Southern rātā-mountain beech-podocarp forest.
- Mixed beech-podocarp-broadleaved forest.
- Silver beech-mountain beech forest.

- Mānuka-tussock-wire rush shrubland.
- Low pākihi.
- Mānuka-mountain beech-podocarp shrubland.
- Tussock-flax shrubland [includes red tussock grassland].
- Mānuka/Gahnia-wire rush shrubland.
- Sandstone erosion pavement and quartzite sands.
- Riparian and vertical wet walls.

Important vegetation and habitat types where lichens of conservation concern are most frequently recorded include sandstone erosion pavement and quartzite sands ('bare rock') and ecotones between those areas and mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, low pākihi and Southern rātā-mountain beech-podocarp forest.

Of the 430 known locations of 'Threatened' and 'At Risk' bryophytes and lichens within and surrounding the Project Area, approximately 67% are outside the Project Area and will be retained if the Project proceeds, whilst 33% will be removed by the Project as outlined in Table 7. Note that, as with any ecological survey, the number and location of existing records is heavily influenced by survey effort and the location of previous surveys in relation to previous development proposals. Many previous surveys at Stockton have included varying degrees of broader contextual surveys in order to determine whether the species of interest within a proposed development were also present elsewhere. In most cases they were.

ESE has the highest number of 'Threatened' and 'At Risk' species (25 species), followed by Stockton (21 species), UWHR (11 species), and MFS (six records) as shown in Table 7, although the higher numbers at ESE likely reflects the higher survey effort there.

Nine species were recorded more often within the Project Area than outside it, and are therefore considered more directly affected by the Project. These include:

- Three lichens: *Austropeltum glareosum*, *Knightia splachnirima* (both regarded as 'Threatened – Nationally Vulnerable') and *Calycidium cuneatum* ('At Risk – Naturally Uncommon').
- One moss: *Pyrrhobryum paramattense* ('At Risk – Naturally Uncommon').
- Five liverworts: *Kurzia nivicola*, *Riccardia furtiva* and *Zoopsis ceratophylla* (all 'At Risk – Naturally Uncommon'), as well as *Chiloscyphus gippslandicus* and *Porella cranfordii*, both Australian species which have not been recorded in New Zealand before.

Seventeen species recorded outside, but unconfirmed inside, the Project Area are considered likely to be present in one or more of the Project sub-areas based on the presence of suitable habitat and location records near the project boundary including:

- Two 'Threatened – Nationally Critical' species (*Allisoniella scottii, Pseudolophocolea denticulata*).
- One 'Threatened – Nationally Vulnerable' species (*Cladia fuliginosa*).
- 14 'At Risk – Naturally Uncommon' species (*Andreaea acuminata, Andrewsianthus perigonialis, Archeophylla schusteri, Bazzania exempta, Degeliella rosulata, Ditrichum strictum, Leiorreuma exaltatum, Lepidozia fugax, Micarea isabellina, Ochrolechia frigida, Pseudocyphellaria lindsayi, Riccardia multicorpora, Schistochila pluriciliata* and *Tayloria callophylla*).

Table 7: 'Threatened' and 'At Risk' bryophytes and lichens present or likely to be present within the Project Area.

Conservation Status	Known locations	Outside Project Area	Inside Project Area	Stockton	MFS	ESE	UWHR
Confirmed Present							
Threatened – Nationally Critical							
Isolembidium anomalum var. *anomalum*	Four locations from Denniston Plateau. Two locations from Stockton Plateau. Two locations in the vicinity of St Patrick Stream. One location from Mangatini Stream	5 records	4 records	Possible	Possible	Present	Likely
Neogrollea notabilis	Seven locations from Denniston Plateau. Two locations from Stockton Plateau (includes one location in VDT). Three locations from Mt William Range One location from Blackburn Stream. One location from Orikaka Pākihi. One location from Ngakawau River.	9 records	6 records	Present (1 record from VDT)	Likely	Present	Likely
Threatened – Nationally Endangered							
Pycnothelia caliginosa	Eight locations from Denniston Plateau. One record from Stockton Plateau.	5 records	4 records	Possible	Possible	Present	Possible
Threatened – Nationally Vulnerable							
Acromastigum verticale	Six locations from Stockton Plateau. Five locations from Denniston Plateau. Two locations from Te Kuha. Two locations from Mangatini Stream. Two locations from A.J Stream. One location from Blackburn Stream. One location from Mt William Range.	15 records	4 records	Present	Present	Present	Likely
Austropeltum glareosum	12 locations from Denniston Plateau. Two locations from Mt William Range Two locations from Stockton Plateau. One location from Te Kuha.	8 records	9 records	Likely	Present	Present	Likely
Knightiella splachnirima	Four locations from Denniston Plateau. Two locations from Stockton Plateau.	2 records	4 records	Present	Possible	Present	Possible
Telaranea inaequalis	Seven locations from Denniston Plateau. 11 locations from Stockton Plateau.	19 records	12 records	Present	Present	Present	Possible

Conservation Status	Known locations	Outside Project Area	Inside Project Area	Stockton	MFS	ESE	UWHR
	Three locations from Mangatini Stream. Two locations from A.J Stream. Two locations from Mt William Range. Two locations from Blackburn Stream. Two locations in the vicinity of St Patrick Stream. One location from Darcy Stream. One location from Erin Stream.						
At Risk – Declining							
Acromastigum interstisiale	Three locations from Stockton Plateau. Three locations from Mangatini Stream. One location from Denniston Plateau. One location from Mt William Range	5 records	3 records	Present	Possible	Possible	Present
Cladia inflata	Nine locations from Stockton Plateau (all locations in VDT). Two locations from Denniston Plateau.	2 records	9 records	Present (9 records from VDT)	Possible	Possible	Possible
Saccogynidium decurvum	Seven locations from Te Kuha. Four locations from Denniston Plateau. Four locations from Stockton Plateau (includes one record from VDT).	9 records	6 records	Present (1 record from VDT and 1 record from Stockton)	Possible	Present	Possible
At Risk – Naturally Uncommon							
Acromastigum mooreanum	Six locations from Stockton Plateau (includes one record from VDT). Four locations from Mangatini Stream. One location from Mt William Range. One location from Denniston Plateau.	6 records	6 records	Present (1 record from VDT)	Present	Present	Possible
Andreaea subulata	Five locations from Denniston Plateau. One location from Mangatini Stream. One record from Mōkihinui Forest.	4 records	3 records	Possible	Possible	Present	Possible
Blindia immersa	Six locations from Stockton Plateau. One location Denniston Plateau.	3 records	4 records	Possible	Possible	Present	Present
Calycidium cuneatum	One location Denniston Plateau.	-	1 record	Possible	Possible	Present	Possible
Campylopus kirkii	Four locations from the Stockton Plateau. One location Denniston Plateau.	4 records	1 record	Present	Possible	Possible	Present

Conservation Status	Known locations	Outside Project Area	Inside Project Area	Stockton	MFS	ESE	UWHR
Cryptolophocolea tuberculata	Three locations from the Stockton Plateau (includes one location from a rehabilitated site). One location from Mt William Range	3 records	1 record	Present (1 record from a rehabilitated site)	Possible	Possible	Possible
Dicnemon dixonianum	One location from the Stockton Plateau. One record from the Denniston Plateau.	1 record	1 record	Possible	Possible	Present	Possible
Herzogianthus sanguineus	Two locations from the Denniston Plateau. Two locations from Te Kuha.	2 records	2 records	Possible	Possible	Present	Possible
Herzogianthus vaginatus	Three records from the Denniston Plateau. One record from Stockton Plateau.	2 records	2 records	Likely	Likely	Present	Possible
Heteroscyphus billardierei	Six records from Stockton Plateau. Two records from Mt William Range. Recorded from the Denniston Plateau Glenny (2012).	7 records	1 record	Present	Possible	Likely	Present
Isotachis westlandica	Eight records from Stockton Plateau. Two records from Charming Creek. One record from Mangatini Stream. One record from Mt William Range. One record from Denniston Plateau.	9 records	4 records	Present	Possible	Present	Possible
Kurzia tenax	Three records from Denniston Plateau. One record from Mt William Range.	2 records	2 records	Possible	Possible	Present	Possible
Kurzia nivicola	One record from Stockton Plateau.	-	1 record	Present	Possible	Possible	Possible
Lembidium longifolium	Four records from Stockton Plateau. Two records from Denniston Plateau.	3 records	3 records	Present	Possible	Present	Present
Lepidolaena novae-zelandiae	10 records from Te Kuha. Eight records from Denniston Plateau. Seven records from Stockton Plateau. One record from Mt William Range.	19 records	7 records	Present	Likely	Present	Present
Pachyschistochila virescens	Three records from Stockton Plateau.	2 records	1 record	Present	Possible	Possible	Possible
Pallavicinia rubristipa	18 records from Stockton Plateau. Six records from Mangatini Stream. Six records from Denniston Plateau. Three records from Blackburn Pākihi.	38 records	3 records	Present	Likely	Present	Likely

Conservation Status	Known locations	Outside Project Area	Inside Project Area	Stockton	MFS	ESE	UWHR
	Three records from Erin Stream. Two records from Mōkihinui Forest. Two records from Mt William Range. One record from a tributary of Darcy Stream.						
Pleurophascum ovalifolium	22 records from Stockton Plateau (includes two records from VDT). 12 records from Denniston Plateau. Five records from Mt William Range. Three records from Te Kuha. Two records from Orikaka Pākihi. One record from Mt Glasgow.	33 records	12 records	Present (2 records from VDT)	Present	Present	Present
Pyrrhobryum paramattense	One record from Stockton Plateau.	-	1 record	Possible	Possible	Possible	Present
Riccardia furtiva	Seven records from Stockton Plateau Three records from Denniston Plateau. Two records from Te Kuha. One record from A.J Stream.	5 records	8 records	Present	Present	Present	Likely
Trichotemnoma corrugatum	Seven records from Stockton Plateau. Five records from Denniston Plateau. Five records from Te Kuha. Two records from Mangatini Stream. One record from Mt William Range.	12 records	8 records	Present	Likely	Present	Possible
Zoopsis bicruris	Five records from Denniston Plateau. Three records from Stockton Plateau. Two records from Te Kuha. One record from A.J Stream. One record from Mangatini Stream.	8 records	4 records	Present	Likely	Present	Present
Zoopsis ceratophylla	Two records from Denniston. One record from Stockton. One record from Te Kuha.	1 record	2 records	Possible	Possible	Present	Present
Zoopsis matawaia	Two records from Denniston. One record from Stockton. One record from Te Kuha.	3 records	1 record	Possible	Possible	Possible	Present
New Records							

Conservation Status	Known locations	Outside Project Area	Inside Project Area	Stockton	MFS	ESE	UWHR
Chiloscyphus gippslandicus	One record from Stockton Plateau.	-	1 record	Possible	Possible	Possible	Present
Porella cranfordii	One record from Stockton Plateau.	-	1 record	Possible	Possible	Possible	Present
Possibly Present							
Threatened – Nationally Critical							
Allisoniella scottii	Two locations from Denniston Plateau.	2 records	-	Possible	Possible	Possible	Possible
Pseudolophocolea denticulata	Three records from Te Kuha.	3 records	-	Possible	Possible	Possible	Possible
Threatened – Nationally Vulnerable							
Cladia fuliginosa	One location from Denniston Plateau. Numerous locations from Stockton Plateau reported by de Lange et al. (2018).	1 record	-	Likely	Possible	Possible	Possible
At Risk – Naturally Uncommon							
Andreaea acuminata	Four records Stockton Plateau. One location from Denniston Plateau.	5 records	-	Possible	Possible	Possible	Possible
Andrewsianthus perigonialis	Four locations from Stockton Plateau. One location from Denniston Plateau.	5 records	-	Possible	Possible	Possible	Possible
Archeophylla schusteri	Four locations from Stockton Plateau. One location from A.J Stream.	5 records	-	Possible	Possible	Possible	Possible
Bazzania exempta	Three locations from Stockton Plateau. One location from Weka Creek.	4 records	-	Possible	Possible	Possible	Possible
Degeliella rosulata	Recorded from the Denniston Plateau by Galloway (2007).	At least 1 record	-	Possible	Possible	Possible	Possible
Ditrichum strictum	One location from the Stockton Plateau.	1 record	-	Possible	Possible	Possible	Possible
Leiorreuma exaltatum	Recorded from the Denniston Plateau Glenny (2012).	At least 1 record	-	Possible	Possible	Possible	Possible
Lepidozia fugax	One record from the Denniston Plateau.	1 record	-	Possible	Possible	Possible	Possible
Micarea isabellina	Two records from Denniston Plateau. One record from Stockton. One record from Mt William Range. One record from Te Kuha.	5 records	-	Possible	Possible	Possible	Possible
Ochrolechia frigida	Recorded from the Denniston Plateau Glenny (2012).	At least 1 record	-	Possible	Possible	Possible	Possible
Pseudocyphellaria lindsayi	One record from Denniston Plateau.	1 record	-	Possible	Possible	Possible	Possible
Riccardia multicorpora	Three records from Te Kuha. Two records from Denniston Plateau.	5 records	-	Possible	Possible	Possible	Possible

Conservation Status	Known locations	Outside Project Area	Inside Project Area	Stockton	MFS	ESE	UWHR
Schistochila pluriciliata	One record from Denniston Plateau.	1 record	-	Possible	Possible	Possible	Possible
Tayloria callophylla	One record from Stockton Plateau	1 record	-	Possible	Possible	Possible	Possible
Number of records of 'Threatened' or 'At Risk' species	430 records	290 records	140 records				
Number of 'Threatened' or 'At Risk' species				21 species	6 species	25 species	11 species
Number of new records				1 species	1 species	1 species	2 species

*'Present' refers to species with at least one confirmed location record within the Project sub-area. 'Likely' and 'Possible' refers to species that do not have a location record within the Project sub-area, but may be present there because there is suitable habitat.

6.0 Terrestrial Fauna

6.1. Avifauna

6.1.1. Species present

Section 5.4.2 of Ecological Solutions Limited (2026a, provided as Appendix A) identified 39 species of birds, including 29 indigenous species and 10 introduced and naturalised species, recorded from throughout the Buller Plateaux. The abundance and distribution of birds varied considerably due to the variety of habitats present (e.g., subalpine forest and shrubland, pākihi, tussock land, lower altitude forest, wetlands, coal measures shrubland, and sandstone pavement) and the degree of previous and current human disturbance due to mining and other activities.

Species present within the Project Area include those adapted to forests, shrublands and open areas, although numbers on the Buller Plateaux are generally lower than in the surrounding habitats which are typically more fertile (Overmars et al. 1998).

As set out in Appendices C–F, the recent surveys undertaken within the Project sub-areas have been consistent with previous surveys and confirm a relatively high diversity and low-moderate abundance of birds within the Buller Plateaux generally, as well as confirming the presence of 'Threatened' and 'At Risk' species.

The number of birds recorded per count typically varies according to personnel (particularly in 5MBCs), location, habitat, year and season. Surveys from the MFS and UWHR Project sub-areas reflected low abundance, despite the good diversity, with less than one record (either seen or heard) for most species in five-minute bird counts. The low call counts observed in multiple surveys are likely a result of the characteristics of the area with high rainfall, cooler temperatures and poor-quality soils having relatively low productivity, but the high diversity of habitats and ecotones contributing directly to the observed species diversity.

Based on repeated annual call counts from the DBEA since 2011, the number of birds, at least in that area, appears to have been declining (as shown in Figures 12 and 13 of Ecological Solutions Limited 2026c, provided as Appendix C), except for weka (*Gallirallus australis australis*) with the number of weka calls during surveys almost doubling from 645 to 1,103 between 2013 and 2022 (Nichol 2022).

The relatively high diversity of birds present likely reflects the diversity of vegetation types on the Buller Plateaux and surrounding adjacent areas. Vegetation type (and associated habitat suitability) is likely the major driver of bird abundance, with different species having particular habitat preferences and therefore occupying different vegetation types to varying degrees. For example, pīhoihoi (New Zealand pipit) is more common in open habitats such as sandstone pavement and roads, whilst mātātā (fernbirds) are more common in pākihi vegetation. Forested habitats generally support both a greater abundance and diversity of birds than more open habitats such as sandstone erosion pavement. Forests provide habitat for common forest birds, as well as for birds of conservation concern. Nine of the bird species recorded within the Project Area are considered 'Threatened' or 'At Risk' (Robertson et al. 2021) as shown in Table 8.

Table 8: 'Threatened' and 'At Risk' bird species known to occur in the Project Area.

Common name	Scientific name	Conservation status	Habitat
Kea	*Nestor notabilis*	Threatened – Nationally Endangered	Occasional visitors to the plateaux, not resident to any habitat type.
Great spotted kiwi, roroa	*Apteryx maxima*	Threatened – Nationally Vulnerable	Large ranges may cover all habitat types. Most common in forest.
Long-tailed cuckoo	*Eudynamys taitensis*	Threatened – Nationally Vulnerable	Forest.
New Zealand bush falcon	*Falco novaeseelandiae ferox*	Threatened – Nationally Increasing	Large ranges may cover all habitat types.
New Zealand pipit	*Anthus n. novaeseelandiae*	At Risk – Declining	Low growing habitats, tussockland, open vegetation.
Yellow-crowned kākāriki	*Cyanoramphus auriceps*	At Risk – Declining	Forest.
South Island fernbird	*Poodytes p. punctatus*	At Risk – Declining	Shrubland and pākihi.
South Island robin	*Petroica australis*	At Risk – Declining	Forest.
Little black shag	*Phalacrocorax sulcirostris*	At Risk – Relict	Rivers, ponds and streams

Forests are patchily distributed throughout the Buller Plateaux, typically being restricted to gullies, and are more extensive in the immediate surrounds such as in the Waimangaroa Valley and slopes of Mt William. These habitats support common native forest birds such as korimako/bellbirds (*Anthornis melanura*), riroriro/grey warblers (*Gerygone igata*), silvereye (*Zosterops lateralis*), tūī (*Prosthemadera novaeseelandiae*), kererū (*Hemiphaga novaeseelandiae*) and miromiro/tomtits (*Petroica macrocephala*). Forests also support birds of conservation concern such as kakaruwai/South Island robin (*Petroica australis*) and roroa/great spotted kiwi (*Apteryx maxima*) with less common species such as yellow-crowned kākāriki (*Cyanoramphus auriceps*), kākā (*Nestor meridionalis meridionalis*) and koekoeā/long-tailed cuckoo (*Eudynamys taitensis*) being occasional or seasonal visitors (McLennan 2012).

Pākihi and other low growing shrubland provides habitat for mātātā/South Island fernbird (*Poodytes punctatus*) which are also locally common throughout parts of the Tiger Pākihi, Blackburn Pākihi, and at Te Kuha within the Ngakawau ED (R Buckingham pers. comm. 2013, G Bramley pers. obs. 2010, 2011). Fernbirds are also locally common at German

and Caledonian terraces (immediately outside the Ngakawau ED). Weka were widespread and may be adversely affecting other populations of other fauna such as *Powelliphanta* snails (Lloyd's Ecological Consulting 2026).

Little black shag (*Phalacrocorax sulcirostris*) are typically associated with major rivers and other waterways in the Ngakawau ED and other shag species, including black shag (*P. carbo*), pied shag (*P. varius*) and little shag (*Microcarbo melanoleucos*) are also likely to use river and stream habitats at least occasionally.

6.1.2. 'Threatened' and 'At Risk' Birds

The surveys undertaken to inform this project have generally confirmed previous findings. Information about the local roroa/great spotted kiwi population is provided in Section 2.5.1 of Ecological Solutions Limited (2026a) provided as Appendix A. Toy et al. (2021) defined the "core" of the Westport sub-population as areas where call counts exceeded one per hour. The "core" area they identified was mostly located north and east of the Buller Plateaux. The Project Area contains a relatively low density of roroa/great spotted kiwi compared to this core area identified by Toy et al. (2021).

Roroa on the Plateaux occupy forested gullies and will travel across the more open areas of the Plateaux to feed (McLennan 2012). When considering population trend and the relatively low densities, McLennan (2012) considered that roroa had a good chance of persistence on the Buller Plateaux because the population appeared to be relatively stable or only slowly declining. The highest densities of roroa occur in tall forest habitats outside the Plateaux with tussock basins identified as a particularly productive habitat (McLennan 2012), but these populations appear to be declining at a higher rate than those on the Plateaux.

Kea are not resident on the Plateaux, although they are occasional visitors. There are no important habitats for kea present, when visiting they are most likely to visit rocky outcrops amongst pākihi and sandstone pavement. Kea can fly long distances (c. 20–30 km) within and between mountain ranges (Young et al. 2012).

Mātātā/South Island fernbird are relatively common on the Buller Plateaux and are typically seen using low, dense vegetation, often interspersed with emergent shrubs, in swamps, pākihi, rushes and tussock-covered frost flats.

Kakaruwai/South Island robin prefer dense forests with an open understorey on fertile soils and are rarely found in areas with widely scattered trees or sparse vegetation (Flack 1979). Robins are common in forested areas on the Buller Plateaux and have usually been recorded in previous surveys including forested sites (e.g., Buckingham 1998, 2002; Wildlife Surveys 2011).

Koekoeā/Long-tailed cuckoo are seasonally present throughout the Ngakawau ED, where one of their host species, pīpipi/brown creeper (*Mohoua novaeseelandiae*) occur. Koekoeā favour forested habitats.

Kārearea/New Zealand falcon (*Falco novaeseelandiae*) have been occasionally observed on the plateaux and may occur in all habitat types. Kārearea typically nest on the ground on rock stacks or small bluffs or in epiphytes within emergent trees. Kārearea have never been recorded breeding at the Buller Plateaux.

Pīhoihoi/New Zealand pipit are relatively common in low and open habitat types, often in and around disturbed areas.

Yellow-crowned kākāriki predominantly occur at low densities in forests within the Project sub-areas.

The 'Threatened' and 'At Risk' species most affected by mining would be roroa (because of

their presence throughout all the habitats affected), mātātā/South Island fernbird and kakaruwai/South Island robin (because of the large amounts of their habitats affected and the relatively high densities occurring in the Project Area).

6.2. Bats

The presence and distribution of either long-tailed bats (*Chalinolobus tuberculatus*) or short-tailed bats (*Mystacina tuberculata*) in the Ngakawau ED and wider environment is considered in more detail in Section 2.5.2 of Ecological Solutions Limited (2026a, provided as Appendix A).

Although bats (presumed to be long-tailed bats) were recorded in Happy Valley in the Upper Waimangaroa Valley in 1997 (Thomas et al. 1997), subsequent surveys, including the most recent acoustic survey of the upper Waimangaroa catchment during summer 2018–2019 have failed to detect bats. Lloyd (2019) considered it extremely unlikely that bats are resident in the Waimangaroa catchment or visit it regularly.

On that basis, it is extremely unlikely that any bats will be affected by the Project.

6.3. Lizards

The lizard fauna of the Ngakawau ED and Buller Plateaux is described in Section 2.5.3 of Ecological Solutions Limited 2026a (provided as Appendix A).

The lizard fauna of the Buller Plateaux includes two 'Threatened' and one 'At Risk' species as follows:

- West Coast green gecko (*Naultinus tuberculatus*).
- Forest gecko (*Mokopirirakau granulatus*).
- Westland speckled skink (*Oligosoma* aff. *newmani* 'Westland').

West Coast green gecko and Westland speckled skink are listed as 'Threatened – Nationally Vulnerable', whilst forest gecko is regarded as 'At Risk – Declining' (Hitchmough et al. 2026).

Purdie (2022) reported that atypical colour morphs are known to occur in a variety of New Zealand lizard species and both gecko species present on the Denniston Plateau have unusual colour morphs not seen elsewhere.

As expected, given the habitats present, all three species have been recorded within the Project Area, with most lizards found in low and open vegetation. This is likely a result of increased detectability in low open vegetation compared with taller or denser vegetation where lizards are harder to find. An evaluation of habitats within the Project Area found that the highest value lizard habitats were those nearest areas of high topographical and habitat diversity such as forested gullies (Alliance Ecology Limited 2024). Lizards use the full suite of habitats with the highest densities found in low open habitats of the Plateaux in proximity to forested gullies and forest edges, although again, this may be because they are easier to detect there.

Encounter rate of lizards has varied, but generally been relatively high, again perhaps due to the relatively low stature of the vegetation making lizards more easily detectable than in taller vegetation. The Buller Plateaux is thought to provide good quality habitat for lizards because of the spatial configuration and ecological connectivity of surrounding habitats. The fine scale mosaic of habitats and relative habitat complexity across small distances provides lizards with the full suite of resources that are necessary for survival, including refugia that protect them from exposure during extreme weather.

All three lizard species would be affected by the Project.

6.4. Terrestrial Invertebrates

6.4.1. Background

Terrestrial invertebrates are one of the richest elements of New Zealand's biota, but little is known about them either generally or in the Ngakawau ED specifically (except in relation to *Powelliphanta* snails), despite the area (particularly the Buller Plateaux) being relatively well studied. Ecological Solutions Limited (2026a, provided as Appendix A) summarises what is known about terrestrial invertebrates in the Ngakawau ED.

Terrestrial invertebrates found in the West Coast region comprise at least three distinct faunal elements:

- Widespread species found throughout New Zealand;
- Species typical of north-west South Island;
- Localised species adapted to the main divide, alpine or wetland habitats.

Terrestrial invertebrate surveys from the Buller Plateaux have revealed predominantly indigenous invertebrate communities. The occurrence of new records or new species is relatively commonplace, which is not unexpected given the diversity of habitats present within the Ngakawau ED and the paucity of systematic invertebrate collection, description and cataloguing nationally.

In general, indigenous invertebrate communities dominate at sites with indigenous vegetation, and there is higher invertebrate species richness at sites with more diverse vegetation. This is due to both the greater variety of potential food plant species present and to the more complex habitat architecture provided by taller vegetation. Nonetheless, each habitat type will have its own specialist species, so that the change from open, heath-like sites to forested sites will be accompanied by changes in the community composition and species present as well as changes in abundance. Key invertebrate groups, such as the moths, reflect the plant species present. Those collected in previous surveys include both generalist feeders and specialists on plants such as *Veronica*, *Juncus*, *Phyllocladus* (toatoa), *Dracophyllum*, ferns, and herbs (e.g., *Liparophyllum gunnii*).

A total of five 'Threatened' or 'At Risk' terrestrial invertebrate species are known to be present within or near the Project Area. In addition, the New Zealand giant stag beetle (also known as Helms's stag beetle, *Geodorcus helmsi*), which is protected under Schedule 7 of the Wildlife Act 1953, has also been detected on the Buller Plateaux. Also present on the Plateaux are white-face cave wētā (*Occultastella morgana*), which were recently described (Trewick 2024), and have yet to be assigned a threat status.

As described in Section 2.5.5 of Ecological Solutions Limited (2026a, provided as Appendix A), what was thought to be a new species of leaf-veined slug in the genus *Pseudaneitea* was discovered at Te Kuha during surveys associated with a mining application there. Despite additional surveys at Te Kuha, no further examples were collected. A second example, thought to be the same species, was collected within the MFS Project sub-area in 2024. The species has still not been described, and is thought to be part of a complex of *Pseudaneitea* distributed in the northern South Island that are poorly known and remain undescribed (Millar & Patrick 2016). It is likely that the range of this species extends across the Buller Plateaux as well.

Lastly, a previously undescribed species of tiger beetle was discovered at Te Kuha in 2018. A further five tiger beetles were collected from the same location in early 2019 and three

were collected at Denniston, and all specimens were considered to be the same species, closely resembling *Neocicindela aureata* or *N. garnerae.* The specimens collected from Te Kuha and Denniston are considered distinct from the species *N. garnerae* from the south of the Buller River in the Paparoa Ranges (Cassola & Moravec, 2010). These specimens were subsequently used to describe the species *Neocicindela aureata* sp. nov. (Johns 2018). This species has not yet been assigned a threat status either.

The terrestrial invertebrate fauna of the Buller Plateaux is discussed in more detail in Section 4.4.5. of Ecological Solutions Limited (2026a, provided as Appendix A).

Indigenous invertebrate populations, particularly of large poorly mobile invertebrates and species restricted to the Buller Plateaux, would be affected by habitat removal brought about by mining. Invertebrate communities would also be affected, particularly where the vegetation is replaced via planting, with more exotic species present and a lower abundance of individuals initially, with the invertebrate communities present changing as vegetation succession proceeds.

6.4.2. Field Surveys

In general, undisturbed areas of the Buller Plateaux contain predominantly native invertebrate fauna. The fauna is highly diverse, and includes several large bodied species with limited dispersal abilities. The invertebrate fauna at parts of the Plateaux that have been rehabilitated via planting, or left un-remediated following historic mining activity, include non-native species such as the Australian copper bellied ant (*Ochetellus glaber*) and the common money spider (*Diplocephalus cristatus*). It remains unknown whether these species will persist as the vegetation matures and indigenous species come to dominate.

Samples from the MFS Project sub-area included a spider from the genus *Huttonia*. Whilst the spider was only identified to genus level, the only described species of that genus (and indeed family) has a threat status of 'At Risk – Naturally Uncommon' (Sirvid et al. 2021). The species found represents either this 'At Risk' species, or a currently undescribed species in the genus. A second specimen of the *Pseudaneitea* slug was also found in the MFS project sub-area as mentioned above.

Results of field surveys undertaken by Ecological Solutions Limited at the ESE Project sub-area can be found in Section 3.8 of Ecological Solutions Limited (2026c, provided as Appendix C), at the MFS Project sub-area in Section 3.3 of Ecological Solutions Limited (2026d, provided as Appendix D), at the UWHR Project sub-area in Section 3.7 of Ecological Solutions Limited (2026f, provided as Appendix F), and at rehabilitated sites at Stockton Mine in Section 6.3.5 of Ecological Solutions Limited (2026h, provided as Appendix H).

6.4.3. Land Snails

The Buller Plateaux and its immediate surrounds contain the entire range of two taxa of carnivorous land snail, both regarded as 'Threatened':

- *Powelliphanta augusta*; and
- *Powelliphanta patrickensis*

Only *P. patrickensis* occurs within the Project Area (Lloyd's Ecological Consulting 2026) and is considered 'Threatened' – Nationally Critical' (Walker et al. 2024). Effects of the Project on P. patrickensis are considered elsewhere (Lloyd's Ecological Consulting 2026) and are not considered further here..

6.5. Mammalian pests

The presence of mammalian pests on the Buller Plateaux is discussed in more detail in Section 2.7 of Ecological Solutions Limited (2026a provided as Appendix A) and in Alliance Ecology Limited (2025b). Mammalian pests are not considered further here.

7.0 Ecological Values

7.1. Introduction

Based on the presence of predominantly indigenous habitats, naturally uncommon ecosystems, wetlands and 'Threatened' and 'At Risk' species, the Project Area contains areas of 'high' and 'very high' ecological value. In addition to these 'high' or 'very high' ecological values, parts of the Project Area have been heavily modified by historic and existing land uses, with roads, fire, underground mining and open cast mining removing coal measures vegetation and modifying the original vegetation structure and composition to varying degrees.

The ongoing effects of invasive weeds and introduced mammalian predators are also apparent at some locations.

This section synthesises our knowledge of the ecological features identified to assign ecological values and determine the relative importance of the ecological features of the existing environment. Assigning values or importance to specific features allows for informed judgements with regard to the application of the effects management hierarchy and the magnitude of potential and actual effects on specific ecological features. Value determinations also allow for the quantification of effects so that appropriate impact management can be designed and recommended.

7.2. Vegetation

The ecological value of the terrestrial vegetation communities across the Project Area ranges from 'Low' at cleared and recently disturbed sites to 'Very High' at sites which are intact, well connected, include predominantly indigenous communities which demonstrate natural ecological gradients and include 'At Risk' plants. The ecological value of vegetation within the Project Area is summarised in Table 9.

The vegetation on the Buller Plateaux comprises an intricate, fine scale mosaic of forest, shrubland, tussock and wetland vegetation with a high degree of natural edge which forms ecotones between different vegetation associations. This results in a high plant species diversity and a correspondingly high diversity of habitats for fauna, including 'Threatened' and 'At Risk' species of bird, lizard and invertebrate. The Buller Plateaux is a low fertility environment with often shallow soils where plant growth is stunted, and plants grow slowly. These conditions coupled with historic land use and anthropogenic influence across the Plateaux has allowed for the ingress of more competitive exotic species with some indigenous vegetation communities being compromised by weeds.

7.3. Bryophytes and Lichens

The ecological value of the terrestrial bryophyte and lichen communities across the Project Area is 'Very High'.

The bryophytes of the Buller Plateaux form a major component of the flora, accounting for ~30% of the species diversity. Bryophytes and lichens of the Buller Plateaux comprise a unique and unusual species assemblage, including endemic genera and nationally rare and uncommon species, some of which have disjunct distributions and biogeographic links with Southwest Tasmania, Stewart Island and Fiordland. The combination of habitat conditions which makes the Buller Plateaux important for bryophytes includes the combination of vegetation types, high and fairly consistent rainfall, infertile soils, cold climate, sandstone geology and the historic role of fire.

Surveys have identified ten key vegetation communities which are valuable for bryophytes and lichens as set out in Section 5.2, including (in no particular order):

- Southern rātā-mountain beech-podocarp forest.
- Mixed beech-podocarp-broadleaved forest.
- Silver beech-mountain beech forest.
- Mānuka-tussock-wire rush shrubland.
- Low pākihi.
- Mānuka-mountain beech-podocarp shrubland.
- Tussock-flax shrubland [includes red tussock grassland].
- Mānuka/Gahnia-wire rush shrubland.
- Sandstone erosion pavement and quartzite sands.
- Riparian and vertical wet walls.

'Threatened' and 'At Risk' bryophytes occupy localised, rare or sparse microhabitats, such as wet vertical walls, riparian bedrock, stream beds, hanging 'sheets' and 'stalactites' of plant roots trapped with peat, low-gradient small streams and tarns with mānuka or isolated, open pākihi with sparse prostrate mānuka and red tussock grassland.

'Threatened' and 'At Risk' lichens predominantly occur on open sandstone pavement, and within low pākihi vegetation. The ecological values of bryophytes and lichens are summarised separately in Table 9.

7.4. Avifauna

Avifauna values range from 'High' to 'Very High' across the Project Area. Thirty-nine species of bird have been recorded using the Buller Plateaux (Ecological Solutions Limited 2026b), including 'Threatened' and 'At Risk' species. Twenty-nine of those, including nine 'Threatened' and 'At Risk' species, have been recorded within the Project Area. Species present include those adapted to forests, shrublands and open areas and visiting species (e.g., kea). This represents a relatively high diversity of bird species, although abundance on the Buller Plateaux is generally lower than in the surrounding habitats.

The bird fauna is relatively intact and includes ecologically important species such as tūī and kererū which are important pollinators and seed dispersers across the landscape. 'Threatened' species such as roroa/great spotted kiwi, kārearea/New Zealand bush falcon and koekoeā/long-tailed cuckoo and 'At Risk' species such as pihoihoi/New Zealand pipit and kakaruwai/South Island robin are present at relatively low levels throughout the Buller Plateaux in suitable habitats.

Pākihi shrubland provides habitat for mātātā/South Island fernbird, which are locally common in some habitats on the Buller Plateaux and elsewhere in the Buller District. Mātātā are considered 'At Risk – Declining' (Robertson et al. 2021).

The ecological value of bird species and their habitats is summarised in Table 9.

7.5. Lizards

Lizard habitat values across the Project Area range from low to high. Determining the relative importance of different habitat types for lizards based on surveys is challenging because survey encounter rates for lizards are influenced by multiple factors, including:

- *Landscape context:* the spatial configuration and ecological connectivity of surrounding habitat types. For example, geckos may be more abundant in habitat mosaics that enable them to move between different habitat types to meet seasonal resource requirements at different times of the year.

- *Habitat complexity:* the diversity of microhabitat types and resources within a particular habitat type. For example, more complex habitat types are more likely to provide lizards with the full suite of resources that are necessary for survival, such as refugia that protect lizards from exposure during extreme weather.
- *Habitat use:* the way lizards use particular habitat types, for example forest geckos and West Coast green geckos may be more abundant in tall forest but are less likely to be encountered during surveys than in prostrate habitats where geckos spend their time on or near the ground.

Given the above variables, whilst individual survey results contribute to our understanding of habitat use by lizards, the strongest determinant of how important a particular habitat or location is for lizards on the Buller Plateaux is likely to be more dependent on landscape context and physical and biological complexity than individual local features. On that basis, habitats were assigned as being of relatively 'Low value', 'Moderate value' or 'High value' for lizards as follows:

- 'Low value' areas for lizards include roads and some associated highly disturbed open areas. These habitats may include lizards, but abundances are expected to be relatively low because of the lack of resources in highly disturbed areas.
- 'Moderate value' areas for lizards include habitats with low topographical diversity that are:
    - Greater than 100m from habitat mosaics with high topographical diversity (large gully systems with tall forest).
    - Greater than 50m from habitat mosaics with moderate topographical diversity (smaller gully systems with tall forest).
    - Less than 100m from large gullies with high topographical diversity and tall forest.
    - Less than 50m from moderate gullies with moderate topographical diversity and tall forest.
- 'High value' areas for lizards include all gully habitat mosaics with high or moderate topographical diversity and associated habitats that are spatially or architecturally complex.

The ecological value of the lizard assemblage itself is set out in Table 9.

7.6. Terrestrial Invertebrates

Despite the lack of 'Threatened' or 'At Risk' species other than *P. patrickensis*, collected to date in surveys to inform this application, a number of such species are known to occur on the Buller Plateaux and the ecological value of the habitats for terrestrial invertebrates is considered 'very high' due to the intactness and relatively high diversity of the communities present.

To date, terrestrial invertebrate surveys have revealed predominantly native invertebrate communities and the occurrence of new records or new species is relatively commonplace, which is not unexpected given the diversity of habitats present and the paucity of systematic invertebrate collection, description and cataloguing nationally.

The ecological value of terrestrial invertebrates is set out in Table 9.

Table 9: Summary of terrestrial ecological values within the Project Area.

Feature	Representativeness	Rarity and Distinctiveness	Diversity and pattern	Ecological Context	Overall value	Comment
Indigenous vegetation, and habitat						
Forest						
Tall forest Mixed beech-podocarp-broadleaved forest	High	Low	Moderate	High	High	Mostly located off the Buller Plateaux itself. Integral part of landscape connectivity. No 'Threatened' or 'At Risk' plant species recorded.
Short forest Southern rātā-mountain beech-podocarp forest	High	High	High	Moderate	Very High	Restricted to gullies and sheltered areas. Provides habitat for Travers horopito ('At Risk – Naturally Uncommon') and red mistletoe ('At Risk – Declining').
Silver beech-mountain beech forest	High	Moderate	Moderate	High	High	Restricted to higher altitude locations. Provides habitat for birds.
Shrubland						
Mānuka-mountain beech-podocarp shrubland	High	Moderate	High	High	Very High	Ecotonal habitat. Used by fernbird, lizards and snails at lower densities. Includes important bryophyte habitat.
Mānuka/Gahnia-wire rush shrubland	High	High	Moderate	High	Very High	Natural inland wetland. Provides habitat for snails and fernbird. Includes important bryophyte and lichen habitat. Wetland habitats are substantially reduced in extent nationally, although the West Coast retains relatively more than many regions.
Weedy shrubland	Low	Low	Moderate	Moderate	Low	Adjacent to previously disturbed areas.
Mānuka-tussock-wire rush shrubland	High	Moderate	High	Moderate	High	Natural inland wetland. Provides habitat for snails, lizards and fernbird. Includes important bryophyte and lichen habitat. Wetland habitats are substantially reduced in extent nationally, although the West Coast retains relatively more than many regions.
Mānuka-mountain flax/wire rush shrubland	High	High	High	Moderate	Very High	Natural inland wetland. Wetland habitats are substantially reduced in extent nationally, although the West Coast retains relatively

Feature	Representativeness	Rarity and Distinctiveness	Diversity and pattern	Ecological Context	Overall value	Comment
						more than many regions. Provides habitat for fernbird, snails and lizards.
Low Vegetation						
Low pākihi	High	High	High	High	Very High	Natural inland wetland. Provides habitat for fernbird, snails and lizards. Includes important bryophyte and lichen habitat. Wetland habitats are substantially reduced in extent nationally, although the West Coast retains relatively more than many regions.
Tussock-Mountain flax shrubland	Moderate - High	High	Moderate	High	Very High	Natural inland wetland. Includes important bryophyte and lichen habitat. Associated with previous fire. Wetland habitats are substantially reduced in extent nationally, although the West Coast retains relatively more than many regions.
Exotic grassland	Low	Low	Low	Low	Low	Exotic dominated, including and adjacent to disturbed areas. Species composition heavily influenced by rehabilitation planting programmes.
Non-vegetated landcover						
Cleared vegetation	Low	Low	Low	Low	Low	Includes roads and areas disturbed by previous mining and not rehabilitated.
Water (doesn't include stream habitats)	Low	Low	Moderate	Moderate	Moderate	Includes mine infrastructure (ponds and the like)
Vascular Plants						
'Threatened' species		Very High			Very High	No species considered 'Threatened' have been detected within the Project Area to date, but a number are known from the wider area and may be present.
'At Risk – Declining' species		High			High	There are a number of 'At Risk – Declining' species present within the Project Area.
Other 'At Risk' and locally uncommon or distinctive species		Moderate			Moderate	There are a number of local endemic and/or distinctive species or species at the limit of

Feature	Representativeness	Rarity and Distinctiveness	Diversity and pattern	Ecological Context	Overall value	Comment
						their range present, e.g., Parkinson's rātā, *Celmisia dubia*.
Nationally and locally common species		Moderate			Moderate	The assemblage of species at the Brunner Coal Measures at the Buller Plateaux contributes to the high diversity and distinctive features.
Naturally Uncommon Ecosystems						
Sandstone erosion pavement	High	High	Moderate	High	Very high	Regarded as 'Endangered' (Holdaway et al. 2013). Few species are restricted to or prefer sandstone pavement as habitat. Buller Plateaux is largest and best example of sandstone erosion pavement nationally.
Tarns	High	Moderate	High	High	Very high	Regarded as 'Not Threatened' (Holdaway et al. 2013). Distinctive feature of the Buller Plateaux used by aquatic fauna and providing habitat for species such as *Liparophyllum gunnii* which is habitat for the Avatar moth.
Boulderfields of acidic rock	High	High	Moderate	High	Very high	Regarded as 'Not Threatened' (Holdaway et al. 2013).
Seepages and flushes	High	Moderate	High	High	Very high	Regarded as 'Endangered' (Holdaway et al. 2013).
Pākihi	High	High	High	High	Very high	Regarded as 'Not Threatened' (Holdaway et al. 2013). As above for low pākihi
Bryophytes						
'Threatened' bryophytes (see Table 7)	Very High	Very High	Very High	High	Very High	Comprises a distinctive assemblage of bryophytes, including 'Threatened', 'At Risk' and endemic genera as well as species with restricted distribution. Includes important bryophyte habitats within the UWHR Project sub-area.
'At Risk – Declining' bryophytes (see Table 7)	High	High	High	High	High	As above.

Feature	Representativeness	Rarity and Distinctiveness	Diversity and pattern	Ecological Context	Overall value	Comment
Other 'At Risk' bryophytes and locally uncommon or distinctive species (See Table 7)	High	Moderate	High	Moderate	High	As above.
Nationally and locally common bryophytes	Moderate	Moderate	High	Moderate	Moderate	Significant component of local flora. High diversity, including several endemics. New records outside previously known distribution. Type locality for some species.
Lichens						
'Threatened' lichens (See Table 7)	Very High	Very High	High	High	Very High	Comprises an assemblage of distinct lichens, including 'Threatened' and 'At Risk' species, as well as species with restricted distribution.
'At Risk – Declining' lichens (See Table 7)	High	Moderate	Moderate	High	High	As above.
Other 'At Risk' lichens and locally uncommon or distinctive species (See Table 7	Moderate	Moderate	Moderate	High	Moderate	As above.
Nationally and locally common lichens	High	Moderate	Moderate	Moderate	Moderate	High diversity, including several endemics. Type locality for some species.
Fauna						
'Threatened' birds (See Table 8)		Very High			Very High	Includes roroa, karearea/NZ bush falcon and koekoeā/long-tailed cuckoo. Most common in forested habitats. Kea visit, but are not residents.
'At Risk' birds (See Table 8)		High			High	Includes mātātā/South Island fernbird, kakaruwai/South Island robin, pīhoihoi/New Zealand pipit, yellow crowned kākāriki. Mātātā occupy pākihi and shrublands, pīhoihoi in open habitats. Kakaruwai and kākāriki occupy forests.
Other birds		Moderate			Moderate	Diverse bird population of moderate abundance
Bird Habitat	High	High	High	High	Very High	Forests provide habitat for 'Threatened' (roroa, kea, koekoeā, kārearea) and 'At Risk'

Feature	Representativeness	Rarity and Distinctiveness	Diversity and pattern	Ecological Context	Overall value	Comment
						(kakaruwai) bird species. Shrublands provide habitat for mātātā.
Bats		Very High			Very High	No known bat population.
Bat Habitat	Negligible	Low	Negligible	Low	Negligible	The lack of a resident bat population confers the lack of value. Bats are not considered further here
'Threatened' lizards (West Coast green gecko and Westland speckled skink)		Very High			Very High	Lizards thought to be present in relatively high abundance.
'At Risk' lizards (forest gecko)		High			High	Lizards thought to be present in relatively high abundance.
Lizard Habitat	High	High	High	High	Very High	Unique assemblage of lizard species. Lizards, including 'Threatened' and 'At Risk' species in relatively high abundance. Short forest provides high value habitat for lizards. Shrublands, pākihi and areas of sandstone also provide habitat for lizards.
Terrestrial Invertebrates						
Powelliphanta patrickensis	High	Very High	High	Very high	Very High	Buller Plateaux includes entire range of *P. patrickensis*, which has the highest possible threat ranking.
Invertebrate communities	High	High	High	High	Very High	Predominantly indigenous communities. Includes endemic, 'Threatened' and 'At Risk' species and species yet to be described. High diversity due to complex structural architecture and diverse vegetation/ecotones.

8.0 Ecological Significance Assessment

Appendix 13 of the Decisions Version of the Te Tai o Poutini District Plan ('the TTPP') sets out the process for identifying new Significant Natural Areas ('SNAs') in the Grey, Buller and Westland Districts. Within the Buller and Westland District and in the Grey District outside the previously identified SNAs set out in Schedule Four of the TTPP, a district-wide assessment will be undertaken to identify areas of significant indigenous vegetation and significant habitat of indigenous fauna, with additional identified areas included in Schedule Four through a future plan change. Until a site has been assessed to determine whether it constitutes an SNA, and a Plan Change introduced which includes the new SNAs, the TTPP does not identify any SNAs in the Buller District. Furthermore, the TTPP does not provide criteria for the assessment of ecological significance. SNAs in the form of Regionally Significant Wetlands are scheduled and identified in Appendix 1 of the West Coast Regional Land and Water Plan and these areas are also included in Schedule Four of the TTPP.

Ecological significance criteria are set out in Appendix 1 (terrestrial biodiversity) and Appendix 2 (wetlands) of the West Coast Regional Council Policy Statement (RPS) and the Appendix 1 of the National Policy Statement for Indigenous Biodiversity (2025) (the NPS-IB). Indigenous vegetation or habitat(s) of indigenous fauna is significant if it meets any one or more of the following criteria.

- Representativeness.
- Rarity and distinctiveness.
- Diversity and Pattern.
- Ecological context.

Significant wetlands meet one or more of the following criteria.

- Ecological context.
- Representativeness.
- Rarity.
- Distinctiveness.

These criteria are intended to be applied by suitably qualified and experienced ecologists, with a good understanding of the local and national context.

The Buller Plateaux and associated vegetation communities and ecosystems are well understood as being unique within the Ngakawau ED and nationally. As reflected in Table 9 and discussed above, the indigenous dominance, ecological integrity, character and pattern of the vegetation communities, as well as the presence of a number of 'Threatened' and 'At Risk' flora and fauna species, as well as the presence of naturally uncommon ecosystems and wetlands all point to the ecological significance of the Project Area when considered against the WCRPS and NPS-IB criteria.

The majority of the Denniston Plateau is identified as a Schedule 2 wetland (NGA P051) in Schedule 1A of the West Coast Regional Land and Water Plan. These areas are not automatically included as SNAs in the TTPP. Wetlands identified in Schedule 2 either are, or are likely to be, ecologically significant. A wetland in Schedule 2 is considered to be significant if it meets any one of the ecological criteria for significant wetlands set out above. Wetlands identified in Schedule 2 require an assessment using the ecological criteria on Schedule 3 during any resource consent process.

Table 10 sets out the assessment of ecological significance for each of the vegetation and habitat types within Project Area.

Table 10: Ecological significance of vegetation and habitats within the Project Area.

Vegetation/habitat type	National Policy Statement for Indigenous Biodiversity			West Coast Regional Policy Statement		
	Ecological significance	Sub-criteria met	Details	Ecological Significance	Sub-criteria met	Details
Forest						
Mixed beech-podocarp-broadleaved forest.	Significant	Representativeness, rarity and distinctiveness diversity and pattern, ecological context	Ecological integrity that is typical of the Ngakawau ED. Habitats support a typical suite of indigenous fauna and retain a good range of species. Presence of ecotones and natural gradients. Provides habitat for 'Threatened' and 'At Risk' species. Large contiguous area well connected to surrounding habitats.	Significant	Representativeness, rarity/distinctiveness, diversity and pattern, ecological context	Vegetation characteristic of the Ngakawau ED. Provides habitat for 'Threatened' and 'At Risk' species, high diversity of taxa, important ecological linkage
Southern rātā-mountain beech-podocarp forest.	Significant	Representativeness, rarity and distinctiveness, diversity and pattern, ecological context	As above	Significant	Representativeness, rarity/distinctiveness, diversity and pattern, ecological context	As above
Silver beech-mountain beech forest.	Significant	Representativeness, rarity and distinctiveness, diversity and pattern, ecological context	As above	Significant	Representativeness, rarity/distinctiveness, diversity and pattern, ecological context	As above
Shrubland						
Weedy shrubland	Significant	Rarity	Vegetation compromised by weeds (particularly gorse). Provides only poor-quality habitat. Few records of snails and bryophytes	Not significant	None	Vegetation compromised by weeds. Provides only poor-quality habitat.
Low Vegetation						
Exotic grassland	Not Significant	None	Vegetation present influenced by planting. Predominantly	Not significant	None	Vegetation present influenced by planting.

Vegetation/habitat type	National Policy Statement for Indigenous Biodiversity			West Coast Regional Policy Statement		
	Ecological significance	Sub-criteria met	Details	Ecological Significance	Sub-criteria met	Details
			exotic species.			Predominantly exotic species.
Wetlands						
Low pākihi	Significant	Representative, diversity and pattern, rarity and distinctiveness, ecological context.	Ecological integrity that is typical of the Ngakawau ED. Habitats support a typical suite of indigenous fauna and retain a good range of species. Presence of ecotones and natural gradients. Provides habitat for *P. patrickensis.*	Significant	Ecological context, representativeness, rarity	Important habitat for snails and 'Threatened' and 'At Risk' bryophytes and lichens. Important contribution to ecological networks. Dominated by pākihi species. Contains naturally uncommon ecosystems.
Weedy low pākihi	Significant	Rarity	Lacks ecological integrity. May provide habitat for 'Threatened' and 'At Risk' bryophytes and lichens. Compromised by weeds. Few records of snails and bryophytes.	Not significant	None	Not considered the best remaining examples of their type. Compromised by weeds. Not distinctive.
Mānuka-tussock-wire rush shrubland	Significant	Representative, diversity and pattern, rarity and distinctiveness, ecological context.	Ecological integrity that is typical of the Ngakawau ED. Habitats support a typical suite of indigenous fauna and retain a good range of species. Presence of ecotones and natural gradients. Provides habitat for 'Threatened' and 'At Risk' flora and fauna.	Significant	Ecological context, representativeness, rarity	Important habitat for snails and 'Threatened' and 'At Risk' bryophytes and lichens. Important contribution to ecological networks. Dominated by pākihi species.
Mānuka/Gahnia-wire rush shrubland	Significant	Representativeness, diversity and pattern, rarity and distinctiveness, ecological context.	As above	Significant	Ecological context, representativeness, rarity	As above.

Vegetation/habitat type	National Policy Statement for Indigenous Biodiversity			West Coast Regional Policy Statement		
	Ecological significance	Sub-criteria met	Details	Ecological Significance	Sub-criteria met	Details
Mānuka-mountain beech-podocarp shrubland	Significant	Representativeness, diversity and pattern, rarity and distinctiveness, ecological context	As above	Significant	Ecological context, representativeness, rarity	Important habitat for 'Threatened' and 'At Risk' flora and fauna. Important contribution to ecological networks.
Mānuka-mountain flax/wire rush shrubland	Significant	Representativeness, rarity and distinctiveness, diversity and pattern, ecological context	As above	Significant	Ecological context, representativeness, rarity	Important habitat for 'Threatened' and 'At Risk' flora and fauna. Important contribution to ecological networks.

9.0 Assessment of Ecological Effects

9.1. Vegetation Clearance

The principal direct adverse effect of the Project will be staged vegetation clearance and habitat removal. The vegetation and land cover to be removed within the Disturbance Areas (including sandstone pavement and open water) comprises approximately 31.3ha at Stockton, 175.4ha at Mt Frederick South, 44.8ha within the transport corridor and 502.9ha at Extended Escarpment. The total directly affected area is 754.2ha, although 69.8ha of that has already been cleared. The extent of vegetation removal (including sandstone erosion pavement) is 684ha. The vegetation to be cleared is summarised by vegetation type in Table 5.

The most affected vegetation types are:

- Low pākihi (213.9ha, 10.3% of this vegetation type within the Mapped Area);
- Southern rātā-mountain beech-podocarp forest (177.1ha, 7.1% of this vegetation type within the Mapped Area;
- Mānuka-tussock-wire rush shrubland (104.2ha), 11.0% of this habitat type within the Mapped Area; and
- Mānuka-mountain beech-podocarp shrubland (84.7ha), 5.8% of this habitat type within the Mapped Area.

In addition to the habitats directly affected by habitat removal, edge effects are estimated to affect a further 128.2ha of vegetation (excluding already cleared vegetation) across the four Disturbance Areas (16.5ha at Stockton, 21.6ha at MFS, 39.8ha at ESE and 41.5ha at UWHR). Edge effects would affect approximately 1-2% of each respective habitat type within the Mapped Area (except exotic grassland, where 3.9% would be affected).

With regard to cumulative effects, the original extent of different vegetation types prior to mining commencing at Stockton remains unknown. At the Buller Plateaux (4,820ha), Brunner coal measures originally covered c. 4,661ha (c. 3,013ha at Stockton Plateau and c.1,648ha at Denniston Plateau). Stockton Mine has removed 1,124ha of Brunner coal measures from the Buller Plateaux, the BPCP will remove a further 985.7ha, leaving 2,551ha (c. 55%) of Brunner coal measures within the Buller Plateaux.

Within the Ngakawau ED, there was originally c. 11,578ha of Brunner coal measures. Stockton Mine has removed approximately 1,155ha leaving c. 10,423ha remaining. The BPCP will remove a further 1,315.7ha leaving c. 9,106ha of Brunner coal measures (c.78.6%) within the Ngakawau ED. The extent to which particular vegetation types have been affected remains unknown.

9.2. Effects on Fauna

- Direct mortality or injury to individual animals that may be harmed during vegetation clearance or earthworks activities or killed by vehicles.
- The creation of habitat edge effects, altering the composition and health of adjacent vegetation (i.e. habitat degradation), which may affect habitat suitability for fauna.
- Disturbance associated with noise, dust, lighting and vibration from mining activities. These effects could extend beyond the boundary at some locations.

Key impacts on *P. patrickensis* and its habitat include:

- Potential increase in animal pests (predators) as a result of increased human activity

(e.g., rats).

- Reductions in snail distribution range.
- Snail mortality (during habitat stripping/VDT and vehicle impact).
- Habitat fragmentation.
- Habitat degradation.

The proposed Project Area would reduce the current distribution range of *P. patrickensis* on the Buller Plateaux by 28.4%, and this species is therefore considered highly affected by the Project (Lloyd's Ecological Consulting 2026).

9.3. Threatened Environments

The Project Area has a land classification of Category 6 (>30% of indigenous cover left and >20% protected) within the Threatened Environments Classification.

9.4. Naturally Uncommon Ecosystems

There are five naturally uncommon ecosystems present within the Project Area as set out in Section 3.3. Effects on pākihi and sandstone erosion pavement can be more reliably assessed because these vegetation types have been quantified by Ecological Solutions Limited (2026a). For smaller features (tarns, seepages and flushes, boulderfields of acidic rock), the extent of these has not been estimated, although it is likely to be relatively small (a few hectares at most) because these features are small and widespread. Seepages and flushes and sandstone erosion pavement cannot be reinstated as part of mine rehabilitation, but tarns and boulderfields of acidic rock can be created and areas of pākihi can be restored via VDT. The comprehensive rehabilitation proposed has considered these matters and taken account of them in developing the rehabilitation plan for the Project.

9.5. Potential and Actual Adverse Effects

The Project would result in a range of adverse effects on terrestrial and wetland ecological values.

The actual and potential adverse effects of mining activities include:

- Terrestrial and wetland habitat loss, fragmentation, degradation and general disturbance through staged vegetation clearance and earthworks including the deposition of overburden.
- Sediment runoff to wetlands and watercourses could affect the quality of aquatic habitats. This matter is considered further in Earth Sciences New Zealand Limited (2026).
- Nutrient and wastewater input to soils from septic tanks could affect vegetation at ESE.
- Potential changes in hydrology such as a lowering of ground water near cut edges and improved drainage for soils in engineered landforms.
- Effects on vegetation and soil fertility associated with exposure of Potentially Acid Forming (PAF) material.
- The creation of habitat edge effects, altering the composition and health of adjacent vegetation (i.e. habitat degradation), which may affect habitat suitability for flora.

The potential adverse ecological effects described above will vary in scale and extent and can change over time. The following section sets out the measures and management actions proposed to avoid, minimise or remedy (rehabilitate) adverse effects.

9.6. Application of the Mitigation Hierarchy

9.7. Introduction

The proposal has been designed to avoid adverse effects on ecological values to the extent practicable and minimise effects where that is achievable. Remediation of Disturbance Areas (to the extent that is achievable) also forms a significant part of the proposal. These effect management measures are summarised below with details set out in the relevant draft management plans.

9.7.1. Avoidance

The ability to avoid adverse effects is constrained by the fixed location of the coal resource. Noting that the location of the coal resource is fixed, avoidance of effects has focussed on avoidance of the highest value habitats for infrastructure such as roads, buildings and overburden disposal sites and reducing the footprint where achievable. Specific avoidance measures include:

- Mine planning has been iterative and included refinement of the disturbance footprint where possible in order to avoid impacts on high value habitats and associated species. This includes:
    - Removal of the Whareatea Gorge from the ESE Project sub-area (approx. 153ha).
    - Removal of the headwaters of Billo Stream from the MFS Project sub-area (approx. 8.5ha).
    - Removal of the road from Mt Frederick to the MFS Project sub-area (approx. 8.3ha).
    - Removal of the proposed additional borrow pit from the Stockton Project sub-area (approx. 18.9ha).
    - Removal of the proposed quarry within the ESE Project sub-area (which post-dates the calculations of extent included here).

The activities proposed at those locations no longer form part of the current proposal.

Annual mine planning for the Project Area can also avoid effects via:

- Vegetation clearance protocols to minimise unnecessary impacts, including:
    - Physically marking the project boundaries to avoid direct effects, such as inadvertent clearance, extending beyond the boundary.
    - Directional felling of vegetation to avoid damage to the immediately adjoining habitats.
- Site specific erosion and sediment control procedures to avoid and/or minimise effects of mobilised sediment on wetlands and other vegetation. This includes, in the short term, creation of surfaces which reduce erosion (i.e., those that land areas that can withstand or resist the gradual loss of their surface material due to mechanical and chemical forces such as water and wind) and/or vegetative cover being established on engineered landforms which are suitable to avoid sediment and runoff effects. This matter is set out in more detail in the site Erosion and

Sediment Control Plan (BPCP-ENV-PLN-013, Bathurst Resources Limited 2026c).

These matters would be set out in the Annual Mine Plan which will be certified by the Buller District and West Coast Regional Councils.

9.7.2. Minimising Effects

Actions to minimise effects can be deployed at every level from initial mine planning to final rehabilitation.

These matters are set out in the Rehabilitation Management Plan (BPCP-ENV-PLN-002, Bathurst Resources Limited 2026a) and will be included in the Annual Work Plan prepared each year in advance of mining and certified by the local Councils.

Actions undertaken during mining to minimise effects include:

- Selection of the UWHR route (refer to Appendix J) to minimise ecological effects of road construction.
- Optimise VDT and other rehabilitation activities to reduce stockpiling where practicable.
- Prompt rehabilitation so that habitats become available for use as quickly as possible.
- Prompt rehabilitation to minimise edge effects on wetlands. Monitoring at Cypress Mine indicates wetland vegetation health adjacent to the pit declines in the short-moderate term (0.5 / 5 points over six years) (Ecological Solutions Limited 2025). Prompt attention to rehabilitation would assist in addressing this decline, thereby minimising any effect.
- Minimising the amount of bare ground at any one time in order to reduce the risk of weed invasion and spread.
- Management of soil and other rehabilitation resources (such as vegetation, logs, stumps, weathered boulders etc.), so that they remain viable and can be used with minimal degradation.
- Applying effective biosecurity to machinery and personnel entering natural and rehabilitated sites. Site biosecurity, including of new and existing sites, will be formalised. Biosecurity measures such as boot washes at the entrances to sensitive rehabilitated areas will be used to assist in reducing weed invasion, particularly for *Juncus* which is more likely to be spread on footwear and other equipment than by wind or animals. Biosecurity is set out in the Biosecurity Management Plan (BPCP-ENV-PLN-007, Bathurst Resources Limited 2026d).
- Surveillance for weeds and regular weed control by experienced site personnel in accordance with the Weed Management Plan (BPCP-ENV-PLN-008, Bathurst Resources Limited 2026c).
- Weed control will be addressed on a site wide basis as set out in the Weed Management Plan for the site (BPCP-ENV-PLN-007, Bathurst Resources Limited 2026b) and prioritised to prevent the establishment and spread of heath rush and other exotic species into natural communities.
- Specific fauna management plans for affected species including birds, lizards and snails (BPCP-ENV-PLN-003, BPCP-ENV-PLN-005 and BPCP-ENV-PLN-004 respectively).
- Sediment and erosion control measures to avoid or minimise effects on wetlands and other vegetation.

- Control measures for fire, dust suppression and accidental spills.
- Salvage and relocation of 'Threatened', 'At Risk' species of vascular and non-vascular flora where practicable as set out in the site Rehabilitation Management Plan (BPCP-ENV-PLN-002, Bathurst Resources Limited 2026a).
- Specific attention will be paid to management of edge effects via planting of newly exposed edges, use of soil, boulders, logs and other resources to create a bund and other actions as required to reduce edge effects.
- Control of mammalian predators and browsers to improve survival and productivity of flora and fauna in areas surrounding the Project Area as set out in the Pest Control and Elimination Plan for the site (Alliance Ecology Limited 2026b).
- Weed control and control of mammalian pests will be ongoing, including following mine closure if required. This will assist in mitigating the effects of weeds and pests on vegetation and fauna and maintain surrounding populations to assist in recolonising the mined areas as rehabilitation proceeds.

9.7.3. Remediating Effects

9.7.3.1. Remediation Outcomes

Vegetation Direct Transfer

In terms of vegetation and fauna, the most successful rehabilitation method used to date at Stockton Mine has been Vegetation Direct Transfer (VDT, as set out in greater detail in Ecological Solutions Limited 2026h, Appendix H). VDT minimises structural damage to both vegetation and soils, and is able to maintain a range of animals with reduced mobility, such as land snails, poorly mobile beetles, lizards and soil invertebrates (including worms). Ecological Solutions Limited (2026h) found that VDT sites had higher vegetation cover, higher native species cover and more suitable habitat for fauna and bryophytes than planted and non-remediated sites. Bryophyte communities within VDT plots contained >25% of indicator taxa and species of conservation concern, confirming that this rehabilitation approach can retain and support mature bryophyte communities as well.

Populations of *Powelliphanta patrickensis* snails survive and remain viable in areas rehabilitated by VDT at similar densities to populations in undisturbed habitats, however this was not the case for planted sites where very few snails were found (Lloyd's Ecological Consulting 2026, Ecological Solutions Limited 2026h).

Five-minute bird counts confirmed that some native birds used rehabilitated areas and that the diversity and abundance increased over time. The conspicuousness of pihoihoi/New Zealand pipit ('At Risk – Naturally Uncommon') and mātātā/South Island fernbird ('At Risk – Declining') was similar at planted and VDT rehabilitation sites.

VDT provides suitable habitat for forest gecko and Westland speckled skink (Ecological Solutions Limited 2026h). It remains unknown whether lizards were present in VDT habitats because they had survived transfer or because they had colonised from surrounding areas or both. It remains unknown whether VDT provides suitable habitat for West Coast Green gecko.

Tarn Rehabilitation

Ecological Solutions Limited (2026h) found that natural tarns were similar to constructed tarns rehabilitated with VDT in terms of ground cover and vegetation parameters, although constructed and planted tarns had higher rock cover than natural tarns or constructed tarns with VDT, and were more variable in terms of the number of species present. Constructed

tarns appeared to emulate natural tarns well in terms of terrestrial invertebrate diversity, with the species diversity at each tarn type being very similar. Watson et al (2024) concluded that many of the constructed tarns provided new and important habitat that was statistically indistinguishable from natural tarns in terms of aquatic invertebrate communities. The year in which tarns were constructed was not a significant determinant of community structure, which suggests that manmade tarns can provide suitable habitat and be colonised quickly by aquatic species (Watson et al, 2024).

9.7.3.2. Remediation Actions Proposed

Mined areas will be progressively rehabilitated as mining proceeds in accordance with a comprehensive site Rehabilitation Management Plan (BPCP-ENV-PLN-002, Bathurst Resources 2026a). The Rehabilitation Management Plan incorporates direct transfer of vegetation ('VDT'), planting and creation of habitats for bryophytes, lichens and fauna. The effective implementation of the Rehabilitation Management Plan is expected to substantially mitigate/remediate adverse effects on ecological values.

In the short term, creation of stable surfaces and establishment of vegetative cover which are suitable to avoid sediment and runoff effects as identified above will assist in remediating the Project Area. In the longer term, disturbed areas will be restored to a cover of locally appropriate indigenous species that is based on pre-mining vegetation types and compatible with the surrounding ecosystems and landscape.

The medium to long term focus of rehabilitation will be to develop self-sustaining ecosystems with similar plant and animal species diversity and functionality to the surrounding (undisturbed) environment. The extent and proportion of vegetation types will be different to the pre-mining situation with fewer, more simple vegetation communities which lack the extensive ecotones and complex mosaic of habitat types characteristic of the pre-mining vegetation. The main ecological drivers of altitude, aspect, drainage, rock cover and slope will remain, albeit permanently modified by mining and simplified in the reconstructed ELFs.

Plant lists for planted areas have been based on pre-mining vegetation plots (described by Ecological Solutions Limited 2026b) so as to include all dominant species in similar proportions to their natural occurrence.

Rehabilitation is set out in a detailed site wide Rehabilitation Management Plan (BPCP-ENV-PLN-002, Bathurst Resources Limited 2026a) and will include provision for fauna species in rehabilitated areas (e.g., providing burrows, suitable plant communities and translocation of species unable to colonise naturally via VDT). The species management plans and the site Rehabilitation Management Plan cross reference each other to maximise the potential of rehabilitated sites for fauna post-mining.

The Rehabilitation Management Plan and other management plans have been prepared in accordance with good practice guidelines[14] and the recommendations of Ecological Solutions Limited's (2026h) review of rehabilitation outcomes at Stockton Mine, including:

- Rehabilitation planning will identify and consider the final ecosystem type achievable taking into account elements such as altitude, slope, drainage and aspect. Planting will be done in such a way as to facilitate succession towards the appropriate vegetation community (forest, shrubland, tussockland etc).
- Specific management actions to protect and maintain the 'Threatened' and 'At Risk'

[14] Simcock, R., & Ross, C. 2014. Guidelines for mine rehabilitation in Westland. Manaaki Whenua Landcare Research report prepared for West Coast Regional Council. Envirolink Advice Grant: 937-WCRC83.

vascular plants and bryophytes. This management includes a variety of actions including direct transfer at a range of scales, propagation and repatriation to rehabilitated areas and explicit consideration in rehabilitation planning as set out in the site Rehabilitation Management Plan (Bathurst Resources Limited 2026a).

- Remediation measures include rehabilitation of the site. The rehabilitation proposed for the Project is comprehensive and includes:
    - Vegetation direct transfer ('VDT').
    - Hand transfer.
    - Planting.
    - Other measures to assist in providing habitats for flora and fauna post-mining such as browser and predator control.
- Mining will proceed in stages with management of overburden stripping so as to establish stable landforms conducive to rehabilitation/regeneration and complete that rehabilitation as quickly as practicable in order to reduce the risk of weed invasion and other adverse effects, including on soil stockpiles.
- Soil stockpiles expected to be required for more than five years will be planted, seeded with appropriate native species or treated with jumble dump and/or slash to assist in maintaining their utility and viability.
- Where achievable, vegetation types typical of natural local coal measures vegetation will be the goal. Where that outcome is not achievable, vegetation types dominated by locally appropriate native species and compatible with the surrounding landscape will be the goal. Wire rush will be prioritised in plantings due to its ability to spread and establish ground cover, protect soils and create favourable growing conditions for other species. Mānuka will also be prioritised because of its relative abundance in most pre-mining vegetation communities.
- Rehabilitation outcomes will be varied across the site as appropriate based on VDT and planting. Ultimately, vegetation will be limited by altitude, drainage, aspect, slope angle and soil depth, so using plants or VDT sods that are suited to site conditions will be more likely to replicate a natural ecosystem in the long term.
- Where possible, topsoil and subsoil will be kept separate and soil compaction by heavy machinery will be avoided to maintain suitable conditions for earthworms and other soil fauna.
- To the extent practicable, altitude, slope, drainage, soil depth and quality and aspect of engineered landforms will be varied so as to create a diversity of microhabitats for rehabilitation.
- Vegetation Direct Transfer will be used to the extent practicable, especially for low-growing vegetation communities on competent soils. To date 15% of Stockton Mine has been rehabilitated using VDT. Noting that there will always be operational and other constraints (e.g. soil depth) which would tend to limit the amount of VDT achievable, the target for this project will be at least 15% over the life of the Project. The Annual Workplan must show planned and completed VDT and an annual Rehabilitation Schedule is proposed to assist in planning and executing rehabilitation activities.
- Vegetation Indirect Transfer (where vegetation is stored between stripping and final placement) will be used as appropriate, provided that sufficient storage space is available without removing additional natural habitats. Maintenance of existing natural habitats will be prioritised over storage of stripped material. Note Vegetation

Indirect Transfer is not included in the 15% target for VDT noted above.

- The location of VDT will be planned to enable both connection with surrounding habitats and placements of 'islands' of habitat to act as a source of seeds/propagules for surrounding planted areas.
- Salvage of topsoil, subsoil, wood, plants, mulch, slash, non-acid forming (NAF) rock, boulders, soil and intact root plates (sods) will be maximised to the extent practicable as required for re-use in rehabilitation. Planting sites will be prepared using appropriate soil, ideally un-compacted topsoil of sufficient depth to allow for root establishment of plants.
- Recreation of wetlands, including tarns, as part of rehabilitation will mitigate the loss of wetland extent and values to the extent practicable.
- Transfer of sods from deforested areas and spreading of fresh mixed soils and vegetation ('jumble dumping') at rehabilitated sites will be prioritised after VDT because even if large trees and shrubs are removed, sods will contain tree stumps and woody debris that can provide habitat for fauna. The existing seed bank, mycorrhizae and soil microbiome retained in sods will also likely encourage the area to revert back to appropriate forest at a faster rate than by replanting alone. The addition of microhabitat features such as logs and boulders will assist in providing microhabitats for plants, bryophytes, lichens and, if properly designed and implemented, habitat for fauna as well.
- Notwithstanding the constraints of mine planning, soil stockpiles for subsequent plant establishment should ideally be not compacted and managed to allow for soil invertebrate communities to survive the stockpiling process and colonise rehabilitated areas when topsoil is spread. Use of fresh soils should be prioritised and planting or other treatment to maintain the viability of any stockpiles planned for longer than one year is recommended.
- The pool of planting species will be expanded to include appropriate local species which have been poorly represented in historical plantings. Appropriate coal measures species that are amenable to nursery propagation, either as seedlings, or divisions, will be used more (e.g., wire rush, tussocks (e.g., *Chionochloa juncea*), podocarps (e.g., pink pine (*Halocarpus biformis*), yellow–silver pine (*Lepidothamnus intermedius*)).
- The use of species not typical of the local coal measures ecosystem will be avoided, or at least minimised. This includes bush and snow tussocks (*Chionochloa conspicua*, *C. flavescens*), koromiko (*Veronica salicifolia, V. stricta*), broadleaf (*Griselinia littoralis*), mountain akeake (*Olearia avicenniifolia*), Northern rātā (*Metrosideros robusta*), harakeke (*Phormium tenax*) and kānuka (*Kunzea robusta*).
- Use of any soil likely to contain *Juncus squarrosus* will be avoided in the first instance. Since avoidance is unlikely to be achievable in all cases due to the shortage of soil at the site, soils known to contain *J. squarrosus* will be used for rehabilitating taller shrublands and forest only, since these communities will eventually shade out and supress this weed (R. Simcock pers. comm.).
- Hydroseeding of steep batters with locally sourced species will assist in reducing the potential for exotic species establishment.
- Creation of habitat for fauna including roroa, lizards and snails. Provision of fauna habitat will be planned as part of rehabilitation through the creation of microhabitat features (e.g., wood stacks, boulders), and macrohabitat features (e.g., logs with holes). This is particularly important for planted areas as it takes a long time for natural refuges to develop. The provision of fauna habitat has the added benefits of

reducing the area of bare ground available for weed colonisation, providing microsites to enable plant establishment, assist with erosion control and provide nutrients for plants through decomposition.

- Specific attention to rehabilitation of bryophyte habitats to assist in maintaining the 'Threatened' and 'At Risk' species throughout their natural range. This includes steep, damp rock faces, boulder fields with sheltered cavities and a range of suitable vegetation types (e.g., pākihi, shrubland, low forest). The most successful rehabilitation method for retaining and promoting ecological values is VDT, which most closely replicates natural ecosystems (Ecological Solutions Limited 2026h). VDT supports a wide range of *in situ* biodiversity and will be used to assist species dispersal across rehabilitated sites via placement and connectivity to other habitats. Consideration of the following variables has been included in the design for bryophyte rehabilitation:
    - The use of VDT with the objective to retain key vegetation communities;
    - Habitat specificity – recognising unique habitat requirements for different species;
    - Habitat design that offers niche and humid microsites, and a variety of hydrological conditions, including the presence of standing water/tarns;
    - Variable substrates – the use of salvaged sandstone, woody debris, low fertility soils and an organic soil layer; and
    - Control of heath rush.
- Monitoring of rehabilitation outcomes using permanent plots is proposed. In addition, control sites will be established to enable a comparison of 'natural' vegetation with vegetation at rehabilitated sites over time.
- Where practicable, direct transfer to previously disturbed but unrehabilitated areas will be undertaken where suitable vegetation consistent with the surroundings is available and the vegetation can be maintained (e.g., not on tracks which experience high public use which cannot be prevented).
- Tarns will be constructed on gently sloping banks with semi-natural hydrologic regimes and suitable (soft, moist) substrates to support diverse plant communities including emergent vegetation. Constructed tarns will aim to have a sediment base over rock/gravel floor so as to more closely resemble natural tarns and provide better habitat for aquatic invertebrates.
- Areas of bare rock and low vegetation will be included in rehabilitation.
- Addition of large woody debris and/or root wads, as well as additional edge planting if required is proposed at constructed tarns.

The management actions recommended to mitigate and remediate effects on particular ecological values are summarised in Table 11.

Table 11: Application of the effects management hierarchy to avoid, minimise and remedy adverse effects on ecological values to the extent practicable within and adjoining the Buller Plateaux Continuation Project.

Ecological Feature	Proposed Management
Avoiding Effects	
Vegetation	Physical delineation of vegetation to be cleared to avoid inadvertent clearance and to minimise potential damage to branches and roots, including from pin-hole borer. Directional felling to prevent damage to vegetation immediately adjacent to the footprint. To the extent practicable avoid storage of soil and other rehabilitation resources on existing vegetation to reduce impacts. Avoid the use of species not typical of the local coal measures ecosystem. This includes bush and snow tussocks (*Chionochloa conspicua, C. flavescens*), koromiko (*Veronica salicifolia, V. stricta*), mountain akeake (*Olearia avicenniifolia*), Northern rātā (*Metrosideros robusta*), harakeke (*Phormium tenax*) and kānuka (*Kunzea* sp.).
Wetlands	Physical delineation of vegetation to be cleared to avoid inadvertent clearance and to minimise potential damage, including from heavy machinery. Directional felling to prevent damage to vegetation immediately adjacent to the footprint. Erosion and sediment control measures to avoid mobilisation of sediment to wetlands and aquatic receiving environments.
Birds	Where practicable avoid forest vegetation clearance during peak bird breeding season (August to December inclusive) to avoid and reduce the risk of mortality of eggs or chicks.
Lizards	Where practicable avoid shrubland vegetation clearance during May – August (inclusive) when lizards are inactive and less likely to be captured.
Invertebrates	No specific avoidance measures proposed. Avoiding effects on habitats will benefit invertebrates.
Minimising Effects	
Vegetation	Staged mining so that areas are rehabilitated promptly and habitats become available for occupancy as quickly as possible. Use of biomass such as felled trees and branches and large rock to reduce the amount of bare substrate, create microhabitats to promote vegetation growth and reduce edge effects (see below). Planting or placement of indigenous vegetation as soon as possible after earthworks and biomass spreading is

	completed. Targeted use of fertilisers at planting to promote growth of indigenous species ahead of weeds as well as the development of litter and above-ground biomass. This will be underpinned by a research programme which will identify the methods best suited for this purpose. Maximise use of fresh jumble dump at rehabilitated sites to maximise potential of vegetative material contained within it. Management of soil stockpiles to maximise soil viability (low stockpiles, short term, perhaps planting). Attention to edges in rehabilitation efforts to reduce severity and longevity of edge effects. This could include bunding/placement of slash and/or boulders to reduce exposure at cut faces and/or dense planting to develop buffer vegetation. Implementation of biosecurity plan to reduce likelihood of new weeds and pests arriving (see below)
Birds (including roroa)	Radio-tracking of roroa in the area prior to commencing works and pre-clearance surveys to ensure resident birds are out of harm's way. Capture and relocation of kakaruwai/South Island robin and mātātā/South Island fernbird in advance of clearance at some locations.
	If vegetation clearance during peak breeding season is unavoidable, consider implementation of setbacks or use of other methods (such as discouraging bird nesting for non-site attached species). Mammalian pest control to assist in maintaining local populations.
Lizards	Where practicable, undertake shrubland and low vegetation clearance during warmer months when lizards are more active and more likely to be detected and salvaged. Where practicable salvage and relocation of West Coast green gecko, forest gecko, Westland speckled skink prior to and during vegetation clearance. Use of VDT since lizards are known to survive VDT process. Use of optimal sized buckets to maximise indirect salvage of individual lizards during the VDT process. Mammalian pest control to assist in maintaining local populations.
Invertebrates	Salvage and relocation of *Powelliphanta patrickensis* snails prior to and during vegetation clearance. Use of VDT since snails are known to survive VDT process and that habitat is suitable for snails more quickly. Topsoil and subsoil should be kept separate during the rehabilitation process and soil compaction by heavy machinery should be avoided to provide favourable conditions for earthworms to persist and provide food for *Powelliphanta* snails and roroa.

	Mammalian pest control to assist in maintaining local populations.
Wetlands/streams	Weed management in wetland areas (see below)
Weed Management	**Pre-disturbance:** Baseline survey of the Weed Management Area set out in the Weed Management Plan to identify the location and extent of weed infestations and produce a comprehensive map of exotic vegetation to inform weed control requirements. Herbicide spraying focused on: • Edges of roads and tracks. • Areas where there has been previous mining including Deep Creek, Escarpment Mine, Mt William North and along Cedar Creek Road. • Previously disturbed areas/tracks including at Blackburn Pākihi. **Post-disturbance:** Minimise the amount of bare ground at any one time in order to reduce the risk of weed invasion. Prompt re-vegetation of bare ground as quickly as possible to reduce the risk of weed invasion. Hydroseeding of steep batters with locally sourced species to assist in reducing the potential for exotic species establishment. Use of any soil likely to contain *Juncus squarrosus* to be avoided in the first instance. Soils known to contain *J. squarrosus* should be used for rehabilitating taller shrublands and forest only, since these communities will eventually shade out and supress this weed Implement the Weed Management Plan (BPCP-ENV-PLN-008) to ensure monitoring/surveillance of disturbed areas for weeds and implementation of regular weed control.
Pest Animal and Invertebrate Management	Stoat and other pest mammal control surrounding the mine in accordance with the Pest Control Plan (BPCP-PLN-ENV-022) so as to maintain fauna numbers in the vicinity and reduce effects on vegetation (including planted vegetation). Implementation of Biosecurity Management Plan (BPCP-ENV-PLN-007) to reduce the risk of new pests establishing (see below)
Biosecurity	Apply effective biosecurity in accordance with the Biosecurity Management Plan (BPCP-ENV-PLN-007) to machinery and personnel entering natural and rehabilitated sites. Surveillance and control at high-risk sites. For example: • Boot wash stations to be installed at entrances to soil stockpiles and other sensitive locations (e.g., Blackburn Pākihi, soil storage locations).

	• Regular surveillance for weeds and pests at hardening off areas and rehabilitation areas with low, vulnerable vegetation and control as required. This includes all VDT locations, and planted areas classified as one of the 'low vegetation' types described in the Rehabilitation Management Plan. • Vehicle wheel wash for vehicles associated with civil and rehabilitation works travelling between existing mining areas and weed free areas. A vehicle assessment for tracked vehicles and new contractor vehicles will also be provided when first arriving at site. Where there is an assessed risk of weed transfer to sensitive areas, these vehicles will be washed. Any commercial nursery raised plants used for restoration planting should be sourced from nurseries which follow best-practice hygiene measures and have Plant Pass accreditation. Bathurst's own nursery to follow best-practice hygiene measures.
Remediating Effects	
Vegetation	Vegetation Direct Transfer (VDT) where practicable. Goal of at least 15% of pre-mining vegetation to be directly transferred across whole project. Top soil availability and use to be monitored via the Annual Work Plan to ensure sufficient growth media is available to meet rehabilitation goals set out in the Rehabilitation Management Plan (BPCP-ENV-PLN-002). Specific management of 'Threatened' and 'At Risk' plant species; depending on species this could include hand-transfer, salvage and repatriation or propagation and planting. Vegetation Indirect Transfer (VIT) to be used as appropriate, provided that sufficient storage space is available without removing additional natural habitats. VDT to previously disturbed areas outside the footprint (such as unused tracks) where achievable. Planting of locally important/distinctive coal measures species to be widely distributed across planted areas to provide a seed source to allow/promote recolonisation throughout rehabilitated areas. Planting of indigenous vegetation as soon as possible after earthworks and biomass spreading is complete. Jumble dump fresh soils/vegetation to be used where practicable to maximise regeneration potential of this resource. VDT to be planned to enable physical/ecological connection with surrounding habitats and placement of 'islands' of habitat to act as a source of seeds/propagules for surrounding planted areas. VIT to be used if it can be stored without affecting natural habitats. Transfer of sods from forested areas, either as VDT or DT of slash, to provide habitat for fauna and assist in maintaining the existing seed bank and encouraging the area to regenerate faster, and with greater species diversity/richness, than by replanting alone. Maximise use of rehabilitation resources (soils, vegetation, rocks and boulders and woody and other debris) to accelerate the return to indigenous vegetation at rehabilitated sites.

	Use of biomass such as felled trees and branches and large rock to treat edges and reduce the amount of bare substrate and create microhabitats to promote vegetation growth. Restoration of vegetation types typical of natural local vegetation will be the rehabilitation goal to be informed by pre-mining plot-based surveys. Where that outcome is not achievable, vegetation types dominated by locally appropriate native species and compatible with the surrounding landscape will be the goal. Wire rush to be prioritised in plantings due to its ability to spread and establish ground cover, protect soils and create favourable growing conditions for other species. Mānuka will also be prioritised because of its relative abundance in most pre-mining vegetation communities. Expand the pool of planting species to include appropriate local species which have been poorly represented in historical plantings. Appropriate coal measures species that are amenable to nursery propagation, either as seedlings, cuttings or divisions, will be used more (e.g., wire rush, tussocks (e.g., *Chionochloa juncea*), podocarps (e.g., pink pine (*Halocarpus biformis*), yellow–silver pine (*Lepidothamnus intermedius*). Planting sites should be prepared using appropriate soil, ideally un-compacted topsoil of sufficient depth to allow for root establishment of plants. If soil stockpiles are to be maintained for more than five years, planting with local species or surface treatment with mixed soils and vegetation should be used to assist in promoting and retaining soil fauna, reducing sediment mobilisation and providing established plant material for transfer.
Bare rock	Creation of areas with a high proportion of rock to provide habitats for flora (vascular and non-vascular) and fauna which typically occupy sandstone pavement (includes coal floor and created rock fields). Creation of boulder fields to provide habitats for flora and fauna which use or are specific to those habitats.
Invertebrates	Rehabilitation site(s) enhancement through: • Salvaged coarse wood or rock deployment to increase habitat suitability and variety. • Targeted use of fertliser to promote plant growth and assist in establishing leaf litter and above ground biomass. • Mammalian pest control surrounding the mine site to assist in maintaining local populations. • Creation of habitat for fauna (including snails) as part of rehabilitation. • Investigate the feasibility of breeding/releasing native earthworms at rehabilitated sites to provide food for snails and roroa. • Use of indigenous vegetation in rehabilitation. • Use of a variety of rehabilitation techniques to assist in creating habitat diversity. • Creation of different indigenous habitat types (rocky, low vegetation, shrubland, tall forest) with varying architecture and species dominance.
Birds	Roroa - creation of burrows/roosts in rehabilitated areas.

Lizards	Relocation site(s) enhancement through: • Salvaged coarse wood or rock deployment to increase habitat suitability. • Excavation of cavities below the surface to provide stable refugia which are protected from extreme cold temperatures during winter. Mammalian pest control.
Bryophytes	VDT of habitats to maintain populations. Hand salvage and relocation of bryophytes of conservation concern when VDT is not an option. Creation of suitable habitats as part of rehabilitation so that appropriate bryophyte communities will develop over time Ex situ propagation (in the lab), research aimed at better understanding habitat requirements, life history and management techniques.
Wetlands	Creation of poorly drained engineered landforms (ELFs) to promote wetland development. VDT of wetland vegetation to suitable ELFs Planting of indigenous wetland species to promote the development of wetland communities typical of/similar to undisturbed wetland habitats across the plateaux. Creation of tarns on gently sloping surfaces with semi natural hydrologic regimes and suitable (soft, moist) substrates. Addition of large woody debris and/or root wads as well as edge planting to assist in development of indigenous communities of flora and fauna.

9.8. Magnitude of Effects Assessment

The magnitude of effects on ecological values is assessed based on the extent, intensity, duration and timing of effects associated with the Project and is independent of the 'Ecological Value' assigned to each ecological feature. It takes into account the actions to avoid, minimise and remedy the effects and the extent to which those actions reduce effects. This assessment is set out in Table 12 for vegetation and habitats and Table 13 for species of 'Threatened' and 'At Risk' fauna and flora. Table 13 identifies species for which the level of effects is such that specific management would most likely assist in reducing adverse effects.

Table 12 and Table 13 include four columns relating to the magnitude of effects – the first relating to site extent (in hectares), the second relating to the proportion of that vegetation type within the Mapped Area and the third relating to the proportion of that vegetation type within the Ngakawau ED. The fourth column (headed 'Overall magnitude of effect' synthesises the previous three columns to come to an overall assessment of the magnitude of effect as explained in Section 2.2.3. See Section 2.2 for an explanation of the categories assigned.

In summary, with respect to vegetation and landcover types, the overall magnitude of effect adopted here is equivalent to the highest magnitude level identified at each of across the three scales assessed. The highest magnitude of effect level is the level which considers site extent, and is equivalent to assessing the effects at the scale of the project, rather than the mapped area or ecological district scales. However, consideration has also been given to the level of effects at these larger scales as they are important for providing context and are therefore included below.

Whilst remediation is important, the uncertainty associated with mine staging and timing of rehabilitation (particularly VDT), means that it is not possible to predict exactly how much vegetation of each type will be salvaged and transferred. Furthermore, remediation via planting will take a long time (decades – centuries) to achieve vegetation of a similar ecological value. For these reasons, remediation is given little weight in determining the magnitude of effects on vegetation types and does not materially change the magnitude once avoidance and minimisation are taken into account.

With respect to species, management actions including remediation/rehabilitation can result in the retention and maintenance of particular species in the local environment. By way of example, some species of 'Threatened' and 'At Risk' plants can be maintained via hand transfer and/or propagation into planted areas. Fauna species can be maintained via salvage and relocation and can make use of rehabilitated habitats, particularly if key habitat features are provided, which do not need to be identical to the habitats present currently. On that basis, the effect of combined management actions aimed at reducing adverse effects (including rehabilitation) is included in the overall assessment of the magnitude of effect for species.

Table 12: Overall Magnitude of Effects of the Buller Plateaux Project on vegetation and habitats.

Indigenous vegetation and habitats	Removed		Edge effects (within the Indirect Effects Contingency areas)		Methods to avoid, minimise or remedy adverse effects.	Rehabilitation goal within Disturbance Area[15]	Change in extent within Disturbance Area	Magnitude of effect (extent)	Magnitude of effect (Mapped area)	Magnitude of effect (Ecological District)	Overall magnitude of effect
	Extent (ha)[16]	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area							
Forest											
Mixed beech-podocarp-broadleaved forest	5.5	0.5	9.1	0.8	Implementation of site environmental management plans including: Mine Plan; Weed Management Plan; Biosecurity Plan; Pest Mammal Control Plan; and Rehabilitation Management Plan (which includes edge effects management. These plans provide for the following: • Staged mining and rehabilitation; • Maximising use of VDT where practicable/achievable; • Management of rehabilitation resources including soil, logs, vegetation and rock; • Weed control; • Management of edges to reduce effects • Vertebrate pest control; • Provision of fauna habitat as part of rehabilitation strategy. • Establishment of vegetation expected to transition to forest vegetation types over time, taking into account drainage, slope, aspect and altitude and pre-mining species composition. The rehabilitation plan provides for creation of 248.7ha of forest habitat as part of the 'native ecosystems' rehabilitation treatment, all of which would be planted. This includes 7.2ha of 'tall forest mix' based on plots from mixed beech – podocarp – broadleaf forest, to be planted at lower elevation. This is a similar amount of tall forest to that present pre-mining, but planted areas will take many decades/more than a century to achieve comparable habitat. Edge-affected areas would not be completely removed, but could be degraded for at least the life of mining at a particular location and until adjoining revegetation matures. Edge effects would be minimised via treatment at vegetation stripping in accordance with the relevant section of the Rehabilitation Management Plan.	7.2	+1.8	Moderate	Negligible	Negligible	Moderate
Southern rātā-mountain beech-podocarp forest	177.1	7.1	49.4	2.0	As above. Of the 248.7ha of forest proposed to be planted as part of rehabilitation, 234.2ha would comprise 'beech forest mix a' based on plot data from Southern rātā-mountain beech-podocarp forest. This is 57ha more than the pre-mining extent, but would take many decades to achieve comparable habitat.	234.2	+57.1	Very High	Moderate	Moderate	Very High
Silver beech-mountain beech forest	5.5	3.4	0.5	0.3	As above. Of the 248.7ha proposed to be planted as part of rehabilitation, 7.3ha would be 'beech forest mix b' based on plot data from silver-beech mountain beech forest and proposed to be planted at higher elevations. This is similar amount to pre-mining, but would take many decades/more than a century to achieve similar habitat.	7.3	+1.8	Moderate	Low	Low	Moderate
Forest overall	**188.1**		**58.9**			**248.7**	**+60.6**	**Very High**	**Moderate**	**Moderate**	**Very High**

[15] Based on final Landform ('Native ecosystem' and 'Wetland' shapefile layers) and the slope of the ELF. Shapefiles released 5 December 2025.
[16] Based on 'Disturbance area' (new and existing disturbance, with respect to Mount Frederick South, Extended Escarpment and the Upper Waimangaroa Haul Road, and new disturbance only with respect to Stockton) shapefiles released 15 October 2025.

Indigenous vegetation and habitats	Removed		Edge effects (within the Indirect Effects Contingency areas)		Methods to avoid, minimise or remedy adverse effects.	Rehabilitation goal within Disturbance Area	Net outcome	Magnitude of effect (extent)	Magnitude of effect (Mapped area)	Magnitude of effect (Ecological District)	Overall magnitude of effect
	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area							
Shrubland											
Mānuka-mountain beech-podocarp shrubland	84.7	5.8	13.4	0.9	Implementation of site environmental management plans including: Weed Management Plan; Biosecurity Plan; Pest Mammal Control Plan; and Rehabilitation Management Plan which includes: • Staged mining and rehabilitation. • Prioritisation of VDT where practicable/achievable. • Management of rehabilitation resources including soil, vegetation and rock. • Weed control • Management of edges • Vertebrate pest control • Rehabilitation of areas to shrubland vegetation types taking into account drainage, slope, aspect and altitude and based on pre-mining vegetation composition. Shrublands and low habitat are particularly amenable to VDT. The rehabilitation plan provides for creation of 125.7ha of shrubland habitats, as part of the 'native ecosystems' and 'wetland' rehabilitation treatments. This includes 52.8ha of planting of 'shrubland mix a'. This is approximately 31.9ha less than pre-mining. Planted areas would take two - three decades to achieve closure based on known growth rates at Stockton. Edge effects would be minimised via treatment at vegetation stripping in accordance with the relevant section of the Rehabilitation Management Plan. Edges could be degraded for at least the life of mining at a particular location and until adjoining revegetation matures.	52.8	-31.9	High	Moderate	Low	High
Mānuka/Gahnia-wire rush shrubland	9.2	6.3	1.1	0.8	As above The rehabilitation plan provides for creation of 125.7ha of shrubland habitats, as part of the 'native ecosystems' and 'wetland rehabilitation treatments, including 5.7ha of 'shrubland mix b'. This is a slight reduction in extent to that present pre-mining. Any VDT habitats would be established almost immediately, but planted areas would take two - three decades to achieve based on known growth rates at Stockton.	5.7	-3.5	Moderate	Moderate	Negligible	Moderate
Weedy shrubland	12.5	7.6	2.1	1.3	As above. Provides an opportunity to remove weeds and improve habitat integrity.	0	-12.5	Moderate	Moderate	Low	Moderate
Mānuka-tussock-wire rush shrubland	104.2	11.0	12.9	1.4	As above. The rehabilitation plan provides for creation of 125.7ha of shrubland habitats, as part of the 'native ecosystems' and 'wetland' rehabilitation treatments, including 64.9ha of 'shrubland mix c'. This is 39.3ha less than pre-mining. VDT habitats would be established almost immediately, but planted areas would take two - three decades to achieve based on known growth rates at Stockton.	64.9	-39.3	High	Moderate	Low	High
Mānuka-mountain flax/wire rush shrubland	3.7	3.0	0.3	0.2	As above. The rehabilitation plan provides for creation of 125.7ha of shrubland habitats, including 2.3ha of 'flax shrubland mix a'. This is 1.4ha less than pre-mining habitat. VDT habitats would be established almost immediately, but planted areas would take two - three decades to achieve based on known growth rates at Stockton.	2.3	-1.4	Low	Low	Negligible	Low
Shrubland overall	**214.2**		**29.8**			**125.7**	**-88.5**	**High**	**Moderate**	**Low**	**High**

Indigenous vegetation and habitats	Removed		Edge effects (within the Indirect Effects Contingency areas)		Methods to avoid, minimise or remedy adverse effects.	Rehabilitation goal within Disturbance Area	Net outcome within Disturbance Area	Magnitude of effect (extent)	Magnitude of effect (Mapped area)	Magnitude of effect (Ecological District)	Overall magnitude of effect
	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area							
Low vegetation											
Low pākihi Naturally uncommon ecosystem	213.9	10.3	23.1	1.1	Implementation of site environmental management plans including: Annual Work Plan, Weed Management Plan, Biosecurity Plan, Pest Mammal Control Plan and Rehabilitation Management Plan which include the following measures: • Management of soil which includes weed seeds to reduce ongoing effects • Management of rehabilitation resources including soil, vegetation and rock • Weed control • Management of edges • Vertebrate pest control • Rehabilitation of areas to forest, shrubland and low growing vegetation types taking into account drainage, slope, aspect and altitude. • Creation of areas with a high proportion of rock to provide habitats for flora and fauna using sandstone pavement. Prioritisation of VDT where slopes and vegetation types allow will favour shrubland and low vegetation types.	129.1	-84.7	Very High	Moderate	Moderate	Very High
Tussock-mountain flax shrubland	1.7	1.5	0.8	0.7	As above Planting of 1ha of 'flax shrubland mix b' based on pre-mining composition	1	-0.7	Low	Low	Low	Low
Exotic grassland	0.8	32.8	0.1	3.9	Replacement with indigenous vegetation in the medium – long term as part of site rehabilitation. Some areas of exotic grassland will remain.	0	0	Negligible	Negligible	Negligible	Negligible
Low vegetation overall	**216.4**		**24.0**			**130.1**	**-85.4**	**Very High**	**Moderate**	**Moderate**	**Very High**
Non-vegetated landcover types											
Bare Rock (Sandstone Pavement) Naturally Uncommon Ecosystem	63.6	7.2	6.3	0.7	As above. Creation of rocky substrates (including exposed coal floor and rockfield) to provide habitat for species adapted to rocky habitats. This does not replicate sandstone pavement, but does provide habitat for some species of flora and fauna which typically occupy pavement. Habitat for biota addressed via provision of rockfield ecosystem rehabilitation type, specific management and prioritisation of threatened plant species.	Rockfield rehabilitation 91.1ha		High	Moderate	Moderate	High
Cleared vegetation	69.8	19.5	8.8	2.5	Loss of 69.8ha of cleared vegetation and associated edge and disturbance related effects estimated to affect 19.5ha. This equates to removal of 8.8% and indirect effects on 2.5% of the available habitat within the mapped area. Loss of 0.5ha of open water infrastructure and associated edge and disturbance related effects estimated to affect 0.2 ha.	23.6ha of infrastructure, 28.0ha of water infrastructure[17], 13.5ha of sump, 6.1ha of undisturbed[18].		Negligible	Negligible	Negligible	Negligible
Non-vegetated Cover Overall	**133.4**		**15.1**					**High**	**Moderate**	**Moderate**	**High**

[17] Excludes water infrastructure for the Upper Waimangaroa Haul Road.
[18] Final landform (shapefiles released 5 December 2025) classified as undisturbed, within Disturbance Area (shapefiles released 15 October 2025).

Other Naturally Uncommon Ecosystems		
Tarns	Unknown extent. At least 500m² of permanent tarn and 600m² of ephemeral tarn to be constructed as part of rehabilitation.	High
Flushes and seeps	Small and widely dispersed. Not reproducible at rehabilitated sites.	Moderate
Boulderfields of acidic rocks	Present at MFS Project Area. At least 400m² of vegetated boulderfields to be constructed as part of rehabilitation.	Low

Table 13: Overall Magnitude of Effects of the Buller Plateaux Continuation Project for 'Threatened' and 'At Risk' flora and fauna.

	Loss of habitat						Methods to avoid, minimise or remedy adverse effects.	Magnitude of effect (extent)	Magnitude of effect (within mapped area)	Magnitude of effect (Ecological District)	Overall magnitude of effect
	High value habitat		Moderate value habitat		Low value habitat						
	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area					
Vascular Plants											
Threatened – Nationally Vulnerable											
Bearded orchid (*Calochilus paludosus*)	0.0	0	239.5	10.9	131.3	10.8	Not detected in the Project Area to date. Orchids have very light wind dispersed seed and there are no proven management techniques. The best outcome that can practically be achieved is to create suitable habitat as part of rehabilitation to assist in natural colonisation. Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation is expected to assist.	High	Moderate	Low	High (if present)
At Risk – Declining											
Bulbinella modesta	117.1	12.4	253.7	10.3	0.0	0.0	As above	Very high	Moderate	Low	Very High (if present)
Caladenia alata	117.1	12.4	0.0	0	127.0	6.7	As above	Moderate	Moderate	Low	Moderate (if present)
Coal measures tussock (*Chionochloa juncea*)	440.7	10.1	79.6	22.0	112.8	6.9	Local endemic. Widespread and locally common on Buller Plateaux. Very amenable to VDT and propagation. Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate.	Very high	Moderate	Moderate	Moderate
Dracophyllum densum	307.0	10.3	79.6	19.3	131.3	0.0	Amenable to VDT and hand DT. Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate.	Very high	Moderate	Moderate	Moderate
Euphrasia wettsteiniana	239.5	10.9	0.0	0	117.1	12.4	Only able to be mitigated by VDT of wetland habitat where it occurs	Very high	Moderate	Moderate	Very high
Long-leaved pimelea (*Pimelea longifolia*)	2.5	2.2	244.1	8.6	469.5	9.9	Not detected in the Project Area to date. Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate.	High	Moderate	Low	Moderate (if present)
Red mistletoe (*Peraxilla tetrapetala*)	232.5	8.8	112.7	4.4	14.6	8.9	Present in ESE Project sub-area. Only three records from Buller Plateaux. Propagation and repatriation can establish new individuals.	Very high	Moderate	Low	Very low - positive
At Risk – Naturally Uncommon											
Astelia subulata	237.0	11.4	2.5	2.0	0.0	0	Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate. Successfully propagated and repatriated.	Very high	Moderate	Moderate	Moderate

	Loss of habitat						Methods to avoid, minimise or remedy adverse effects.	Magnitude of effect (extent)	Magnitude of effect (within mapped area)	Magnitude of effect (Ecological District)	Overall magnitude of effect
	High value habitat		Moderate value habitat		Low value habitat						
	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area					
Brachyglottis traversii	307.0	10.3	2.5	2.0	209.9	13.4	Not detected in the Project Area to date. Wind dispersed seeds. Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate. Small numbers of closely related *B. belidioides* have been successfully propagated and repatriated.	Very high	Moderate	Moderate	Very high
Carse's sedge (*Carex carsei*)	2.5	2.2	237.0	11.4	244.1	8.6	As above.	High	Moderate	Low	Moderate
Dall's sedge (*Carex dallii*)	119.6	11.3	237.0	11.4	127.0	6.7	As above.	High	Moderate	Low	Moderate
Euphrasia disperma	239.5	10.9	0.0	12.3	0.0	0.0	Only able to be mitigated by VDT of wetland habitat where it occurs	Very high	Moderate	Low	Very high
Hymenophyllum australe	0.0	0	0.0	0	0.0	0	Not detected in the Project Area to date. Lives in forest. Nothing planned.	Negligible	Low	Very low	Low (if present)
Hymenophyllum pluviatile	0.0	0	345.2	6.6	0.0	0	Not detected in the Project Area to date. Lives in forest. Nothing planned.	High	Moderate	Low	High (if present)
Dwarf rush (*Juncus pusillus*)	117.1	12.4	253.7	10.3	0.0	0.0	Not detected in the Project Area to date. Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate.	Very high	Moderate	Low	Moderate
Pterostylis humilis	0.0	0	2.5	2.2	315.6	12.9	Not detected in the Project Area to date. Orchids have very light wind dispersed seed. Creation of suitable habitat as part of rehabilitation is expected to assist in colonisation. Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate.	High	Moderate - low	Very low	High
Travers horopito (*Pseudowintera traversii*)	0.0	0	247.0	6.6	240.2	8.8	Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate. Small numbers of individuals have successfully propagated and repatriated.	Very high	Moderate	Low	Moderate
Schizacme helmsii	232.5	8.8	112.7	4.4	0.0	0	Not detected in the Project Area to date. Only realistic mitigation is hand DT or VDT	Very high	Moderate	Low	Very high (if present)
Townsonia deflexa	239.5	10.9	70.0	7.9	117.1	12.3	Not detected in the Project Area to date. Orchids have very light wind dispersed seed. Creation of suitable habitat as part of rehabilitation is expected to assist in colonisation. Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk' species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate.	Very high	Moderate - low	Low	Moderate (if present)
Sticherus tener	247.0	6.6	98.2	6.7	14.6	14.6	Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) including Threatened Plants management which collectively provide for retention and maintenance of 'Threatened' and 'At Risk'	High	Moderate	Moderate	Low – positive

	Loss of habitat						Methods to avoid, minimise or remedy adverse effects.	Magnitude of effect (extent)	Magnitude of effect (within mapped area)	Magnitude of effect (Ecological District)	Overall magnitude of effect
	High value habitat		Moderate value habitat		Low value habitat						
	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area					
							species via direct transfer, creation of suitable habitats as part of rehabilitation and including hand transfer, propagation and other methods as appropriate. Moderate numbers of individuals have successfully propagated and repatriated.				
Sticherus urceolatus	0.0	0	324.7	8.2	14.6	8.9	As above.	High	Moderate	Moderate	Low – positive
Bryophytes											
Threatened – Nationally Critical											
Allisoniella scottii	0.0	0	0.0	0	368.3	11.2	Use of VDT to maintain bryophyte populations, creation of habitats suitable for bryophytes as part of site rehabilitation, specific bryophyte management actions including hand DT and research with respect to propagation.	Moderate	Moderate	Moderate	Moderate (if present)
Isolembidium anomalum var. *anomalum*	693.0	9.6	70.0	7.9	37.6	2.4	As above.	Very high	Moderate	Moderate	Moderate
Neogrollea notabilis	366.9	11.2	73.9	7.4	14.6	8.3	As above.	Very high	Moderate	Moderate	Moderate
Pseudolophocolea denticulata	232.5	8.8	215.2	8.9	14.5	1.3	As above.	Very high	Moderate	Moderate	Moderate (if present)
Threatened – Nationally Vulnerable											
Acromastigum verticale	324.7	8.2	10.3	7.1	9.9	3.5	As above.	Very high	Moderate	Moderate	Moderate
Telaranea inaequalis	226.5	9.1	6.0	3.7	466.7	8.3	As above.	Very high	Moderate	Moderate	Moderate
At Risk – Declining											
Acromastigum interstisiale	353.4	6.6	6.0	3.7	2.5	2.0	As above	Very high	Moderate	Low	Moderate
Saccogynidium decurvum	695.5	9.4	6.0	3.7	84.5	4.2	As above.	Very high	Moderate	Low	Moderate
Lichens											
Threatened – Nationally Endangered											
Pycnothelia caliginosa	353.4	6.6	6.0	3.7	2.5	2.0	Creation of habitats suitable for lichens as part of site rehabilitation, and use of VDT.	High	Moderate	Moderate	High
Threatened – Nationally Vulnerable											
Austropeltum glareosum	70.0	7.9	0.0	0	354.1	11.7	As above.	High	Moderate	Moderate	High
Knightiella splachnirima	370.8	10.9	0.0	0	70.0	7.8	As above.	Very high	Moderate	Moderate	Very High
Cladia fuliginosa	370.8	10.9	70.0	7.9	0.0	0.0	As above.	Very high	Moderate	Moderate	Very High
At Risk – Declining											
Cladia inflata	253.7	10.3	215.2	8.9	0.0	0.0	As above.	Very high	Moderate	Moderate	Very High
Birds											
Rorca/great spotted kiwi	249.5	6.5	108.5	6.7	442.6	10.4	Implementation of the Avifauna Management Plan (BPCP-ENV-PLN-003), which includes the following measures: • Radio tracking in advance of mining to map home ranges and inform management. • Decision making as to whether to leave birds in situ or move them for their own protection (e.g., depending on the amount of habitat within their home range removed). • Avoidance of vegetation clearance when birds are incubating eggs.	Very high	Moderate	Low	Moderate

	Loss of habitat						Methods to avoid, minimise or remedy adverse effects.	Magnitude of effect (extent)	Magnitude of effect (within mapped area)	Magnitude of effect (Ecological District)	Overall magnitude of effect
	High value habitat		Moderate value habitat		Low value habitat						
	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area					
							• Pre-clearance survey to ensure birds are outside clearance area Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002), which includes provision for creation of burrows/roosts in rehabilitated areas. Reliant on management techniques which are proven and commonly used. Residual effects to be addressed via offset – compensation package.				
Kārearea/NZ bush falcon	247.0	6.6	536.4	9.4	18.0	6.2	Nothing planned. Effects mitigated by low numbers of highly mobile birds. Exotic birds using the Project Area during mine life and until rehabilitation establishes still provide prey.	Very high	Moderate	Low	Low
Koekoeā/long-tailed cuckoo	247.0	6.6	225.5	8.8	0.0	0	Nothing planned.	Very high	Moderate	Low	Moderate
Kererū	345.2	6.6	0.0	0	135.6	11.1	As above.	Very high	Moderate	Low	Moderate.
Korimako/bellbird	345.2	6.6	0.0	0	148.4	9.7	As above.	Very high	Moderate	Very low	Moderate.
South Island robin	247.0	6.6	98.2	6.7	131.3	10.4	As above.	Very high	Moderate	Very low	Moderate.
Brown creeper	247.0	6.6	229.5	8.4	14.6	8.9	As above.	Very high	Moderate	Very low	Moderate
Tūī	345.2	6.6	0.0	0	148.4	9.7	As above.	Very high	Moderate	Very low	Moderate.
Mātātā/South Island fernbird	133.8	10.1	567.6	9.2	85.5	7.7	As above.	Very high	Moderate	Very low	Moderate.
Pīhoihoi (New Zealand pipit)	524.6	11.2	10.3	7.1	98.2	6.5	As above.	Very high	Moderate	Very low	Positive (short – medium term) Very low (long term)
Weka	730.6	8.3	0.0	0	149.5	12.0	As above.	High	Very high	Low	Moderate
Lizards											
West Coast green gecko	785.9	8.2	14.6	8.3	0.0	0	Implementation of the Lizard Management Plan (BPCP-ENV-PLN-005) which includes the following measures: • Salvage and relocation operations • Relocation site habitat enhancement Implementation of the Rehabilitation Management Plan (BPCP-ENV-PLN-002) which includes the following measures for lizard habitat rehabilitation: • Deployment of salvaged wood and rocks to provide lizard habitat in rehabilitated areas. • Restoration of diverse indigenous vegetation to the ELF promptly. Residual effects to be addressed via the offset – compensation package.	Very high	Moderate	Moderate	Very high
Forest gecko	785.9	8.2	14.6	8.3	0.0	0	As above	Very high	Moderate	Moderate	Very high
Westland speckled skink	430.4	10.3	123.1	6.9	325.6	7.9	As Above	Very high	Moderate	Moderate	Very high
Terrestrial Invertebrates											
Threatened – Nationally Critical											
Avatar moth (*Arctesthes avatar*)	239.5	10.9	187.0	10.2	14.2	5.1	Site biosecurity to reduce risk of new invasions of pest species which might adversely affect this species. Use of VDT to retain host plant (*Liparophyllum gunnii*) Restoration of diverse indigenous vegetation to the ELF promptly, including creation of tarns which can be colonised by *L. gunnii* over time	Very high	High - moderate	Moderate	Very high

	Loss of habitat						Methods to avoid, minimise or remedy adverse effects.	Magnitude of effect (extent)	Magnitude of effect (within mapped area)	Magnitude of effect (Ecological District)	Overall magnitude of effect
	High value habitat		Moderate value habitat		Low value habitat						
	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area	Extent (ha)	% of habitat within mapped area					
Powelliphanta patrickensis	360.5	11.1	108.5	6.5	247.1	8.8	Use of VDT Attention to providing snail habitat as part of rehabilitation Search and salvage	Very high	Very high	Very high	Very high
At Risk - Relict											
Forest ringlet (*Dodonidia helmsii*)	684.7	9.6	17.0	1.4	0.0	0	Planting of high proportion of Gahnia (host plant for caterpillars) in rehabilitation plantings. Larval feeding sites usually associated with shaded canopy which will take some time (decades) to develop.	Very high	High	High	Very high

9.9. Level of Adverse Effects

Table 14 sets out the overall level of effects for terrestrial and wetland values after efforts to avoid, remedy or minimise effects have been implemented effectively. The level of effects is based on the more detailed assessment of ecological value in Section 7.0 and the identification of the magnitude of effects in Section 9.0, particularly Table 12 and Table 13.

Of particular note, the level of effects was assessed as:

- Very High for:
  - Southern rātā-mountain beech-podocarp forest.
  - Mānuka-mountain beech-podocarp shrubland.
  - Mānuka-tussock-wire rush shrubland.
  - Pākihi.
  - Sandstone erosion pavement.
  - Tarns.
  - 'Threatened' and 'At Risk' vascular plants.
  - 'Threatened' and 'At Risk' lichens.
  - 'Threatened' and 'At Risk' lizards and lizard habitats.
  - *Powelliphanta patrickensis* and other 'Threatened' and 'At Risk' invertebrates.
- High for:
  - Mixed beech-podocarp-broadleaved forest.
  - Silver beech-mountain beech forest.
  - Mānuka-Gahnia-wire rush shrubland.
  - Flushes and seeps.
  - 'Threatened', 'At Risk' and locally important or distinctive bryophytes.
  - 'Threatened' and 'At Risk' birds and bird habitats.
  - Terrestrial invertebrate habitats.
  - Locally important or distinctive invertebrates.
- Moderate for:
  - Mānuka-mountain flax/wire rush shrubland.
  - Tussock-mountain flax shrubland.
  - Boulderfields of acidic rock.
  - Locally important or distinctive vascular plants.
  - Locally important or distinctive lichens.
  - Exotic grassland.
  - Cleared vegetation.

Residual effects ranked as 'Moderate' or higher warrant specific consideration for offsetting and/or compensation, which is addressed by Alliance Ecology Limited (2026a).

Table 14: Summary of the level of effect of the Buller Plateaux Continuation Project after measures to avoid, minimise or remedy effects have been implemented.

Habitats	Ecological value	Magnitude of effect	Level of effect	Confidence
Terrestrial ecosystem types				
Mixed beech-podocarp-broadleaved forest	High	Moderate	High	High
Southern rātā-mountain beech-podocarp forest	Very High	Very High	Very High	High
Silver beech-mountain beech forest	High	Moderate	High	High
Mānuka-mountain beech-podocarp shrubland	Very High	High	Very High	High
Mānuka-Gahnia-wire rush shrubland	Very High	Moderate	High	High
Weedy shrubland	Low	Moderate	Low	High
Mānuka-tussock-wire rush shrubland	High	High	Very High	High
Mānuka-mountain flax/wire rush shrubland	Very High	Low	Moderate	High
Tussock-mountain flax shrubland	Very High	Low	Moderate	High
Exotic grassland	Low	Negligible	Very low	High
Cleared vegetation	Low	Negligible	Very low	High
Water	Moderate	Negligible	Very low	High
‘Threatened’ vascular plants (see Table 13)	Very high	High	Very High	Moderate
‘At Risk’ vascular plants (see Table 13)	High	High	Very High	Moderate
Other locally important or distinctive vascular plants	Moderate	Moderate	Moderate	Moderate
Nationally and locally common vascular plants	Moderate	Low	Low	High
Naturally uncommon ecosystems				
Sandstone erosion pavement	Very high	High	Very High	High

Habitats	Ecological value	Magnitude of effect	Level of effect	Confidence
Boulderfields of acidic rock	Very high	Low	Moderate	Moderate
Flushes and seeps	Very high	Moderate	High	Low
Tarns	Very high	High	Very High	Moderate
Pākihi	Very high	Very High	Very high	High
Bryophytes				
'Threatened' bryophytes (see Table 13)	Very high	Moderate	High	Moderate
'At Risk' bryophytes (see Table 13)	High	Moderate	High	Moderate
Locally important or distinctive bryophytes	High	Moderate	High	Moderate
Nationally and locally common bryophytes	Moderate	Low	Low	Moderate
Lichens				
'Threatened' lichens (see Table 13)	Very High	Very High	Very High	Moderate
'At Risk' lichens (see Table 13)	High	Very High	Very High	Moderate
Locally important or distinctive lichens	Moderate	Moderate	Moderate	Moderate
Nationally and locally common lichens	Moderate	Low	Low	Moderate
Terrestrial fauna species				
'Threatened' birds (see Table 13)	Very high	Moderate	High	High
'At Risk' birds (see Table 13)	High	Moderate	High	High
Nationally and locally common birds	Moderate	Low	Low	High
Habitats for birds	Very High	Moderate	High	High
'Threatened' lizards (see Table 13)	Very high	High	Very High	High

Habitats	Ecological value	Magnitude of effect	Level of effect	Confidence
'At Risk' lizards (see Table 13)	High	High	Very High	High
Lizard habitats	Very High	High	Very High	High
Terrestrial Invertebrates				
Powelliphanta patrickensis	Very High	Very High	Very High	High
Threatened Invertebrates (see Table 13)	Very High	High	Very High	Low
At Risk Invertebrates (see Table 13)	High	High	Very High	Low
Locally important or distinctive invertebrates	High	Moderate	High	Moderate - Low
Other common and widespread terrestrial invertebrates	Moderate	Low	Low	Moderate
Invertebrate habitats	Very High	Moderate	High	Moderate

10.0 Wildlife Act Matters

Wildlife Act matters in relation to the BPCP are set out in Appendix G.

11.0 Conclusion

Despite the extensive history of mining, the Buller Plateaux comprises a fine-scale mosaic of fifteen predominantly indigenous vegetation and habitat types (and one cleared vegetation type) according to local ecological gradients in altitude, rainfall, exposure, soil depth and fertility and disturbance history. It also includes five naturally uncommon ecosystem types and much of the vegetation comprises natural inland wetlands. The fine-scale variation in vegetation has resulted in the presence of a high diversity of vascular flora and fauna and the combination of microhabitats present has resulted in a similarly high diversity of bryophytes and lichens. A number of 'Threatened' and 'At Risk' species are present, and a number of species, particularly invertebrates, are yet to be described. The communities present are distinctive and unique, both within the Ngakawau Ecological District and nationally. The ecological values of the Buller Plateaux are very high.

The Project would occupy 2,709ha[19], including 754ha[20] of new Disturbance Area (i.e., directly affected) with a further 128ha affected by edge effects. 2,133.7ha would be located on the Buller Plateaux, with 575.3ha located off the Plateaux. Mining and rehabilitation would be staged and at any one time the total area disturbed would be much less than tht total footprint with progressive rehabilitation, including VDT, mitigating and remedying effects as mining proceeds. There will still be a substantial lag between removal of vegetation and its replacement with usable habitat and this lag constitutes one of the biggest components of the adverse effects of the Project. For indigenous vegetation types, the highest proportion of the Mapped Area affected by vegetation clearance and edge effects would be 12.4% for mānuka – tussock – wire rush shrubland followed by 11.4% for low pākihi. Other vegetation types would be affected to lesser degrees.

The overall residual level of effects for the Project ranges from net gain (for already cleared vegetation replaced by planting or VDT and some species adapted to open habitats) to very high (e.g. for *Powelliphanta patrickensis*). Overall, 33 of the 42 ecological attributes identified would have a 'moderate' or higher level of residual effects, sufficient to require offsetting and/or compensation.

12.0 References

Alliance Ecology Limited. 2024. Baseline Lizard Monitoring Report, Buller Coal Continuation Project. Unpublished draft report prepared for Bathurst Resources Limited.

Alliance Ecology Limited. 2026a. Residual Effects Management Report Buller Plateaux Continuation Project. Unpublished draft report prepared for Bathurst Resources Limited.

Alliance Ecology Limited. 2026b. Pest Control and Elimination Plan. Unpublished draft report prepared for Bathurst Resources Limited.

Bathurst Resources Limited. 2025. Buller Plateaux Continuation Project: Project Description

[19] Based on the GIS shapefiles released 4 December 2025.
[20] Based on the GIS shapefiles released 15 October 2025.

(Version 3).

Bathurst Resources Limited. 2026a. Buller Plateaux Continuation Project: Rehabilitation Management Plan. BPCP-ENV-PLN-002.

Bathurst Resources Limited. 2026b. Buller Plateaux Continuation Project: Weed Management Plan. BPCP-ENV-PLN-008.

Bathurst Resources Limited. 2026c. Buller Plateaux Continuation Project: Erosion and Sediment Control Plan for land disturbance activities. BPCP-ENV-PLN-013.

Bathurst Resources Limited. 2026d. Buller Plateaux Continuation Project: Biosecurity Management Plan. BPCP-ENV-PLN-007.

Buckingham, R.P. 1998. Surveys for endemic bats in the Upper Waimangaroa Exploration Permit Area, and surrounding areas, South Island West Coast, New Zealand. Prepared for Solid Energy International.

Cassola, F. and Moravec, J. 2010. New records of tiger beetles from New Zealand with taxonomic and nomenclatural notes on the genus Neocicindela (Coleoptera: Cicindelidae). Fragmenta entomologica, Roma, 42 (1): 1-22.

Dawson, D.G., Bull, P.C. 1975. Counting birds in New Zealand forests. Notornis 22: 101–109.

de Lange, P., Blanchon, D., Knight, A., Elix, J., Lucking, R., Frogley, K., Harris, A., Cooper, J., and Rolfe, J. 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27. Department of Conservation, Wellington. 64 pp.

de Lange, P.J., Glenny, D., Frogley, K., Renner, M.A.M., von Konrat, M., Engel, J.J., Reeb, C., and Rolfe, J.R. 2020. Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31. Department of Conservation, Wellington. 30 pp.

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

Ecological Solutions Limited. 2025. Cypress Mining Area Annual Vegetation Monitoring Report. Unpublished report prepared for BT Mining Limited by Ecological Solutions Limited, Kāeo, Northland. May 2025. 40 pages + appendices.

Ecological Solutions Limited. 2026a. Buller Plateaux Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 101 pages + appendices.

Ecological Solutions Limited. 2026b. Buller Plateaux Vegetation Mapping. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. January 2026. 65 pages + appendices.

Ecological Solutions Limited. 2026c. Buller Plateaux Continuation Project: Escarpment Extended Project Sub-Area Baseline Surveys. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 37 pages + appendices.

Ecological Solutions Limited. 2026d. Buller Plateaux Continuation Project: Mt Frederick South Project Sub-Area Baseline Surveys. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 28 pages + appendices.

Ecological Solutions Limited. 2026e. Buller Plateaux Continuation Project: Stockton Project Sub-Area Baseline Surveys. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 19 pages + appendices.

Ecological Solutions Limited. 2026f. Buller Plateaux Continuation Project: Upper Waimangaroa Haul Road Project Sub-Area Baseline Surveys. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 23 pages + appendices.

Ecological Solutions Limited. 2026g. Technical Evaluation to Accompany an Application for a Wildlife Act Authorisation for Cypress Consent Area. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 29 pages.

Ecological Solutions Limited. 2026h. Assessment of Rehabilitation Outcomes for Stockton Mine. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. April 2026. 82 pages + appendices.

Ecological Solutions Limited. 2026i. Upper Waimangaroa Haul Road Wildlife Mitigation – Literature Review. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 36 pages.

Ecological Solutions Limited. 2026j. Upper Waimangaroa Haul Road (UWHR) Options Assessment. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 24 pages.

Ecological Solutions Limited. 2026k. Conservation Prioritisation at the Buller Plateaux. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. Ecological Solutions Limited, Kāeo. August 2026. 45 pages + appendices.

Galloway, D.J. 2007. Flora of New Zealand Lichens, Revised Second Edition: Including lichen-forming and lichenicolous fungi. Manaaki Whenua Press, Landcare Research.

Glenny, D. 2012. Bryophytes and lichens in the proposed Escarpment Mine area, Denniston Plateau. Landcare Research Contract Report: LC 1131. Prepared for Buller Coal Ltd. October 2012.

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson G.B., Reardon J.T., van Winkel, D., Makan, T., and Michel, P. 2026. Conservation status of reptiles in Aotearoa New Zealand, 2025. New Zealand Threat Classification Series 50. Department of Conservation, Wellington. 32 pp.

Holdaway, R.J., Wiser, S.K. and Williams, P.A. 2012. Status assessment of New Zealand's Naturally Uncommon Ecosystems. Conservation Biology 26(4):619-629.

Johns, P. M. 2018. *Neocicindela aureata* sp. nov. and notes on some congeners (Coleoptera: Carabidae: Cicindelinae). Records of the Canterbury Museum, 32, 16-22.

Johnson, P. and Gerbeaux, P. 2004. Wetland types in New Zealand. Wellington, Department of Conservation.

Kingett Mitchell & Associates Ltd. 1996. Upper Waimangaroa Project Environmental Baseline Studies.

Landcare Research. 2012. Naturally Uncommon Ecosystems. https://www.landcareresearch.co.nz/publications/naturally-uncommon-ecosystems/. Accessed 1 May 2024.

Lloyd, B.D. 2019. An acoustic survey for bats in the Upper Waimangaroa Catchment. Unpublished report for Bathurst Resources Limited by Lloyd's Ecological Consulting, Nelson. April 2019. 10pp.

Lloyd's Ecological Consulting. 2026. An assessment of the impacts of the Buller Plateaux Continuation Project on *Powelliphanta patrickensis* snails and proposed effects management. Unpublished report, prepared for Bathurst Resources Ltd.

Mabin M., 2012. Statement of evidence of Mark Charles Grace Mabin. Prepared for West Coast Environmental Network Incorporated, Royal Forest and Bird Society of New Zealand Incorporated, West Coast Regional Council and Buller District Councils and Buller Coal Limited. Dated 7 June 2012.

Markham J., M Baber, J Quinn, M Christensen, T Ryan, M Lowe, S Knowles, D Miller, G Ussher. 2022. Assessing limits to biodiversity offsetting in Aotearoa: a proposed framework. Resource Management Journal, November 2022: pp 22 – 26.

McEwen, W.M. (Ed.).1987. Ecological regions and districts of New Zealand (3rd revised ed., Publication No. 5, Part 3: Descriptions of districts in central New Zealand, from Eastern Wairarapa to Akaroa; also Chathams). Department of Conservation, Wellington.

McLennan, J. 2012. Fauna of the Denniston CML 37-161 Denniston Plateau. Prepared for Solid Energy New Zealand Ltd. Draft.

Michel, P., deRegnier, R., Emmitt, T., Ford, M., Perrie, L., Pritchard, A.S.E. 2026. Conservation status of mosses in Aotearoa New Zealand, 2025. Report 1155. Department of Conservation, Wellington. New Zealand Threat Classification System Series 49.

Millar, I. R. and Patrick, B.H. 2016. Follow-up invertebrate survey at the Te Kuha Mine site. Entecol Contract Report ENT-045. 18 pp.

Mitchell Daysh Limited. 2026. Buller Plateaux Continuation Project Assessment of Environmental Effects.

Nichol, R., Overmars, F. 2008. Vegetation and Flora Baseline Survey L & M Coal Ltd Escarpment Mine Project Denniston Plateau. Unpublished report prepared for Resource and Environmental Management Ltd.

Nichol, R. 2021. Mine Creek Sump Proposal Stockton. Unpublished draft report prepared for BT Mining by Richard Nichol Ecology Ltd.

Nichol, R. 2022. Kiwi and Weka Survey, Winter 2022 Escarpment Mine and Denniston Permanent Protection Area, Denniston Plateau. Prepared for Buller Coal Ltd.

Nichol, R. 2023. Denniston 2023 Bird Monitoring. Unpublished report prepared by Richard Nichol Ecology Ltd.

Ministry for the Environment. 2020. National Policy Statement for Freshwater Management (NPS-FM) 2020. Amended December 2025. Wellington: Ministry for the Environment.

Ministry for the Environment. 2023. National Policy Statement for Indigenous Biodiversity (NPS-IB). Wellington: Ministry for the Environment.

Overmars, F.B., Kilvington, M.J., Gibson, R.S., Newell, C.L., Rhodes, T.J. 1998. Ngakawau Ecological District: Survey report for the Protected Natural Areas Programme. Department of Conservation, Hokitika. 178 pp.

Purdie, S. 2022. A Naturalist's Guide to the Reptiles and Amphibians of New Zealand. John Beaufoy Publishing.

Robertson, H.A., Baird, K.A., Elliott, G.P., Hitchmough, R.A., McArthur, N.J., Makan, T.D., Miskelly, C.M., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A., and Michel, P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 pp.

Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. (2018). Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.

Simcock, R., & Ross, C. 2014. Guidelines for mine rehabilitation in Westland. Manaaki Whenua Landcare Research report prepared for West Coast Regional Council. Envirolink Advice Grant: 937-WCRC83

Simcock, R., Innes, J., Samarasinghe, O., Lambie, S., Peterson, P., Glen, A., & Faville, N. 2022. Road edge-effects on ecosystems: A review of international and New Zealand literature, an assessment method for New Zealand roads, and recommended actions (Waka Kotahi NZ Transport Agency research report 692).

Sirvid, P.J., Vink, C.J., Fitzgerald, B.M., Wakelin, M.D., Rolfe, J., Michel, P. 2021. Conservation status of New Zealand Araneae (spiders), 2020. New Zealand Threat Classification Series 34. Department of Conservation, Wellington. 33 p.

Templeton, L. and McMorran, T. 2020. Geomorphological Assessment of the Stockton Plateau. Golder Associates.

Thomas, B. and Toft, R.J. 1997. Surveys for Fauna in the Upper Waimangaroa Valley. Prepared by Landcare Research for Kingett Mitchell and Associated Ltd.

Thomas, B., Toft, R.J. and Mason, R. 1997. Fauna of the Proposed Northern Opencast Development, Waimangaroa Valley, Buller Coalfield. Landcare Research.

Townson, W. 1906. On the vegetation of the Westport district. Transactions and Proceedings of the New Zealand Institute 39: 380–433.

Toy, R.J, Toy, S., Mackenzie, D., Simister, K. and Yong, S. 2021. Distribution of great spotted kiwi (*Apteryx maxima*), 2012–2021. Notornis, 2021, 69(1):1–18.

Trewick, S.A. 2024. Two new genera of tokoriro (Orthoptera: Rhaphidophoridae: Macropathinae) from Aotearoa New Zealand. Zootaxa 5481, 531–546. https://doi.org/10.11646/zootaxa.5481.5.3

Walker, K. 2003. Recovery plans for Powelliphanta land snails. Threatened Species Recovery Plan. Retrieved from DOC, Wellington.

Walker, K. 2018. Systematics and phylogeography of the large land snail Powelliphanta. (Ph.D.). Massey University.

Walker, K., Walton, K., Edwards, E., Hitchmough, R., Payton, I., Barker, G., Michel, P. 2024. Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and snails) Part 3. Rhytididae (carnivorous snails): 2022. Retrieved from DOC, Wellington, NZ.

Wildland Consultants Limited. 2010. Mapping of vegetation and habitats on the Stockton and Denniston plateaux, northern Westland. Wildlands contract report No. 2334. Prepared for Department of Conservation, West Coast Tai Poutini Conservancy, Hokitika.

Williams, P.A., Wiser, S., Clarkson, B. and Stanley, M.C. 2007. New Zealand's historically rare terrestrial ecosystems set in a physical and physiognomic framework. New

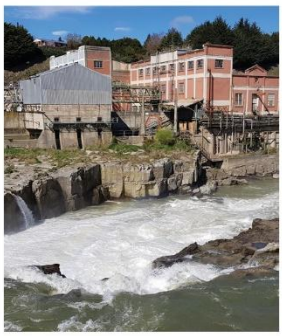
Zealand Journal of Ecology 31(2):119–128.

APPENDIX A

Buller Plateaux Contextual Study (Ecological Solutions Limited 2026a)

ecoLogical Solutions
Environmental Consultants







January 2026

Buller Plateaux Contextual Study

Submitted to:
Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by:

[redacted]

[redacted]

[redacted]

Ecologist

[redacted]

[redacted]

[redacted]

Herpetologist

Reviewed by:

[redacted]

Senior Terrestrial Ecologist

[redacted]

Status: Final v4 **Issued:** 30 January 2026

Recommended Citation: Ecological Solutions Limited 2026. Buller Plateaux Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited. Kāeo, Northland. January 2026. 91 pages + appendices.

tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 2/195 main highway,
ellerslie, auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

nelson office
58 factory road, brightwater, nelson
p: 0273 576 87
www.ecoLogicalsolutions.co.nz

Table of Contents

Executive Summary **1**
1.0 Introduction **3**
1.1 Background 3
1.2 Objectives 3
1.3 Report Structure 4
1.4 Previous Field Surveys 4
1.5 Desktop Investigation 4
2.0 Ngakawau Ecological District **5**
2.1 Introduction 5
2.2 Vegetation Types 2
2.3 Naturally Uncommon Ecosystems 5
2.3.1 Definition and Types 5
2.3.2 Description 6
2.3.3 Extent 9
2.3.4 Conservation Status 9
2.4 Bryophytes 10
2.5 Fauna 11
2.5.1 Birds 11
2.5.2 Bats 12
2.5.3 Lizards 14
2.5.4 Snails 14
2.5.5 Other Terrestrial Invertebrates 15
2.6 Aquatic Ecology 17
2.6.1 Freshwater Fish and Kōura 17
2.6.2 Benthic Invertebrates 22
2.7 Pest Animals 22
2.8 Pest Plants 23
2.9 Ecosystem Management in the Ngakawau Ecological District 23
3.0 Location and Extent of the Buller Plateaux **26**
3.1 Introduction 26
3.2 Brunner Coal Measures 27
3.2.1 Coal Measures Geology 27
3.2.2 Coal Measures Vegetation 29
3.3 Denniston Plateau 29
3.4 Stockton Plateau 31

4.0 Biotic Features of the Buller Plateaux 33
4.1 Features of the Buller Plateaux 33
4.2 Vascular Vegetation 33
4.3 Bryophytes and Lichens 37
4.3.1 Background 37
4.3.2 Liverworts and Hornworts 39
4.3.3 Mosses 42
4.3.4 Aquatic Bryophytes 42
4.3.5 Previous Surveys 43
4.3.6 Lichens 46
4.4 Fauna 47
4.4.1 Birds 47
4.4.2 Bats 51
4.4.3 Lizards 54
4.4.4 Snails 59
4.4.5 Other Terrestrial Invertebrates 59
4.5 Aquatic Ecology 65
4.5.1 New Zealand Freshwater Fish Database 65
4.5.2 Kōura 65
4.5.3 Previous Surveys 65
4.6 Pest Species 69
4.6.1 Pest Animals 69
4.6.2 Pest Plants 70
4.7 Naturally Uncommon Ecosystems 71
4.8 Ecological Intactness and Connectivity 71
4.9 Rehabilitated Habitats 71
5.0 Summary 74
5.1 Vascular Plants 74
5.1.1 Species Presence and Diversity 74
5.1.2 Vegetation Types 74
5.2 Bryophytes 74
5.2.1 Terrestrial Bryophytes 74
5.2.2 Aquatic Bryophytes 75
5.3 Lichens 75
5.4 Birds 75
5.4.1 Rōroa 75
5.4.2 Forest Birds 76

5.5 Bats 76
5.6 Lizards 76
5.7 Invertebrates 77
5.7.1 *Powelliphanta* Snails 77
5.7.2 Other Terrestrial Invertebrates 77
5.8 Aquatic Ecology 78
5.9 Pests 78
5.9.1 Mammals 78
5.9.2 Weeds 78
5.10 Naturally Uncommon Ecosystems 78
5.11 Rehabilitated Sites 78
6.0 References 80

Index to Tables

Table 1: Summary of fish records by catchment from the Ngakawau Ecological District 1986-2023. 19
Table 2: 'Threatened' and 'At Risk' Plant species recorded at the Buller Plateaux. 36
Table 3: Bryophytes of conservation concern previously recorded on the Buller Plateaux. 40
Table 4: 'Threatened' and 'At Risk' lichen species previously recorded at the Buller Plateaux. 46
Table 5: Summary of bat surveys within/near the Ngakawau Ecological District 1997 – 2019. 51
Table 6: Summary of lizard surveys, level of effort and species identified on the Buller Plateaux and surrounds. 56
Table 7: Invertebrate species of conservation concern previously recorded on the Buller Plateaux. 60
Table 8: Summary of Buller Plateaux macroinvertebrate community indices. 68

Index to Figures

Figure 1: The location of the Buller Plateaux and Ngakawau Ecological District. 1
Figure 2: Stunted tussock-shrubland on the southern Stockton Plateau. 2
Figure 3: Forested gully with emergent Southern rātā at the Denniston Plateau. 3
Figure 4: Low mānuka shrubland on the Denniston Plateau. 3
Figure 5: Shallow tarn on the Stockton Plateau. 4
Figure 6: Pākihi vegetation on the Stockton Plateau. 5
Figure 7: Boulderfield near Mt Rochfort on the Denniston Plateau. 7
Figure 8: Sandstone erosion pavement at the southern Stockton Plateau. 8

Figure 9: Seepage with herbfield vegetation at the southern Stockton Plateau. 8
Figure 10: Acoustic bat survey results from the northern South Island 2007- 2013 (from Lloyd 2018, 2019). 13
Figure 11: Acoustic bat survey results from the Northern South Island 2007 – 2013 (from Lloyd 2018, 2019). 14
Figure 12: Location of fish surveys in the northern Buller region (NZFFDB and other surveys). 21
Figure 13: Ecological Management Areas within the Ngakawau Ecological District. 25
Figure 14: Location of Brunner Coal Measures on the Buller Plateaux, in relation to the Ngakawau Ecological District. 28
Figure 15: Denniston Plateau as defined by Mabin (2012). 30
Figure 16: Stockton Plateau as defined by Templeton and McMorran (2020). 32
Figure 17: 'Forested blockfield' at Stockton Plateau. 39
Figure 18: Great spotted kiwi surveys on the Buller Plateaux. 49
Figure 19: Acoustic bat survey results from the Buller Plateaux 1997 – 2019. 53
Figure 20: Undescribed vagrant spider (*Uliodon* sp.) at Stockton Mine. 61
Figure 21: Location of Forest Ringlet butterfly feeding sign on *Gahnia* January - February 2019 (G Bramley unpubl. data). 63
Figure 22: Terrestrial invertebrate surveys on the Buller Plateaux. 64
Figure 23: Location of Buller Plateaux macroinvertebrate survey sites. 67
Figure 24: Approximate rodent tracking indices (rats) since 2014 in the Denniston Biodiversity Enhancement Area (data from Department of Conservation annual reports). 69
Figure 25: Approximate rodent tracking indices (mice) since 2014 in the Denniston Biodiversity Enhancement Area (data from Department of Conservation annual reports). 70
Figure 26: Stockton Mine Rehabilitation Status as at December 2023. 73

Appendices

Appendix A – Vascular Plant Species on the Buller Plateaux

Appendix B – Bryophytes recorded from the Ngakawau ED

Appendix C – eBird Records from the Ngakawau ED

Appendix D – Bat Surveys in the Ngakawau ED

Appendix E – GBIF Terrestrial Invertebrate Records from the Ngakawau ED

Appendix F – Vegetation Classifications on the Buller Plateaux

Appendix G – Lichen Species on the Buller Plateaux

Executive Summary

This report reviews and synthesises the available ecological surveys from the Ngakawau Ecological District and Buller Plateaux to describe the ecological values of the Buller Plateaux and the context in which they are located. Some elements of this work will be updated by current workstreams including vegetation mapping of the Buller Plateaux and an assessment of rehabilitation outcomes there (Ecological Solutions Limited 2026a, 2026b).

The Buller Plateaux comprises the Denniston and Stockton plateaux which are separated by the Waimangaroa Gorge. The Denniston Plateau covers approximately 1,700ha, forming a roughly circular area about 4.5km across. Most of the Denniston Plateau lies between 600 – 700m asl, but it includes c. 280ha which is up-warped to the west (near Mt Rochfort) and a down-warped part covering c. 200ha in the northwest. The Stockton Plateau covers approximately 3,120ha, forming an oval shape between Mt Augustus, the Mt William Range and Mt Stockton and comprises five separate areas. It includes a large triangular shaped area of outcropping Brunner coal measures within which Stockton Coal Mine is located and smaller areas (sub-plateau) of outcropping Brunner coal measures further south, between the Waimangaroa River and the existing mine. The Stockton Plateau slopes towards the northeast at elevations mostly varying between 610m and 860m above sea level. The South 1 sub-plateau rises to 1,105m asl at the peak of Mt Frederick. The division of the smaller sub-plateau is predominately due to faulting and incision of watercourses into the plateau forming valleys and gorges.

The Buller Plateaux lies within the Ngakawau Ecological District and North Westland Ecological Region. The North Westland Ecological Region is floristically one of the richest in New Zealand. More than 50 terrestrial and aquatic ecological surveys have been undertaken in various parts of the Ngakawau Ecological District including the Upper Waimangaroa valley and the Buller Plateaux. Altitudinal sequences of lowland to subalpine vegetation occur on steep coastal hillslopes such as Mt Frederick (1,105m asl), which overlays fertile gneiss and granite parent material, Mt Rochfort (1,040m asl), which overlies infertile Brunner Coal Measures and Mt William (1,062 m asl), which includes both granite and coal measures geology (Nathan et al. 2002, Rattenbury et al. 1998). At these locations lowland mixed beech-kāmahi-podocarp (often rimu) forest grades into beech (including both mountain beech and silver beech) and Southern rātā forest which becomes more stunted with increasing altitude.

The studies we have located from within the Ngakawau ED have identified at least 542 species of terrestrial plant, 56 species of bird (including 28 native species), 473 species of bryophytes (345 liverworts, 123 mosses, five hornworts), 98 species of lichen, four species of lizards, more than 300 species of terrestrial invertebrates and 186 taxa of aquatic invertebrates. There are also at least five naturally uncommon ecosystems present within the Ngakawau Ecological District, all of which occur on the Buller Plateaux including boulderfields of acidic rock, sandstone erosion pavement, tarns, seepages and flushes and pākihi wetlands.

Vegetation on the Buller Plateaux includes stunted forest, shrubland with a high component of mānuka (*Leptospermum scoparium* agg.), pākihi, and various rushland and tussockland vegetation types. Mānuka, pink pine (*Halocarpus biformis*), yellow-silver pine (*Lepidothamnus intermedius*) and *Gahnia* spp. are a significant component of the dense shrubland and low stature forest on the high elevation slopes.

Vegetation on the gently sloping sandstone pavements of the Buller Plateaux is dominated by stunted tussock-shrublands. *Chionochloa* spp. (tussock), *Gleichenia dicarpa* (tangle fern), *Dracophyllym* spp., wire rush (*Empodisma minus*) and prostrate mānuka are common and widespread. Based on the vegetation alone, large parts of the Buller Plateaux meet the criteria for natural inland wetlands (Ministry for the Environment 2025).

Approximately 94% of the 5,272ha Buller Plateaux receives ecosystem management funded by Bathurst Resources as part of the Denniston Permanent Protection Area (718ha); Denniston Biodiversity Enhancement Area (1,742ha); Snail Enhancement Area (893ha) or Wider Habitat Enhancement Area (1,588ha) which extend beyond the plateau to adjoining habitats. Together the DPPA and the WHEA comprise 12,700ha which covers c. 26% of the Ngakawau Ecological District.

1.0 Introduction

1.1 Background

Bathurst Resources Limited ('Bathurst') is New Zealand's largest coal producing company and is a New Zealand registered, ASX-listed, resource company with the majority of its shareholders being investors from outside New Zealand. All Bathurst's mining operations are located within New Zealand, being distributed across the West Coast, Southland and Waikato regions. Bathurst operations provide thermal coal to domestic dairy and food processing industries and for electricity generation. Bathurst also provides coking coal to local steel makers and exports high quality metallurgical coal to international steel makers.

Bathurst is a 65% joint venture owner (with Talley's Group) of BT Mining. BT Mining currently operates the existing Stockton Mine near Westport. All of the coal mined from the Buller Plateaux is exported as coking coal for steel making. The remaining estimated mine life at the Stockton Mine is currently approximately 5 – 7 years. To enable ongoing continuity of mining and supply of their premium coking coal product from Stockton to domestic and international steel makers, Bathurst has been undertaking exploration in areas of known coal resource across the Stockton and Denniston plateaux (collectively 'The Buller Plateaux'). This exploration work has identified at a concept level several areas containing suitable coal resources to extend mine life and enable ongoing coal supply to existing customers. Ongoing mining in the area would significantly extend the life and profitability of the existing mines on the Buller Plateaux and provide financial security for the Buller District.

Bathurst will be seeking approvals to mine some or all of these viable coal resources in the near future.

A large number of ecological surveys have been undertaken across parts of the Buller Plateaux since at least the early 1990s by Solid Energy New Zealand Limited and others, mostly to inform previous mining or other development proposals including hydroelectricity projects at Stockton and Mōkihinui. These historical baseline ecological studies have included surveys for:

- Vascular vegetation;
- Aquatic and terrestrial bryophytes;
- Avifauna, including rōroa (great spotted kiwi, *Apteryx maxima*);
- Bats;
- Lizards, including habitat mapping informed by the vegetation maps.
- *Powelliphanta* snails;
- Other terrestrial invertebrates;
- Aquatic ecology.

The purpose of this report is to synthesise these historic baseline ecological studies, into a description of the existing environment to inform any future applications.

1.2 Objectives

The objectives of this report are to:

1. Identify the species and habitats present within the Ngakawau Ecological District;
2. Identify the species and habitats present within the Buller Plateaux;
3. Describe the ecological context in which these species and habitats exist at the Buller Plateaux and elsewhere.

1.3 Report Structure

This report includes six sections as follows:

- Section 1.0 (this introduction) which sets out the purpose of this report and the methods used in compiling it;
- Section 2.0 summarises the features of the Ngakawau Ecological District of which the Buller Plateaux is a part;
- Section 3.0 defines the location and extent of the Buller Plateaux;
- Section 4.0 describes the biotic features of the Buller Plateaux;
- Section 5.0 provides a summary of the ecological values;
- Section 6.0 provides the references used in compiling this report.

1.4 Previous Field Surveys

More than 50 flora and fauna surveys have been undertaken in various parts of the Ngakawau Ecological District including the Upper Waimangaroa valley and the Buller Plateaux, usually in preparation for a development proposal, which may or may not have proceeded.

In 2012 the Royal Forest and Bird Protection Society held a “bioblitz” at Denniston which involved around 150 people working in 12 teams. The bioblitz preliminary results (Brooks 2012) recorded:

- 127 vascular plants and 78 non-vascular plants;
- 14 birds;
- Two species of gecko and one species of skink;
- More than 200 species of invertebrates, including forest ringlet butterfly, a probable new species of moth (now confirmed as the avatar moth (*Arctesthes avatar*) and a jumping spider. Other previously collected, but undescribed spiders were also found.
- More than 40 diatoms.

1.5 Desktop Investigation

In compiling this report, we have located and reviewed relevant information including published papers and unpublished reports, as well as database records from the Department of Conservation (bats and lizards), eBird and the Global Biodiversity Information Facility (GBIF).

Bathurst has lodged a large amount of material relevant to the Buller Plateaux in a bibliographic database (Papers, papersapp.com), which is a reference library where one can organize, read, annotate, share and cite research. The Papers library is maintained and updated regularly by Bathurst. In compiling this report, we undertook searches via Google, Google Scholar and Papers using the keywords (either alone or in combination): ‘lizard’, ‘skink’, ‘gecko’, ‘*Powelliphanta’*, ‘snail’, ‘invertebrate’, ‘insect’, ‘birds’, ‘great spotted kiwi’, ‘flora’, ‘fauna’, ‘vegetation’, ‘bryophyte’, ‘moss’, ‘liverwort’, ‘hornwort’, ‘lichen’, ‘fish’, ‘river’, ‘stream’, ‘freshwater’, ‘Ngakawau’, ‘Denniston’, ‘Stockton’, ‘Buller’, ‘Waimangaroa’, ‘Escarpment’, ‘Sullivan’ and ‘Cypress’.

Using the reports obtained we have compiled species lists for vascular plants, terrestrial and aquatic bryophytes, birds and lizards. We have updated species names as required using information available on the New Zealand Plant Conservation Network website

(www.nzpcn.org.nz) and the Birds New Zealand website (www.birdsnz.org.nz).

In relation to bryophytes, we have compiled a list of bryophytes recorded in the Ngakawau Ecological District over the past 20 years, drawing from literature and survey data. This period has seen significant taxonomic and phylogenetic revisions and the description of new bryophyte species. This list, though not exhaustive, serves as a baseline for future studies.

2.0 Ngakawau Ecological District

2.1 Introduction

The Buller Plateaux lies just north of the township of Westport within the Ngakawau Ecological District (Ngakawau ED) and North Westland Ecological Region (McEwen 1987). The Ngakawau ED is situated within the Western Nelson Ecological Province which is floristically the richest in New Zealand for vascular plants (Wardle 1991, Engel and Glenny 2008).

The boundaries of the Ngakawau Ecological District (shown in Figure 1) are defined by a line connecting Te Kuha to Mount Rochfort, Mount William and a peak west of Mt Lyall in the south, the Glasgow Range in the east and the Mōkihinui River in the North. The coastal escarpment marks the boundary of the district to the west, with the coastal plain forming part of the adjacent Foulwind Ecological District. The district covers approximately 48,710ha and the boundaries were defined on the basis of geology, topography and vegetation (McEwen 1987, F. Overmars pers. comm. 2012).

When the Department of Conservation digitised the hand drawn maps of McEwen (1987), the southern boundary of the Ngakawau ED was inadvertently altered to exclude Te Kuha from the online version of the maps, but it was agreed by the expert ecologists participating in the Environment Court hearing for the proposed Te Kuha Mine that the Ngakawau ED correctly includes the coal measures and other vegetation at Te Kuha[1].

The Ngakawau ED is characterised by elevated coal plateaux (Stockton and Denniston, collectively the Buller Plateaux), southwest and west trending coastal hills and low mountains up to 1,400 m asl in the north and southeast (McEwen 1987, F. Overmars pers. comm. to G. Bramley 2011). The district includes large areas of Eocene (40–50 million years old) quartz sandstone, grit and conglomerate with Brunner coal seams forming dissected plateaux with highly distinctive vegetation as described in Section 4.2. There are also smaller areas of gneiss, granite, greywacke and argillite (McEwen 1987, Rattenbury et al. 1998, Nathan et al. 2002). Soils overlying granitic geologies are typically deeper and more fertile and occur most commonly in the southeast of the district (in the headwaters of the Mackley (Orikaka) River), with occasional instances elsewhere. The area experiences mild temperatures and high rainfall and most of the district remains in indigenous vegetation (McEwen 1987).

The Ngakawau ED includes the distinctive coal measures vegetation and exposed sandstone pavement which characterise the Buller Plateaux as well as large areas of wetland, pākihi shrubland and forest and much smaller areas of tussockland, herbfield and boulderfield. The Ngakawau ED is the only ecological district in New Zealand defined by the presence of extensive elevated coal measure geology with its associated landforms, vegetation and flora.

[1] Decision 2023-NZEnvC-68 in the matter of the Resource Management Act 1991 and an appeal under s120 of the Act between Royal Forest and Bird Protection Society of New Zealand Incorporated (ENV-2017-CHC-90) (Appellant) and West Coast Regional Council and Buller District Council (Respondents) and Stevenson Mining Limited (Applicant). 19 April 2023. New Zealand Environment Court, Christchurch.

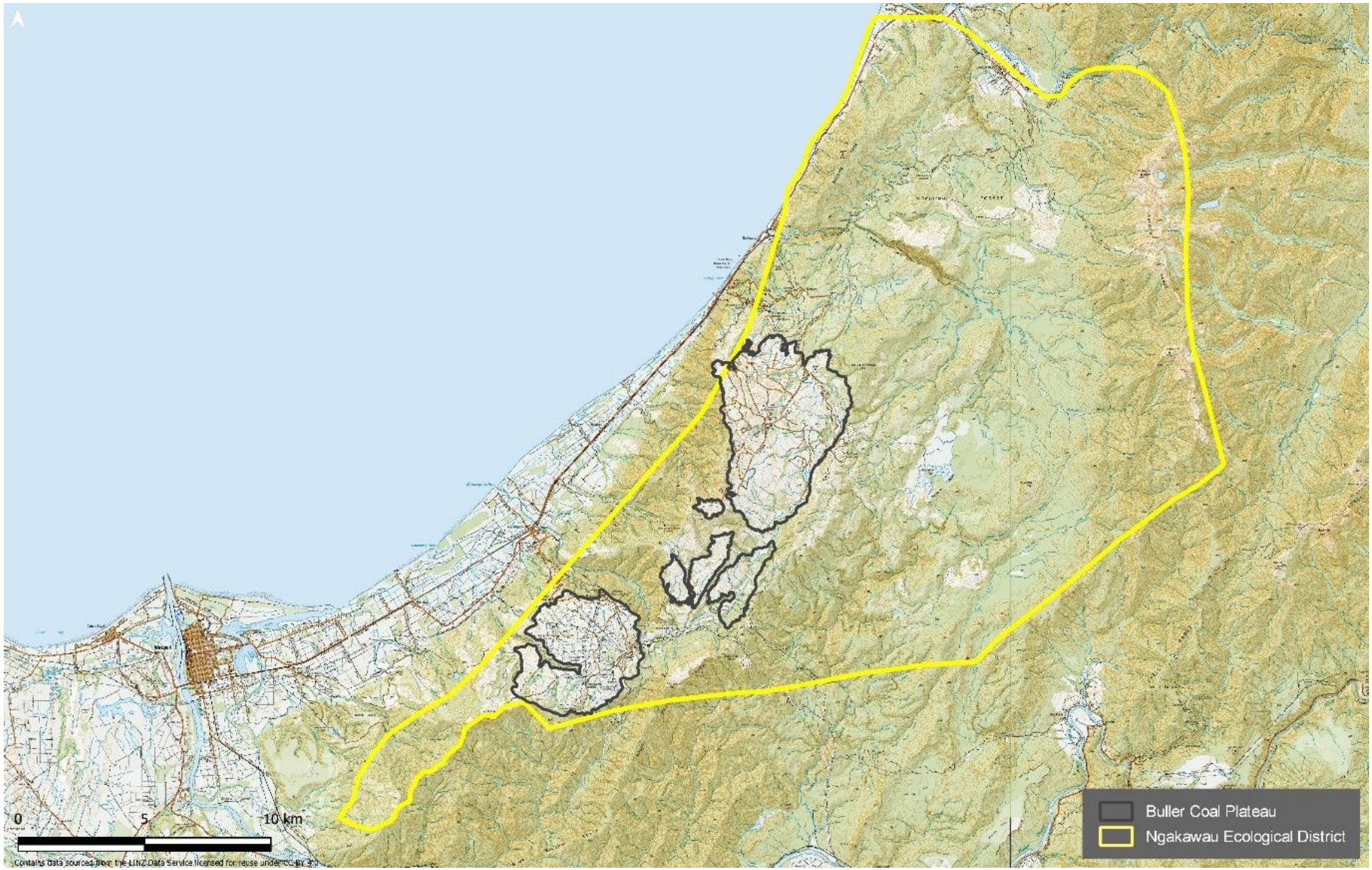


Figure 1: The location of the Buller Plateaux and Ngakawau Ecological District.

Overmars et al. (1998) identified 485 indigenous vascular plant species as being present in the Ngakawau ED, along with 30 adventive species. The studies we have located from within the Ngakawau ED have identified at least 542 species of terrestrial plant[2], 56 species of bird (including 28 native species), four species of lizard, 473 species of bryophyte (345 liverworts, 123 mosses, five hornworts), 98 species of lichen, more than 300 species of terrestrial invertebrates and 186 taxa of aquatic invertebrates.

The flora of the Ngakawau ED is diverse and the district is home to endemic species such as *Chionochloa juncea* ('At Risk – Declining') and *Celmisia morganii* ('At Risk – Naturally Uncommon') (McEwen 1987, Overmars et al. 1998, de Lange et al. 2024). The wider botanical province of Western Nelson is a hotspot for *Celmisia*, with 25 out of the 78 named species occurring there (Godsen 2023). There is also a high diversity of *Dracophyllum,* with 11 out of c. 35 species present in the Ngakawau ED (Venter 2009).

Olearia cheesemanii (streamside tree daisy, 'At Risk – Declining') is also present in the Ngakawau ED, along with the umbrella ferns *Sticherus tener*, *S. urceolatus* (both 'At Risk – Naturally Uncommon') and the small tree *Metrosideros parkinsonii* (Parkinson's rātā). Both species of *Sticherus* and *M. parkinsonii* have disjunct (discontinuous) distributions which include the Ngakawau ED. *Pseudowintera traversii* ('At Risk – Naturally Uncommon'), a small woody shrub found only in Northwest Nelson and North Westland, is also known to occur in the Ngakawau ED and the southern limit for that species occurs near Mt Rochfort.

Peraxilla tetrapetala (red mistletoe), which has a conservation ranking of 'At Risk – Declining', has also been occasionally recorded in forests within the ecological district, both at Denniston (two individual plants, Nichol and Overmars 2008) and near the Cypress Mining area at Stockton (one individual plant, G. Bramley pers. obs. 2011, 2020).

The Ngakawau ED comprises four main river catchments (Mōkihinui, Ngakawau, Waimangaroa and Whareatea) which ultimately drain west towards the Tasman Sea. It is also intersected near its southern extent by several smaller catchments (e.g., Orowaiti Stream) or by headwaters and tributaries of larger river systems located outside the Ngakawau ED (e.g., Buller River).

The Ngakawau River system, located toward the northern extent of the Ngakawau ED, is the largest catchment in the ecological district and drains the northern part of Stockton Plateau. The Ngakawau catchment extends from its northern border with the Mōkihinui River catchment, east to the Glasgow Range and south to its border with the upper Waimangaroa River and Buller River catchments. Granity Stream, Miller Stream and Sandy Stream, which mark the northern limit of the Stockton Plateau, are all tributaries of the Ngakawau River.

The Waimangaroa River system separates the Denniston Plateau from the Stockton Plateau with a 500m deep westward draining gorge. The southern part of Stockton Plateau is drained by tributaries of the Waimangaroa River which separate the four sub-plateau areas identified by Templeton and McMorran (2020) as South 1 – 4 as described in Section 3.3. The deeply incised Deep Stream drains to the Waimangaroa River and separates the main plateau and South 1 from the southern areas (2 – 4). The southern and southeastern extent of the Ngakawau ED drains towards the Buller River including via the Orikaka (or Mackley) River.

The Whareatea River catchment is located immediately south of the Waimangaroa catchment, and drains the Denniston Plateau via a 2.5km long, up to 350m wide and 60m deep, gorge (Whareatea Gorge). The southeastern side of the Denniston Plateau drops away steeply into the valley drained by Cascade Creek which flows to the Buller River.

The narrow southern/southwestern part of the Ngakawau ED is drained by the Orowaiti River

[2] Species lists from vegetation surveys undertaken on the Buller Plateaux from 1990 – 2024 were compiled to produce the vascular plant species list in Appendix A. In some cases, species identified in surveys were excluded from this list due to taxonomic changes or incompatible geographical distribution and habitat type.

which flows west towards the lagoon of the same name which enters the sea immediately north of the Buller River mouth.

2.2 Vegetation Types

Vegetation surveys carried out across the Ngakawau ED, particularly within the Buller Plateaux, have generally attempted to describe vegetation associations and types and have identified the presence of locally endemic and 'Threatened' or 'At Risk' species of vascular plants. A list of vascular plants recorded in the studies we reviewed is provided as Appendix A. Threat status is that provided by de Lange et al. (2024).

The majority of the vegetation in the Ngakawau ED comprises coal measures vegetation which exhibits a range of forms, including stunted forest, shrubland with a high component of mānuka (*Leptospermum scoparium* agg.), pākihi, and various rushland and tussockland vegetation types. Altitudinal sequences of lowland to subalpine vegetation occur on steep coastal hillslopes such as Mt Frederick, which overlays fertile gneiss and granite parent material, Mt Rochfort, which lies on the infertile Brunner Coal Measures and Mt William, which includes both granite and coal measures geology (Rattenbury et al. 1998, Nathan et al. 2002). At these locations lowland mixed beech-kāmahi (*Pterophylla racemosa*)-podocarp (often *Dacrydium cupressinum*, rimu) forest grades into beech (*Fuscospora cliffortioides* (mountain beech), *Lophozonia menziesii* (silver beech) and *Metrosideros umbellata* (Southern rātā) forest which becomes more stunted with increasing altitude.

Mānuka, pink pine (*Halocarpus biformis*), yellow-silver pine *(Lepidothamnus intermedius*) and *Gahnia* spp. are a significant component of the dense shrubland and low stature forest on the high elevation slopes (Overmars et al. 1998, Newell 1990).

Vegetation on the gently sloping sandstone pavements of the Buller Plateaux is dominated by stunted tussock-shrublands as shown below in Figure 2. *Chionochloa* spp. (tussock), *Gleichenia dicarpa* (tangle fern), *Dracophyllum* spp., wire rush (*Empodisma minus*) and prostrate mānuka are common and widespread.



Figure 2: Stunted tussock-shrubland on the southern Stockton Plateau.

Forested gullies dissecting the sandstone pavement are typically dominated by stunted mountain beech, silver beech and Southern rātā in the canopy, with other common species including pink pine, yellow-silver pine, mānuka, mountain toatoa (*Phyllocladus alpinus*) and

kāmahi. An example of this vegetation is shown below in Figure 3.



Figure 3: Forested gully with emergent Southern rātā at the Denniston Plateau.

Mānuka shrubland with *Gahnia* spp., *Dracophyllum* spp., tangle fern, mountain flax (*Phormium cookianum*) and scattered podocarps often forms an ecotone between tussock-shrubland and forest habitats as shown below in Figure 4.



Figure 4: Low mānuka shrubland on the Denniston Plateau.

Seepages and small tarn-wetland complexes support a range of montane and subalpine bog species such as *Astelia subulata* ('At Risk – Naturally Uncommon'), *Donatia novae-zelandiae*, *Drosera* spp. (sundews), *Euphrasia wettsteiniana* ('At Risk – Declining'),

Liparophyllum gunnii and *Utricularia dichotoma* subsp. *novae-zelandiae.* A typical tarn and associated vegetation is shown below in Figure 5.



Figure 5: Shallow tarn on the Stockton Plateau.

Pākihi, shown in Figure 6, is characterised by the combination of flat/gently sloping topography, leached, very infertile soil, high rainfall and impeded drainage which supports sedgeland, rushland and fernland vegetation (Johnson & Gerbeaux 2004). It is typically described as low stature mānuka-tangle fern (*Gleichenia dicarpa*) shrubland. In North Westland these are dynamic ecosystems that exist mainly as a result of human-induced fire, and may be on a successional trajectory back towards forest, although some soils are likely too infertile to support closed forest (Mew 1983). Pākihi is most prevalent around the northern and eastern areas of the Stockton Plateau (e.g. Blackburn Pākihi). Pākihi rush (*Machaerina teretifolia*), tangle fern, red tussock (*Chionochloa rubra*), *Rytodisperma* spp. and low stature mānuka are characteristic species of pākihi ecosystems. The orchid *Calochilus paludosus* ('Threatened – Nationally Vulnerable') and the monocot herb *Bulbinella modesta* ('At Risk – Declining') have been observed in pākihi habitat on the Denniston Plateau and Mt Frederick (Overmars et al. 1998, Nichol 2021).



Figure 6: Pākihi vegetation on the Stockton Plateau.

2.3 Naturally Uncommon Ecosystems

2.3.1 Definition and Types

Naturally uncommon ecosystems (previously referred to as 'historically rare ecosystems') are defined as those which have a (natural) total extent of less than 0.5% of New Zealand's total area (i.e. <134,000 ha, Williams et al. 2007), or those that meet International Union for Conservation of Nature (IUCN) threat assessment criteria taking into account current and historic extent, distribution and ecological function (Holdaway et al. 2012). There are at least five naturally uncommon ecosystems present within the Ngakawau ED, including:

i) Boulderfields of acidic rock;

ii) Sandstone erosion pavement;

iii) Tarns;

iv) Seepages and flushes; and

v) Pākihi wetlands

Naturally uncommon ecosystems often have highly specialised and diverse flora and fauna associated with them, including endemic and nationally rare species (Overmars and Lloyd 2012). Consequently, naturally uncommon ecosystems have been recognised as a 'national priority' for protection on private land (Ministry for the Environment & Department of Conservation 2007).

Sandstone erosion pavement and seepages and flushes both have an IUCN threat status of 'endangered' (Holdaway et al. 2012).

Tarns are small ponds, which in the context of the Buller Plateaux, are embedded amongst the sandstone erosion pavement landscape. They are most common on the Stockton Plateau, where they form 'wetland-shallow tarn complexes' (Wildland Consultants Limited 2010). Bogs form where rainwater pools in shallow depressions in the sandstone pavement, supporting montane and subalpine plants, bryophytes and lichens.

Boulderfields of acidic rock derived from quartz-rich sandstone are present to the north of Mt Rochfort and in the Deep Stream catchment (Wildland Consultants Limited 2010). Low subalpine scrub and shrubland are associated with this ecosystem, where pockets of mānuka, yellow-silver pine, *Gahnia procera*, mountain flax and tussocks (*Chionochloa flavescens*, *C. juncea*) are interspersed among the boulders.

Sandstone erosion pavements are a key feature of the Buller Plateaux. They are characterised by areas of flat to gently sloping quartzose sandstone bare of topsoil, resulting from chemical weathering and erosion of topsoils. Vegetation persists in cracks and fissures in the rock, mainly comprising herbs (such as *Celmisia* spp.), small shrubs (such as prostrate mānuka and *Dracophyllum densum*), *Empodisma minus* (wire rush) and tussocks (notably *Chionochloa australis* and coal measures tussock). Although historically rare from an abiotic standpoint, in terms of the biota present, sandstone erosion pavement is not particularly species rich. The extent of sandstone erosion pavement may have increased after human arrival due to burning of vegetation and subsequent loss of shallow topsoil (Overmars et al. 1998), however open-cast mining on the Stockton Plateau, which began around 120 years ago, has now reduced the extent of this ecosystem.

Seepages and flushes have a limited extent across the plateau, being present on hillslopes, gullies and among red tussock vegetation in Happy Valley. These small ecosystems are often found where slope angle changes or impermeable soil layers raise the water table, causing permanent (seepage) or temporary (flush) soil saturation (Johnson & Gerbeaux 2004). Seepage ecosystems were identified by Wildland Consultants Limited (2010) in Happy Valley, and by Overmars et al. (1998) in the upper Denniston Plateau and south-east of Mt Frederick. These ecosystems contain assemblages of herbaceous vegetation similar to those found in subalpine bogs, such as sundews (*Drosera* spp.), cushion plants (such as *Donatia novae-zelandiae*), *Celmisia alpina*, *Carpha alpina*, eyebright (*Euphrasia* spp.), *Liparophyllum gunnii*, and *Utricularia dichotoma* subsp. *novae-zelandiae* (Overmars et al. 1998).

Wildland Consultants Limited (2010) mapped both sandstone erosion pavement (1,474ha) and seepages (1.1ha) across the Stockton-Denniston plateaux. Due to the difficultly in mapping small, sometimes ephemeral features like seepages, the extents of these features were likely underestimated, however a portion of the seepages present in 2010 have since been removed due to development of the Cypress Mine.

2.3.2 Description

Boulderfields of acidic rocks are defined as land in which the area of unconsolidated bare boulders (>200mm diameter) formed by acidic rocks (e.g., greywacke, granite) exceeds that of any other vegetation (Atkinson 1985). The first colonists of boulderfields are typically mosses and lichens, followed by ferns and lianes (Landcare Research Limited 2012). Older boulderfields may support woody species and communities (e.g., grey shrubland) (Landcare Research Limited 2012). Boulderfields of acidic rocks are present on most granite and greywacke mountain ranges in the South Island. A typical boulderfield at Stockton is shown in Figure 7.



Figure 7: Boulderfield near Mt Rochfort on the Denniston Plateau.

Sandstone erosion pavement is exposed rock at the surface of the ground, caused primarily by the removal of soil material by surface rain wash or wind (Lowdermilk & Sundling 1950). Sandstone erosion pavement is present throughout the district, from the northern end of the Mt William range, through to Mt Rochfort with small amounts at Te Kuha in the south. Small areas are present on Mt Garibaldi (Landcare Research Limited 2012) and Mt Davy, but it is largely confined to the Buller Plateaux. Sandstone erosion pavement is likely more extensive than it was historically, due to previous burning and soil erosion (Overmars and Lloyd 2012). Within the Ngakawau ED, sandstone erosion pavement is the preferred habitat for *Dracophyllum densum* ('At Risk – Declining'), and provides habitat for coal measures tussock ('At Risk – Declining'). A typical example of the sandstone erosion pavement community is shown in Figure 8.

Tarns are described above and an example shown in Figure 5.

Seepages are defined as an area on a slope which retains a steady flow of groundwater, often also surface water, including water that has percolated to the stream surface (Johnson & Gerbeaux 2004). Flushes are within the same wetland class as seepages, and occur when a periodic pulse of water produces a sheet-flow of surface water (Johnson & Gerbeaux 2004). Seepages and flushes are present in small areas within the district (Overmars et al., 1998). Plants such as *Actinotus novae-zelandiae*, *Androstoma empetrifolia* and *Donatia novae-zelandiae* are commonly associated with seepages and flushes. An example of a seepage is shown in Figure 9.

Pākihi wetlands are a type of wet heath described above and shown in Figure 6.



Figure 8: Sandstone erosion pavement at the southern Stockton Plateau.



Figure 9: Seepage with herbfield vegetation at the southern Stockton Plateau.

2.3.3 Extent

Tarns, boulderfields of acidic rock, and seepages and flushes have a combined area of ≤20ha on the Denniston and Stockton Plateaux (Overmars & Lloyd 2012 based on Nichol & Overmars 2008). The original extent of these small and separated features remains unknown.

Wildland Consultants Limited (2010) estimated the amount of sandstone pavement at that time as approximately 1,474ha. LCDB6 defines approximately 930ha of "gravel and rock" within the Stockton and Denniston Plateaux. Scree slopes and erosion pavement are included in this cover class. For this cover class the dominant cover is bare surfaces consisting of unconsolidated or consolidated materials generally coarser than 60mm. Surfaces are recent and vegetation, if present, is of very low biomass and not apparent in the imagery used in creating the database.

Reference to Wildland Consultants Limited (2010) shows that the 1,474ha of sandstone pavement they identified can be assigned into the following categories:

- Public Conservation Land 619.4ha
- Within Stockton CML (37150) 456.5ha
- Within Sullivan CML (37161) 5.6ha
- Within Upper Waimangaroa MP (41151) 392.3ha

Total 1,474ha

Pākihi wetlands are widespread on the Stockton and Denniston Plateaux with vegetation across large parts of both plateaux meeting the criteria to be considered a 'natural inland wetland' (Ministry for the Environment 2025, Ecological Solutions Limited 2026a).

2.3.4 Conservation Status

Holdaway et al. (2012) considered that two of the five naturally uncommon ecosystems present within the ecological district (sandstone erosion pavement and seepages and flushes) are 'Endangered' (Rodriguez et al. 2011, Holdaway et al. 2012).

Holdaway et al. (2012) used three criteria to classify sandstone erosion pavement as an endangered ecosystem:

- C1: small current distribution (extent of occurrence) and decline, or very few locations; ≤ 5000km^2, continuing decline in distribution, continuing reduction in ecological function, exists at 5 or fewer locations;
- C2: small current distribution (area of occupancy) and decline, or very few locations; ≤ 500km^2, continuing decline in distribution, continuing reduction in ecological function, exists at 5 or fewer locations;
- D: area of occupancy ≤ 50km^2 and serious plausible threats (principally mining).

Seepages and flushes are considered endangered by Holdaway et al. (2012) based on the following criteria:

- B2: historical decline in ecological function; very severe decline throughout ≥70% of extant distribution.

Holdaway et al. (2012) considered tarns and boulderfields of acidic rock to be 'Not Threatened'. Pākihi was not one of the 11 wetland ecosystems identified as 'critically endangered', 'endangered' or 'vulnerable'.

2.4 Bryophytes

Bryophytes is a collective term for three subgroups of nonvascular plants, including mosses (approximately 540 species in New Zealand), liverworts (around 770 species in New Zealand), and hornworts (13 species in New Zealand) (Glenny 2012, de Lange et al. 2020, Gibb et al. 2022). A significant percentage of New Zealand's bryophyte species are endemic, with approximately 21% of mosses, 50% of liverworts and 60% of hornworts being unique to the region (Fife et al. 2010). Overall, about 33% of New Zealand's bryophyte flora is endemic (Gibb et al. 2022).

Bryophytes and lichens can act as a pioneer plant community assisting in soil development and moisture retention and assisting vascular plants to establish on bare rocks. Bryophytes in forest, shrubland, pākihi and tussock/grassland vegetation also retain significant amounts of moisture and assist in nutrient recycling. The bryophyte flora of the Ngakawau Ecological District is unusual in that it includes a high diversity of species, including a large number of 'Threatened' and 'At Risk' species, several 'Data Deficient', as well as a number of unusual records of species either found at few other locations elsewhere in New Zealand (e.g. Rakiura/Stewart Island, Fiordland), or otherwise known only from overseas (e.g. Southwest Tasmania). The Ngakawau ED also supports several liverwort genera endemic to New Zealand, including *Herzogianthus*, *Lembidium*, *Megalembidium* and *Pseudolophocolea*.

Between 1997 and 2020, bryophyte surveys in the Ngakawau Ecological District identified approximately 123 moss species, 345 liverwort species, and five hornwort species, which are listed in Appendix B. The liverwort *Bazzania engelii* was first described from the Ngakawau ED (Glenny and Bartlett 2008). In addition, several undescribed liverwort species, including some from the genus *Riccardia*, have been observed in pākihi habitats across the Buller Plateaux (D. Glenny pers. comm. May 2024). A recent addition to the liverwort flora is *Riccardia dimorpha* as described by David Glenny in 2024. Its type location is the Stockton Plateau (Glenny 2024).

Within the Ngakawau ED, Glenny (1999, 2005, 2012, 2015), Glenny and Fife (2001) and Meagher (2020a) have identified seven vegetation communities as being of particularly high value for bryophytes including:

- Red tussockland (dominated by *Chionochloa rubra*). This vegetation is uncommon within the Ngakawau ED (at present, four known localities[3]);
- Pākihi ecotones (low heathlands, fernlands, sedgelands, and cushionfield);
- Mānuka shrublands with open sandstone pavement;
- Stunted conifer-beech-hardwood forest/scrub on ridgelines (cloud forest);
- Large boulders overlain by forest with abundant bryophytes growing between and among the boulders (forested blockfield);
- Forest / forest patches on nutrient poor soils with impeded drainage (e.g., yellow-silver pine forest and shrubland), and
- Diverse (Southern rātā) / tall-beech forest with mountain toatoa.

These vegetation communities are widespread throughout the Ngakawau ED, but bryophyte surveys have generally been restricted to areas proposed for development and the specific distribution of bryophyte species in the Ngakawau ED is therefore incomplete.

[3] Stockton Plateau: Cypress Stream (Glenny 1999); southern saddle of Mt. Frederick (Wildlands 2010; pers. obs. 13 Feb 2024), Upper Waimangaroa Valley (Wildland Consultants Limited 2010; Bramley & Aguillar 2020; pers. obs. 14 Dec 2023), and head of Billo Stream (pers. obs. 6 Dec 2023).

2.5 Fauna

2.5.1 Birds

Great spotted kiwi/Rōroa

The national population of rōroa (*Apteryx maxima*) is estimated at c. 14,000 birds spread across approximately 850,000ha (approximately one bird per c. 61ha) (Toy et al. 2021, Roroa Practitioner Group 2021). Nationally, the population is thought to be declining at a rate of approximately 2% per annum, mainly because of stoat (*Mustela erminea*) predation on juveniles. Rōroa are classified as 'Threatened – Nationally Vulnerable' (Robertson et al. 2021).

The population is considered to comprise four sub-populations (or regional populations) (Toy et al. 2021) as follows:

- North of the Karamea River (Kahurangi National Park) – approximately 50% of adults.
- Paparoa Range – approximately 30% of adults
- Southern Alps (near Arthur's Pass) – 12% of adults
- Westport (between the Karamea and Buller Rivers) – 8% of adults.

The Westport sub-population includes the Ngakawau ED. The Department of Conservation has not divided the population of rōroa into distinct management units on the basis of genetic separation as they have for some other species of kiwi, but there is evidence of genetic structuring of the population where geographically closely located individuals are more similar than geographically widely spaced individuals (McLennan 2020). On that basis, genetic mixing of previously distant kiwi risks "homogenising" genetic diversity and reducing the population's overall ability to cope with future environmental changes. For that reason, the Department of Conservation have not ruled out translocations, but where permitted, they are most likely to occur within 15km of the origin of the affected birds (McLennan 2020).

Call rates within the Westport sub-population recorded by Toy et al. (2021) were between 0.3–3 calls/hour depending on location. Within the Westport sub-population, approximately 48,000ha is considered "core habitat" where call rates exceeded 1 call/hour. Outside the core habitat (approximately 41,000ha) call rates ranged from 0.01–1 calls/hour.

The Department of Conservation has collected rōroa call count data from four sites between the upper Waimangaroa and Orikaka Rivers east of the Denniston Plateau since 1993. Call rates decreased notably between 1995 and 2000, and although there is variability between sites and between years, the overall trend is a slow decline in call rates, which may indicate a stable or slowly declining population (Williams 2024).

Surveys for rōroa have been undertaken across the Buller Plateaux since at least 1997. Call count monitoring of great spotted kiwi and weka (*Gallirallus australis*) has been undertaken on the Denniston Plateau in May and June approximately every two years since 2015 (Nichol 2022). Two observers listened for an hour beginning 30 minutes after sunset and recorded the sex of each bird heard and estimated the distance and compass bearing from a stationary point.

Toy et al. (2021) identified three locations where rōroa call rates exceeded three calls/hour: part of Kahurangi National Park, the southern Paparoa Ranges (north of Greymouth) and part of the Ngakawau ED located east and north of the Buller Plateaux extending beyond the ED boundary. These three locations are likely to be particularly important for rōroa conservation elsewhere within their range, where call counts were generally lower.

Forest birds

Fifty-six species of birds have been recorded in the Ngakawau Ecological District (eBird 2024) including coastal, wetland and terrestrial birds as shown in Appendix C. Most of the existing records are from near Charming Creek and the Denniston Plateau, probably due to these areas having a higher frequency of foot-traffic than other, harder to access, parts of the Ngakawau ED.

Species present include those adapted to forests, shrublands and open areas, although numbers on the Buller Plateaux are generally lower than in the surrounding habitats which are typically more fertile (Overmars et al. 1998).

Pākihi shrubland provides habitat for South Island fernbird (*Poodytes punctatus punctatus*, 'At Risk – Declining') which are also locally common throughout parts of the Tiger and Blackburn Pākihi and at Te Kuha within the Ngakawau ED (R. Buckingham pers. comm. 2013, G. Bramley pers. obs. 2016). Fernbirds are also locally common at German and Caledonian terraces (immediately outside the Ngakawau ED).

Black shag (*Phalacrocorax carbo*) and little shag (*Phalacrocorax melanoleucos*) are characteristic of major rivers and other waterways. Long-tailed cuckoo (*Eudynamys taitensis,* 'Threatened – Nationally Vulnerable') are also seasonally present throughout the Ngakawau ED, where one of their host species, brown creeper (*Mohoua novaeseelandiae*) are present.

2.5.2 Bats

2.5.2.1 Bat Distribution in the Northern South Island

Short-tailed bats

Based on surveys undertaken since 2008, it is unlikely that any short-tailed bat (*Mystacina tuberculata*) populations remain in the top of the South Island (Lloyd 2013, 2018). While a small short-tailed bat population was discovered at Oparara in Kahurangi National Park during 1996 (Buckingham 1998a), recent survey results suggest that this population is unlikely to remain (Lloyd 2013).

Long-tailed bats

As recently as 1962, long-tailed bats (*Chalinolobus tuberculatus*) were reported to be in good numbers in the top of the South Island. Dwyer (1962) compiled historical data indicating that bats were common throughout north-western Marlborough, Nelson and northern Westland; particularly in catchments of the Wairau, Pelorus, Motueka, Karamea, Buller and Grey Rivers. He also noted that, at that time, the Buller River catchment was a location likely supporting one of the highest bat densities in New Zealand. Taylor (1967), cited in Lloyd (2013), reported good numbers of bats in the upper catchment of the Buller River around the same time. More recently, bat surveys undertaken since 2008 indicate that long-tailed bat populations in the top of the South Island have declined dramatically over the last fifty years and long-tailed bats are now rare in the region (Lloyd 2011, 2013, 2018).

As part of bat surveys conducted between 2008 and 2017, acoustic detectors were deployed at 1,282 sites in the top of South Island with 13,950 detector nights of monitoring effort (Lloyd 2018). The resulting dataset detected three populations of long-tailed bats which Lloyd considered "significant": one in the mid-sections of the Mōkihinui River catchment in the West Coast region, another near the confluence of the Pelorus and Rai Rivers in Marlborough, and a third on D'Urville Island at the top of the South Island. The location of these populations is shown in Figure 10 and Figure 11 below.

All three populations are likely to be at least regionally, and more likely nationally, significant.

The three populations occur at low altitude (<500m asl) and in locations with large tracts of unlogged indigenous old growth forest (Lloyd 2013). In addition, there appears to be a population of long-tailed bats inhabiting the low altitude forest in the Oparara Basin and Aorere Valley along the northern and western edges of Kahurangi National Park (Lloyd 2013, 2018). Long-tailed bats were also present at potentially low densities over extensive areas in the headwaters of the Buller River and most of the interior of Kahurangi National Park below 800m asl, although these populations were not considered significant because of the low densities recorded (Lloyd 2013). Given the widespread occurrence of low densities of long-tailed bats throughout South Island forests, Lloyd (2013) considered it likely that individual bats were able to disperse between adjacent populations to create a functioning meta-population (Lloyd 2013).

Current national bat distribution data suggests that in the South Island there is one relatively large offshore population of long-tailed bats (on D'Urville Island) and at least five relatively large mainland populations (in Eglinton, Kepler, Maruia, Mōkihinui and Pelorus-Rai) as well as low densities of long-tailed bats spread over wide areas elsewhere, especially in lowland West Coast forests (Lloyd 2013). The Mōkihinui population is considered significant at the regional and national scale (Lloyd 2011). The Mōkihinui Forks, where bats have most commonly been recorded, is approximately 5km east of the Ngakawau Ecological District boundary, separated by the Glasgow Range.

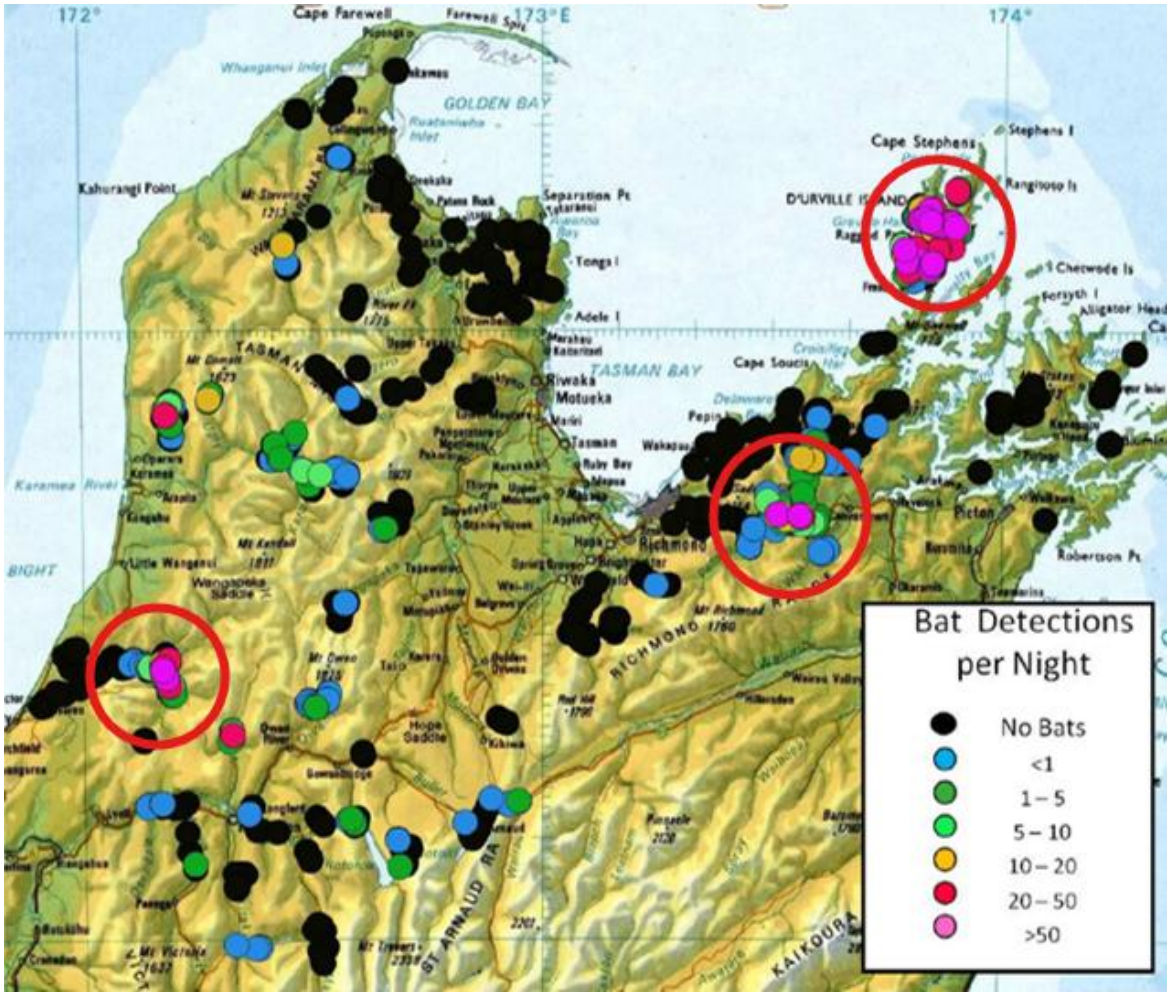


Figure 10: Acoustic bat survey results from the northern South Island 2007- 2013 (from Lloyd 2018, 2019).

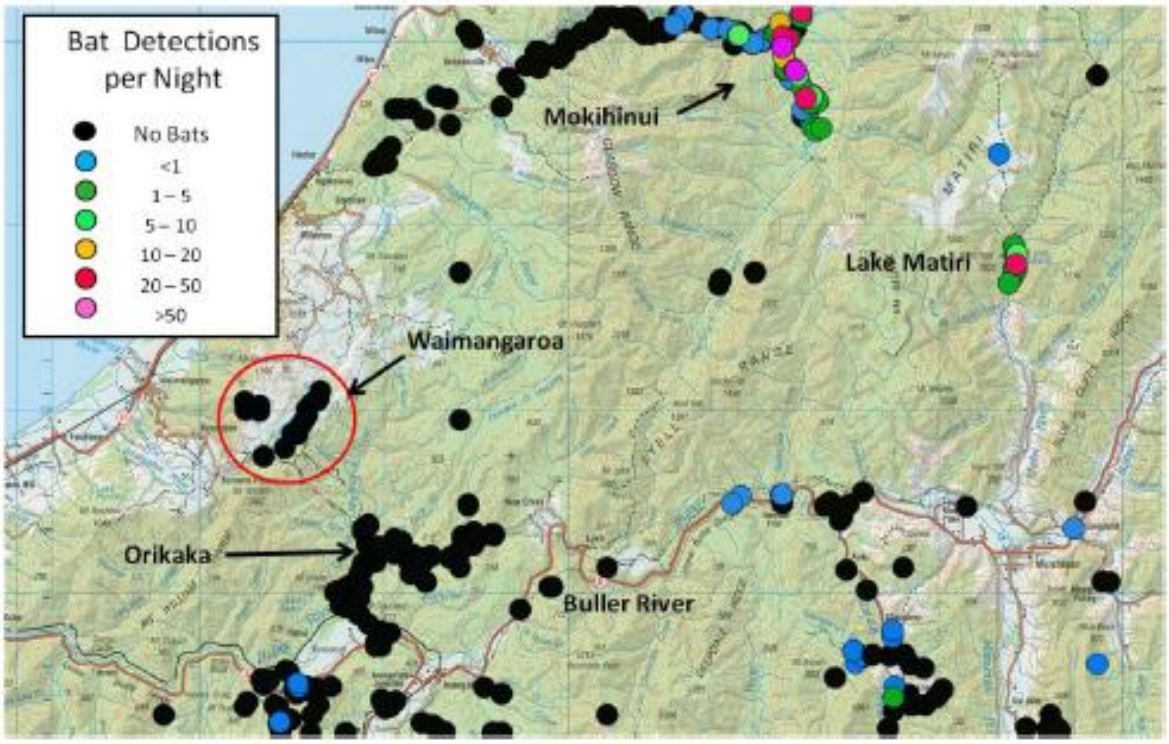


Figure 11: Acoustic bat survey results from the Northern South Island 2007 – 2013 (from Lloyd 2018, 2019).

2.5.3 Lizards

In 2004, approximately 17 species of lizards were reported from the West Coast region of the South Island (Whitaker & Lyall 2004). The taxonomy of lizards has been revised since then (Chapple et al. 2011, Nielsen et al. 2011) which has affected the estimate of the number of lizard species present.

The Ngakawau ED is known to provide habitat for four species of native lizard (two geckos and two skinks) as follows:

- Forest gecko (*Mokopirirakau granulatus*);
- West Coast green gecko (*Naultinus tuberculatus*);
- Newman's speckled skink (*Oligosoma* aff. *newmani* 'Buller');
- Northern grass skink (*Oligosoma polychroma*).

West Coast green gecko and Newman's speckled skink are listed as 'Threatened – Nationally Vulnerable', whilst forest gecko is regarded as 'At Risk – Declining' (Hitchmough et al. 2026). Northern grass skink is considered 'Not Threatened'.

This four species assemblage of lizards occurs only in the Ngakawau ED and the relative abundance of forest and West Coast geckos appears to be high compared to elsewhere within their range.

2.5.4 Snails

The Rhytidae are a group of large carnivorous land snails distributed in the southern hemisphere. In New Zealand, the genus *Powelliphanta* has at least 20 species and 59 subspecies, representing some of the most distinctive invertebrates in New Zealand (Walker et al. 2008). However, in part due to their restricted mobility, the conservation status of species of *Powelliphanta* is of concern as a result of habitat loss and predation by introduced

mammals (Walker 2003, Walker et al. 2024) and weka (Lloyd 2026).

Giant land snails (*Powelliphanta* spp.) are widespread throughout the Ngakawau ED, with several populations being subspecies of *Powelliphanta lignaria.* *Powelliphanta lignaria rotella* ('Threatened – Nationally Critical') is a lowland species with a localised distribution on the poorer soils of Mōkihinui Forest, between Charming Creek and the Glasgow Range (Walker 2003). *Powelliphanta lignaria johnstoni* ('Threatened – Nationally Critical') is also a lowland species, living in acidic soils with frequent coal measure exposures. *P. l. johnstoni* occurs patchily in the catchment of Charming Creek and its tributaries, and in the Mōkihinui Forest, between Ngakawau and Seddonville (Walker 2003). *Powelliphanta lignaria unicolorata* ('Threatened – Nationally Critical') is found on both sides of the southern branch of the Mōkihinui River downstream almost to the river mouth (Overmars et al. 1998).

Further south, *Powelliphanta augusta* ('Threatened – Nationally Critical') is present at Mt Augustus on the Stockton Plateau. Prior to the species being determined genetically distinct from *P. patrickensis,* a large amount of habitat at Mt Augustus had been stripped for coal mining. Currently, *Powelliphanta augusta* is restricted to an area of approximately 8.5ha at Mt Augustus, including natural and rehabilitated habitats, and a small area near Mt Rochfort where captive bred snails have been released.

Powelliphanta patrickensis ('Threatened – Nationally Critical') is scattered throughout the Buller Plateaux. This species is confined to the infertile, poorly drained Brunner coal measures of the Buller Plateaux and occurs patchily from the headwaters of St Patrick Stream south to Mt Rochfort. There is some evidence suggesting that the Stockton and Denniston population of *P. patrickensis* may be a distinct subspecies (Walker et al. 2018), but this is yet to be confirmed. Given the narrow strip of suitable habitat joining the Stockton and Denniston Plateaux, the snail's sedentary behaviour and restricted habitat requirements, populations of *P. patrickensis* on the plateaux could well be separate subspecies, but available morphological and genetic evidence is inadequate to confirm this (Lloyd 2023).

Rhytida spp. are also present throughout the Ngakawau Ecological District. Powell (1946) distinguished a subspecies of *Rhytida meesoni* as *Rhytida meesoni perampla* present in the western South Island. Efford (1998) speculated that there are at least two species present in the western South Island, however all species are currently recorded as *R. m. perampla.* DNA profiling of 12 *Rhytida* specimens collected from various locations in the Ngakawau and Buller ecological districts was undertaken by Toft (2017). Toft (2017) concluded that the samples he collected comprised four species, *Rhytida oconnori*, and three other unnamed, but previously recognised species. Specimens collected from Te Kuha, Mt William (Ngakawau ED) and Mt Davy (Blackball ED), were all unnamed species 'A2' and previous records of 'A2' include specimens from Cypress Stream (Stockton Plateau), and on the Denniston Plateau (Toft 2017). The species name *perampla* has been used as a catch-all for a variety of species in the upper South Island (Toft 2017).

2.5.5 Other Terrestrial Invertebrates

Terrestrial invertebrates are one of the richest components of New Zealand's biota, but little is known about them either generally or in the Ngakawau ED specifically, despite the area (particularly the Buller Plateaux) being relatively well studied.

Terrestrial invertebrates found in the West Coast region comprise at least three distinct faunal elements:

- Widespread species found throughout New Zealand;
- Species typical of north-west South Island;
- Localised species adapted to the main divide, alpine or wetland habitats.

In general, indigenous invertebrate communities dominate at sites with indigenous

vegetation and there is higher invertebrate species richness at sites with more diverse vegetation. This is due to both the greater variety of potential food plant species present and to the more complex habitat architecture provided by taller vegetation. Nonetheless, each habitat type will have its own specialist species, so that the change from open, heath-like sites to forested sites will be accompanied by changes in the community composition and species present as well as changes in abundance.

Vegetation assemblages across the Ngakawau ED are expected to have high faunal values for invertebrates (Overmars et al. 1998). We have located only one invertebrate study within the Ngakawau ED generally (Overmars et al. 1998), although there have been five invertebrate surveys undertaken on the Buller Plateaux over the last 30 years, all of which were carried out in association with development proposals. The Denniston Bioblitz was carried out in 2012 as discussed in Section 1.4 above.

Overmars et al. (1998) conducted a limited ground invertebrate survey using pitfall traps at 16 sites across the district to inform the Protected Natural Area surveys. Twelve carabids (ground beetles, Carabidae), two scarab beetles (Scarabaeidae), and several other invertebrates including Curculionids (weevils, Curculionidae), Staphylinids (rove beetles, Staphylinidae), and Scirtids (marsh beetles, Scirtidae) were collected.

Large-bodied invertebrates of note in the Ngakawau ED include alpine grasshoppers (*Sigaus crassicauda*), tree wētā (*Hemideina crassidens* and *H. broughi*) and vagrant spiders (*Uliodon* spp.). Alpine grasshoppers are abundant throughout tussocklands and low vegetation up to 900m asl (Kingett Mitchell 1996). Wellington tree wētā (*H. crassidens*) and West Coast bush wētā (*H. broughi*) are present within dense forest such as beech–podocarp (Overmars et al. 1998). New species continue to be described from the Ngakawau ED with the cave wētā Occultastella morgana, first collected in 2012, formally described in 2024 (Trewick 2024).

Vagrant spiders (*Uliodon* spp.) are widespread throughout the Ngakawau ED and are often encountered beneath loose slabs of sandstone pavement on the Buller Plateaux (Kingett Mitchell 1996, M. Lambert pers. obs. 2023).

The Global Biodiversity Information Facility (GBIF) returned 313 records for terrestrial invertebrates in the Ngakawau ED (April 2024). The most common order observed was Diptera (true flies, n=101) followed by Lepidoptera (moths and butterflies, n=68) and Coleoptera (beetles, n=31). Additionally, the most common family within Diptera was Chironomidae (non-biting midges, n=51), within Lepidoptera was Geometridae (geometer moths, n=35) and within Coleoptera was Elmidae (riffle beetles, n=12). A list of the species records is provided in Appendix E.

At the southern end of the Ngakawau ED, the invertebrate assemblage at Te Kuha contained many large-bodied and flightless species across different invertebrate orders, including tree wētā, ground wētā, cave wētā, stag beetles, stick insects, spiders, slugs and snails (Patrick 2017).

Patrick (2017) considered Te Kuha to be a significant site for forest ringlet butterfly (*Dodonidia helmsii*) ('At Risk – Relict', Hoare et. al 2015), due to its unmodified state, isolation, and array of vegetation and topographic features. Te Kuha was thought to be home to the largest known population of forest ringlet butterfly at the time (Patrick 2017). The forest ringlet butterfly has also been observed on the Denniston Plateau, although only in very small numbers (Patrick 2017).

Helms's stag beetle (*Geodorcus helmsi*) were also present at Te Kuha, and Te Kuha arguably hosts an important population of this species (Patrick 2017). Helm's stag beetle does not currently have a conservation status, but eight of the ten species in the genus *Geodorcus* in New Zealand are classified as 'Threatened' or 'At Risk' (McClellan et al. 2014). Helms's stag beetle is protected by Schedule 7 of the Wildlife Act (1953).

What was thought to be a new species of leaf-veined slug in the genus *Pseudaneitea* was

discovered at Te Kuha, during surveys associated with a mining application (Entecol Limited 2013). The specimen was photographed by one of the ecological survey team and no individuals were collected for formal identification. Despite additional surveys, no further examples have been collected (Entecol Limited 2016). The species is thought to be part of a complex of *Pseudaneitea* distributed in the northern South Island that are poorly known and undescribed (Millar & Patrick 2016, Mitchell Partnerships 2016).

Lastly, an undescribed species of tiger beetle was discovered at Te Kuha by Mr Peter Johns in 2018. A further five tiger beetles from the same location were collected in early 2019 and three were collected at Denniston, and all specimens were considered to be the same species, closely resembling *Neocicindela aureata* or *N. garnerae.* The specimens collected from Te Kuha and Denniston are considered distinct from the species *N. garnerae* from the south of the Buller River in the Paparoas (Cassola & Moravec 2010).

To date, terrestrial invertebrate surveys have revealed predominantly native invertebrate communities and the occurrence of new records or new species is relatively commonplace, which is not unexpected given the diversity of habitats present within the Ngakawau ED and the paucity of systematic invertebrate collection, description and cataloguing nationally.

2.6 Aquatic Ecology

2.6.1 Freshwater Fish and Kōura

A feature of New Zealand's freshwater fish fauna is the high proportion of diadromous species (i.e. those which migrate up-river from the sea at some stage of their life cycle). Because these diadromous species migrate upriver from the sea, they are vulnerable to natural and artificial barriers created by falls, chutes, dams, weirs, and culverts.

A total of 868 individual records of 18 fish species within the Whareatea, Ngakawau and Mōkihinui river catchments were lodged between 1972 – 2023 in the New Zealand Freshwater Fish database (NZFFDB). These records are summarised by catchment in Table 1 and Figure 12. Eighteen species (35%) of New Zealand's 51 fish species have been recorded within the Whareatea, Ngakawau and Mōkihinui river catchments. Of the 18 species recorded, three (16%) are regarded as 'Threatened – Nationally Vulnerable' (lamprey (*Geotria australis*) and shortjaw kōkopu (*Galaxias postvectis*) and īnanga (*Galaxias maculatus*)), five (27%) are regarded as 'At Risk – Declining', four (22%) are considered 'Not Threatened' and six (33%) are regarded as 'At Risk – Naturally Uncommon' (giant bully) (Dunn et al. 2025). Within the records in the NZFFDB for the Ngakawau ED there are 31 surveys where no species were captured or observed during the survey.

Some species (eels and certain galaxiids) can climb vertical wet rock faces and as a result penetrate far upriver to high altitudes. Others cannot climb and are restricted to lowland, coastal streams. Therefore, the geographical species distributions vary widely within rivers and are greatly affected by both altitude and distance from the sea (Minns 1990).

Overmars et al. (1998) noted that there was limited data about native freshwater fish species in the Ngakawau ED, but that there was a general pattern of higher diversity in the small tributary streams with lower diversity in the main waterways. Banded kōkopu (*Galaxias fasciatus,* 'At Risk – Naturally Uncommon'), inanga (*Galaxias maculatus,* 'Threatened – Nationally Vulnerable') and kōura (*Paranephrops planifrons,* 'Not Threatened') are known from the lower reaches of the Ngakawau River, but the upper reaches of the Waimangaroa River were known to support only kōaro (*Galaxias brevipinnis*), exotic brown trout (*Salmo trutta*) and kōura (Tweed 1986, Overmars et al. 1998, Grainger et al. 2018, Dunn et al. 2025).

Lamprey have been recorded in the lowland, coastal streams between the Whareatea River and Granity Stream. There are no records from the main stems of the major rivers within the Ngakawau ED. Shortjaw kōkopu are apparently more widespread, occurring between just

south of the Whareatea River to north of the Mokihinui River. Like the lamprey, all of the NZFFDB shortjaw kokopu records are from tributaries of the main rivers.

Harding et al. (2006) surveyed 52 sites in the Mōkihinui River, which is not influenced by mining, and the Ngakawau and the Waimangaroa Rivers, which are mine affected. The Mōkihinui River, immediately north of the Ngakawau ED, supports a comparatively rich fish fauna including brown trout, longfin eel (*Anguilla dieffenbachii*), torrentfish (*Cheimarrichthys fosteri*), shortjaw kōkopu, common bully (*Gobiomorphus cotidianus*), redfin bully (*G. huttoni*), bluegill bully (*G. hubbsi*), and kōaro as shown in Figure 12. A total of 12 fish species and 472 fish and kōura have been recorded within the Mōkihinui River catchment including all of the five migratory galaxiid species. No fish were collected at any site with pH <5, while kōaro, redfin bullies, upland bullies (*G. breviceps*) and longfin eels were the only species collected from streams with pH less than 6.5. The authors considered this fish diversity was 'moderate'.

Fish diversity in the main stems of the Waimangaroa and Ngakawau Rivers was low, with six and three species being recorded respectively in 2005 (Harding et al. 2006). This low diversity has been attributed to poor water quality and natural instream barriers. Kōaro were found in the upland tributaries of St. Patricks Stream which drains the Cypress Mining area of Stockton Plateau to the Ngakawau River.

Strickland (1995) reported nine species including brown trout and kōura and noted that the native fish fauna was under represented in the upper Waimangaroa River. The reasons for this were thought to be a combination of factors including physical barriers in the Waimangaroa Gorge downstream of Deep Creek and unsuitable biotic and abiotic conditions in the upper catchment. Kingett Mitchell (1996) reviewed the existing fish data and concluded that the Waimangaroa River does not have any significant native fisheries value.

Table 1: Summary of fish records by catchment from the Ngakawau Ecological District 1986-2023.

Report	Common name	Waimangaroa River			Hutt Creek	Cedar Creek	Burnett Creek	Conns Creek	Kiwi Creek	Drain	WW Creek	Charming Creek	Coastal	Whareatea River		Ngakawau River		Mōkihinui River	
		Lower	Mid	Upper										Lower	Upper	Below gorge	Above gorge	Lower	Mid
Feasey (1986)	Brown trout		●																
	Giant kōkopu								●	●									
	Banded kōkopu									●									
	Inanga								●										
	Kōaro	●						●			●								
	Lamprey								●										
	Redfin bully								●										
	Longfin eel								●										
	Kōura		●	●	●	●													
Strickland (1995)	Longfin eel	●																	
	Banded kōkopu	●																	
	Brown trout			●															
	Inanga	●																	
	Short jaw kōkopu	●																	
	Giant kōkopu																		
	Lamprey	●																	
	Kōaro	●																	
	Redfin bully	●																	
	Kōura			●															
Kingett Mitchell (1996)	Banded kōkopu														●				

| | | |

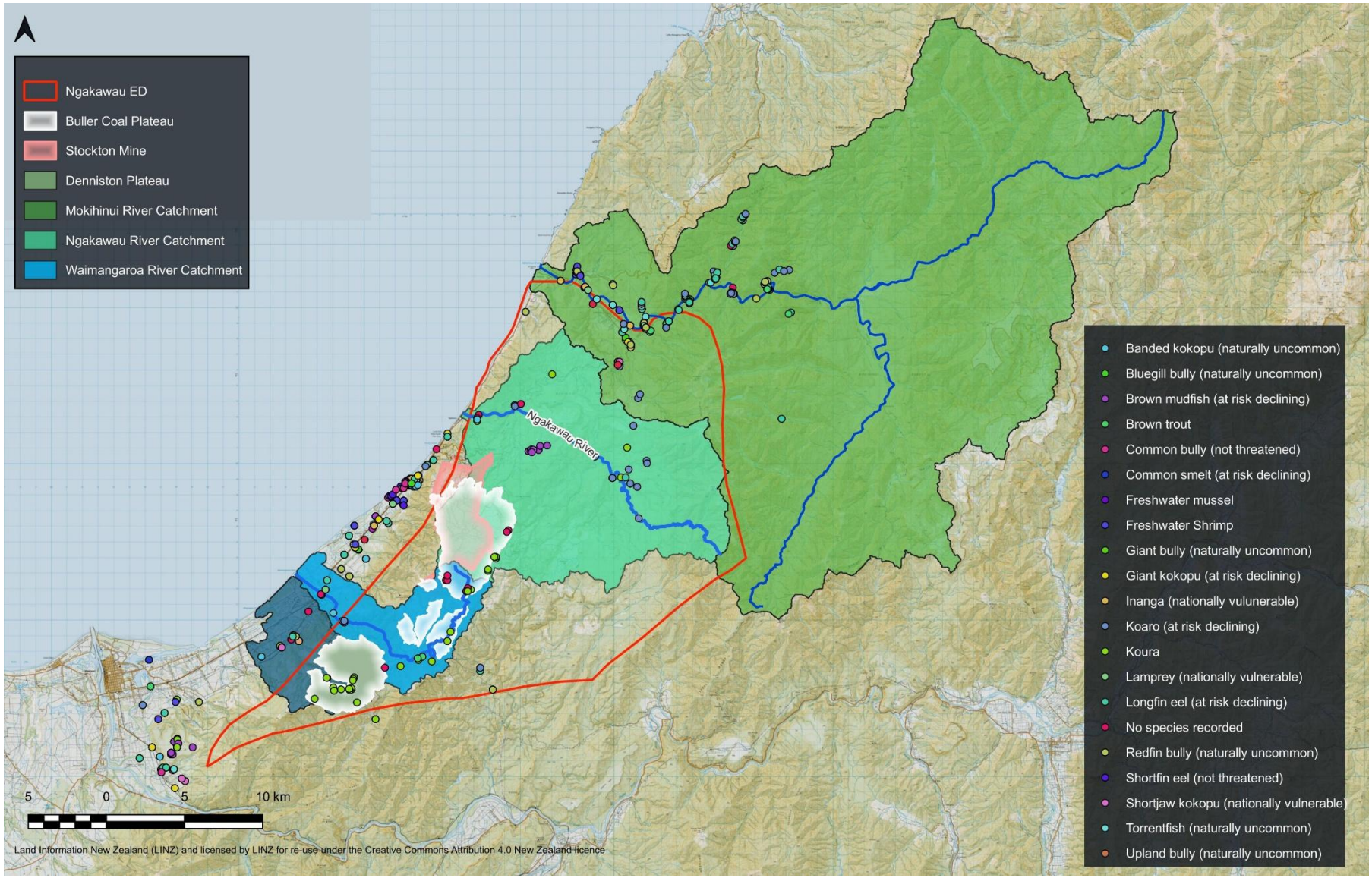


Figure 12: Location of fish surveys in the northern Buller region (NZFFDB and other surveys).

2.6.2 Benthic Invertebrates

Overmars et al. (1998) noted that previous surveys of freshwater invertebrates within the Ngakawau ED had revealed depauperate communities at both modified (mostly mine affected) and unmodified sites, which has been attributed to naturally low pH, high altitudes, high annual rainfall and significant variation in stream and river flows (flashiness).

Surveys undertaken by Kingett Mitchell in 1995 and 1996 indicated low taxa richness and abundance in the main stem of the Waimangaroa River and higher richness and abundance in the tributary sites. Several previously undescribed caddisfly species were collected during the 1996 survey including *Alloecentrella linearis* and two new species of *Pycnocentria* (sand-cased caddis) which were found in the upper tributaries of the Waimangaroa River.

Kingett Mitchell also surveyed the Whareatea River in 1997. The survey sites included near the State Highway 67 bridge over the Whareatea River and upstream of Trent Stream, which is approximately 4.3km upstream of the bridge site. Kingett Mitchell (1997) compared those samples to the samples collected in 1995 and 1996 and found that in the Whareatea River, the samples were dominated by diptera (true flies) whereas the surveys conducted in the Waimangaroa River tributaries were dominated by mayflies (Ephemeroptera) and stoneflies (Plecoptera).

Despite low taxa richness and abundance, the biological communities inhabiting the lower Whareatea River were indicative of a healthy ecosystem, but macroinvertebrate densities were low compared to other West Coast streams in the vicinity (Kingett Mitchell & Associates 1997).

2.7 Pest Animals

Overmars et al. (1998) and Parkes (2020) reported that introduced mammals occur throughout the Ngakawau ED. Red deer (*Cervus elaphus*) occur throughout the forests and subalpine communities (Overmars et al. 1998). Feral goats (*Capra hircus*) are common on the Glasgow Range and they have been observed below Mt Rochfort on the bluff outcrops and the former Cascade Mine (G Bramley, 2024). Wild pigs (*Sus scrofa*) were present behind Waimangaroa and Seddonville, in the lower Ngakawau Gorge and on the Blackburn Pākihi (Overmars et al. 1998). Chamois (*Rupicapra rupicapra*) are also present within the district (Parkes 2020).

Smaller mammals (e.g., ship rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*), mice (*Mus domesticus*), rabbits (*Oryctolagus cuniculus*), hare (*Lepus europaeus occidentalis*), mustelids (stoats (*Mustela erminea*), ferrets (*Mustela furo*) and weasels (*Mustela nivalis vulgaris*)) and feral cat (*Felis catus*)) are likely present where suitable habitat occurs (Overmars et al. 1998). Rodents and mustelids in particular are common in the forests within and surrounding the Ngakawau ED, particularly following beech masting.

Mammals have not generally been monitored throughout the Ngakawau ED, although monitoring has been conducted following control operations, including at the Denniston Biodiversity Enhancement Area ('DBEA' described in Section 2.9).

Australian brushtail possums (*Trichosurus vulpecula*) are likely to occur throughout all forested habitat, although not in universally high or consistent densities (Overmars et al. 1998), particularly given efforts to control them as part of tuberculosis vector control.

Operational Solutions for Primary Industries New Zealand ('OSPRI') undertakes semi-regular aerial 1080 operations throughout the wider area as part of their efforts to control brush-tailed possums as vectors for bovine tuberculosis. Such operations are sometimes undertaken in collaboration with the Department of Conservation and have included parts of the Ngakawau ED in 2005, 2009, 2015, 2019 and 2023. These operations will also have temporarily reduced populations of other resident mammals (particularly rodents and mustelids)

throughout the Ngakawau ED and beyond, depending on the extent of the application area.

Vespulid wasps (common wasps (*Vespula vulgaris*) and German wasps (*Vespula germanica*)) are seasonally abundant in the lower altitude beech forests in the district, but are seldom recorded at the higher altitudes of the Buller Plateaux.

2.8 Pest Plants

The Ngakawau ED has a cover of predominantly indigenous vegetation and most pest plants are associated with disturbances such as vehicle tracks and old mining infrastructure or settlements (Overmars & Lloyd 2012). Exotic species are widely, but patchily distributed throughout the district.

Pest plants known to occur within the Ngakawau ED include montbretia (*Crocosmia* × *crocosmiiflora*), European broom (*Cytisus scoparius*), heath rush (*Juncus squarrosus*) and gorse (*Ulex europaeus*).

Pest plants associated with old mining infrastructure include tiger lily (*Lilium lancifolium*), exotic pasture grasses such as brown top (*Agrostis capillaris*), sweet vernal (*Anthoxanthum odoratum*) and Yorkshire fog (*Holcus lanatus*), and various herbaceous dicot weeds (Mitchell Partnerships 2012). Weedy areas are also associated with former settlements throughout the district (e.g. Burnett's Face).

We could not find any evidence of specific weed control efforts in the Ngakawau ED beyond that which occurs at the Denniston Plateau as part of Bathurst Resources Limited's offset and compensation arrangements there in relation to Escarpment Mine and at Stockton Mine as part of mine management.

2.9 Ecosystem Management in the Ngakawau Ecological District

As part of the consent conditions for the Cypress Mining Area, Bathurst implement the 1,990ha Snail Enhancement Area ('SEA') targeting rats and possums for protection of *Powelliphanta patrickensis* and the 8,200ha Wider habitat Enhancement Area ('WHEA') targeting possums, rats and stoats for wider habitat protection to buffer the snail enhancement area for a period of 35 years. The effectiveness of this management in maintaining snails has recently been questioned because the increase in Western weka has resulted in an increase in weka predation on snails and apparently a significant decline in snail numbers (B. Lloyd, pers. comm., October 2024).

The Denniston Biodiversity Enhancement Area ('DBEA') was required by the consents permitting the construction and operation of Escarpment Mine[4]. The DBEA involves weed, predator and pest control and monitoring within 4,500ha on and around the Denniston Plateau. Similarly, the Denniston Permanent Protection Area ('DPPA') was required by the consents of the Escarpment Mine. The DPPA supports many conservation values similar to those adversely affected by Escarpment Mine and weed and animal control is currently undertaken in the area by the Department of Conservation, funded by Bathurst.

There is an ongoing weed control programme within the DBEA funded via the Escarpment Mine compensation package as described above and BT Mining also has an active weed control programme in current mining areas at the Stockton Plateau.

The location and extent of the managed areas are shown in Figure 13. Together these areas comprise 94% of the 5,272ha Buller Plateaux (DPPA 718ha 14%; DBEA 1,742ha 33%; SEA

[4] The Escarpment Mine consents also require the Heaphy Management Area ('HMA'). The HMA involves 10,000ha of weed, pest and predator control in Kahurangi National Park. The HMA also includes a 3 km buffer zone of weed and pest management, bringing the total area under management there to 24,000ha. This weed, pest and predator control is to be provided for at least 50 years at the DBEA and for a term of 35 years at the HMA.

893ha 17%; WHEA 1,588ha 30%) and extend beyond the plateau to adjoining habitats. Together the DPPA and the WHEA comprise 12,700ha which covers c. 26% of the Ngakawau ED.

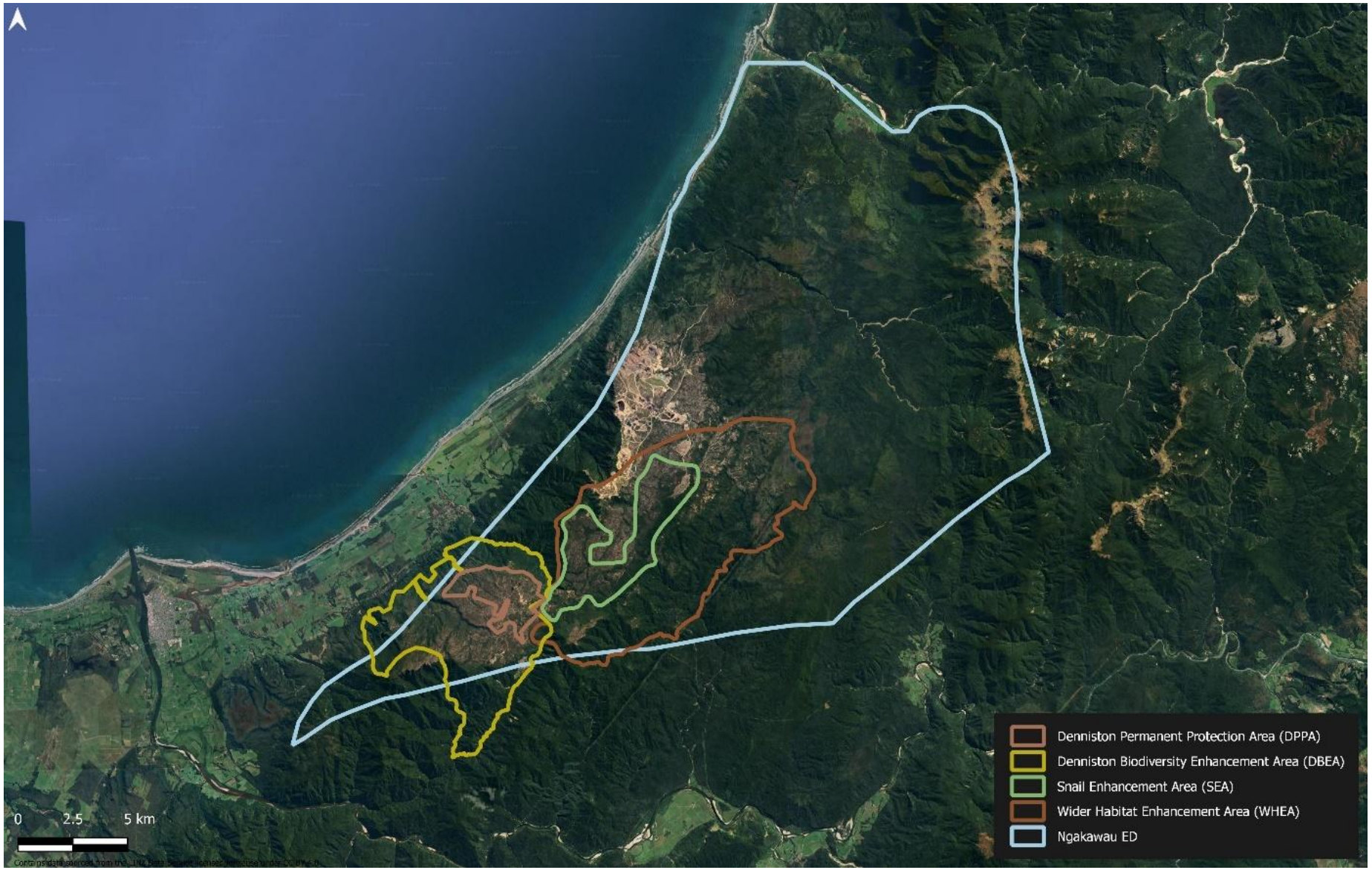


Figure 13: Ecological Management Areas within the Ngakawau Ecological District.

3.0 Location and Extent of the Buller Plateaux

3.1 Introduction

Despite being commonly used, the names Denniston Plateau, Stockton Plateau and Buller Plateau / Plateaux are not listed in the New Zealand Geographic Board gazetteer of geographical place names[1].

Bathurst and its predecessor, Buller Coal Limited, retained specialist geomorphologists to define the Denniston Plateau and Stockton Plateau respectively based on the geomorphological features evident (Templeton and McMorran 2020). The Environment Court adopted Mabin's (2012) definition of the Denniston Plateau in 2013[5]. These areas together (i.e. the Stockton and Denniston Plateaux) are referred to here as 'the Buller Plateaux'.

Templeton and McMorran (2020) considered that the current shape of the Buller Plateaux is a function of the tectonic forces which have uplifted a north-south elongated block of the earth's crust and erosion processes that have removed the younger part of the sedimentary sequence exposing the relatively smooth and flat surface of the underlying Brunner coal measures which are resistant to weathering.

The large Waimangaroa River system has sufficient gradient and flow to erode through the Brunner coal measures into the basement rock, which has dissected the Buller Plateaux forming the now separated Denniston and Stockton Plateaux. The extent and location of Brunner coal measures in the Ngakawau ED is set out in Section 3.2 and each element of the Buller Plateaux is defined separately in Sections 3.3 and 3.4 below for clarity. The ecological values of these two areas together (i.e., the Buller Plateaux as a whole) are considered in Section 4.0.

Rough Milne Mitchell Limited (2021) concluded that the physical and perceptual values of the Denniston Plateau are very high and relate to the unique geology and geomorphology with high quality Tertiary coal measures. Rough Milne Mitchell (2021) also noted that although much of the Denniston Plateau is protected as stewardship land under the Department of Conservation's management, and its vegetation has been highly modified, the perception is that the natural character, legibility, the appreciation of cultural heritage and human endeavour, transient qualities, recreational opportunities are all high, along with a generally high austere aesthetic. Rough Milne Mitchell Limited also concluded that the associative values are widely recognised with very highly valued historical and heritage characteristics associated with mining, but also relating to tourism and recreation. Rough Milne Mitchell (2021) agreed with the Environment Court that due to the prevalence of human intervention and modification, the Denniston Plateau was not sufficiently natural to be an Outstanding Natural Feature or an Outstanding Natural Landscape.

Rough Milne Mitchell Limited (2021) considered that the Stockton Plateau covers 4,704.65ha that shares particular landscape attributes such as underlying coal measures, low relative relief, existing land cover and current/consented land use. They divided the Stockton Plateau into three main landscape character units (LCUs) based on differences in topography, land cover, land use.

LCU 1 comprised the northern two thirds of the Stockton Plateau and contained the opencast workings of the Stockton and Cypress mines. A small central portion of this LCU remained in a relatively undisturbed natural state with some notable features including Whirlwind Rise, the Webb Fault escarpment, areas of low-stature native forest, exposed pavement and tussock grassland dissected by deeply incised streams. Rehabilitated and revegetated areas are

[5] Decision 2013 – NZEnvC – 047 in the matter of an appeal under section 120 of the Resource Management Act (1991) between West Coast Environmental Network Inc, Royal Forest and Bird Protection Society (Appellants) and West Coast Regional Council and Buller District Council (Respondents) and Buller Coal Limited (Applicant). 27 March 2013.

recognisable and continuing to establish (Rough Milne Mitchell 2021).

LCU 2 was contained within the southern third of the Stockton Plateau, being bounded by the Waimangaroa River Gorge to the south and the seaward mountains to the west. LCU 2 was a large, relatively undisturbed, area of gently sloping plateau comprising extensive areas of exposed sandstone rock pavement, deeply incised streams and a distinctive scarp named Rata Ridge (Rough Milne Mitchell 2021).

LCU 3 comprises the north-south trending shallow-dished valley of the Waimangaroa River, which covers 494.71ha along the eastern edge of the Stockton Plateau. The valley was dominated by its relatively dense and mostly continuous forest cover and the Waimangaroa River. The southern part of the river valley is, however, obviously modified by power transmission infrastructure, Cedar Creek Road that connects to the Denniston Plateau, and the presence of historic underground mines (Rough Milne Mitchell 2021).

Each landscape character unit had particular landscape values with LCU 1 being predominantly industrial in nature, LCU 2 having high physical and perceptual values such that the overall LCU was distinctive and memorable, and LCU 3 having moderate-high physical and perceptual values, mainly derived from the moderate to high level of natural character and aesthetic qualities of the forest cover, reduced in the southern part by the level of human modification there (Rough Milne Mitchell 2021).

The Buller Plateaux is located within the Ngakawau ED and North Westland Ecological Region (McEwen 1987) as described above.

3.2 Brunner Coal Measures

3.2.1 Coal Measures Geology

The term “coal measures” refers to geological sediments laid down in a depositional environment in which coal can form (Overmars et al. 1998). Coal measures may, or may not, contain coal.

There are three coal measure formations on the West Coast: Late Cretaceous–Palaeocene Paparoa Coal Measures (e.g., Greymouth Coalfield), Eocene Brunner Coal Measures (e.g., Buller Plateaux) and Miocene Rotokohu Coal Measures (near Reefton). Coal measures parent material often develops naturally acidic and infertile soils.

Brunner coal measures occupy an area of 26,585ha on the northern West Coast of the South Island between Golden Bay and Ross and extending as far east as the Gordon Range (north of St Arnaud). The largest concentration of Brunner coal measures occurs on the Buller Plateaux, where the acidic geology combines with poor drainage in a cool, wet, and windy environment to create distinctive vegetation communities and exposed gently sloping rock pavements which are known as sandstone erosion pavement or ‘sandstone pavement’.

Brunner coal measures cover around 3,013ha and 1,648ha at Stockton and Denniston, respectively (4,661ha combined), where the most extensive vegetation communities on the exposed gently sloping rock pavements are dominated by prostrate shrub and tussock communities. The approximate extent of Brunner coal measures on the Buller Plateaux is shown in Figure 14[6].

Forests and shrublands comprising species adapted to infertile environments develop in more sheltered locations, or those with deeper soils, such as hill slopes and deeply incised gorges.

[6] The Brunner coal measures estimate provided here and the associated layer shown in Figure 14 was retrieved as a GIS map layer from the QMAP series of geological maps produced by GNS Science available at http://www.gnx.cri.nz/static/datadict/ (accessed August 2011).

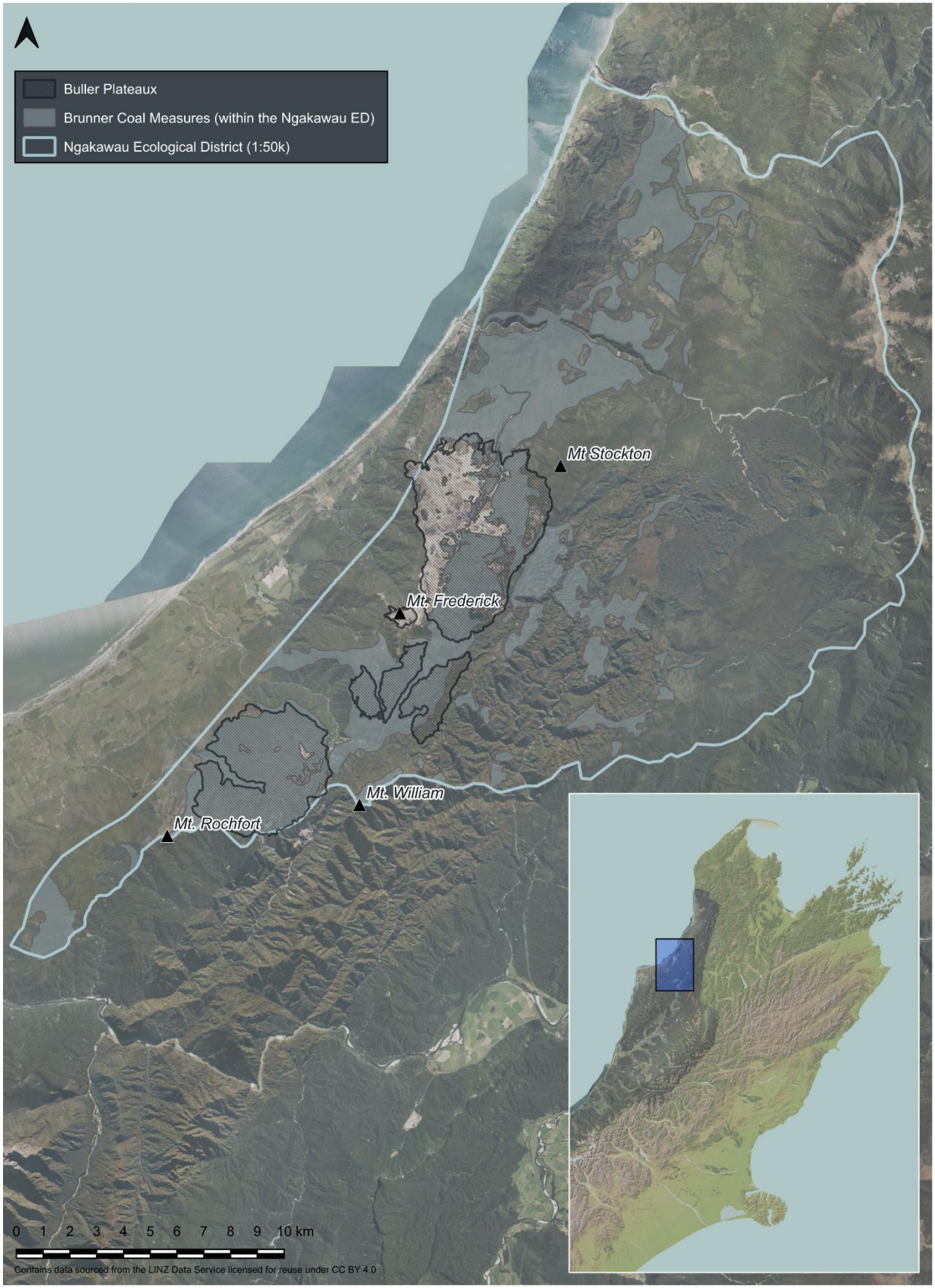


Figure 14: Location of Brunner Coal Measures on the Buller Plateaux, in relation to the Ngakawau Ecological District.

3.2.2 Coal Measures Vegetation

Coal measures parent material develops acidic and infertile soils. This, combined with poor drainage in cool, wet and windy conditions, makes coal measures vegetation distinctive. Stunted Southern rātā-podocarp-beech forest occupies gullies that dissect the gentle plateaux slopes, where vegetation is dominated by variations of shrub-tussock-wire rush vegetation. The vascular flora of the coal measures includes locally endemic species such as coal measures tussock (*Chionochloa juncea*) and the alpine daisy (*Celmisia dubia*), as well as 'Threatened' and 'At Risk' species and species with localised distributions within New Zealand. Coal measures vegetation is present notably on the Stockton and Denniston Plateaux, Blackburn and Tiger pākihis, and on Te Kuha ridge.

3.3 Denniston Plateau

Mabin (2012) defined the Denniston Plateau as covering approximately 1,700ha, forming a roughly circular area about 4.5km across as shown in Figure 15. Most of the Denniston Plateau lies between 600 – 700 metres above sea level (m asl), but it includes c. 280ha which is up-warped to the south (near Mt Rochfort) and a down-warped part covering c. 200ha in the northwest.

These up- and down-warped areas, shown in Figure 15, share the relatively smooth relief of the plateau and have been tilted respectively up to 840m, and down to about 450m elevation. Most slope angles are in the range of 5° to 10°, but notwithstanding the ups and downs associated with watercourses, the overall plateau is effectively level across its 3.4km width with the western and eastern edges both at around 600m elevation.

The margins of the Denniston Plateau give way to a range of geomorphological features as follows:

- The northern side of the plateau falls away very abruptly into the 500m deep Waimangaroa Gorge.
- The western edge of the plateau is formed along the coastal escarpment that faces the Tasman Sea, but is separated from the sea by a coastal plain.
- The southern side of the plateau (including the up-warped area) has topography rising in steps a further 200m to the 1,040m high peak of Mt Rochfort.
- The south-eastern side of the plateau drops away steeply into the valley drained by Cascade Creek.
- The eastern edge of the plateau transitions into the lower slopes of Mt William that rises to an elevation of 1,062m, about 400m above the plateau.
- The Whareatea River is one of several streams that drain the plateau to the west. The Whareatea River has formed a 2.5km long, up to 350m wide gorge incised about 60m into the western part of the plateau. Mabin (2012) did not consider the Whareatea River Gorge to be part of the Denniston Plateau.

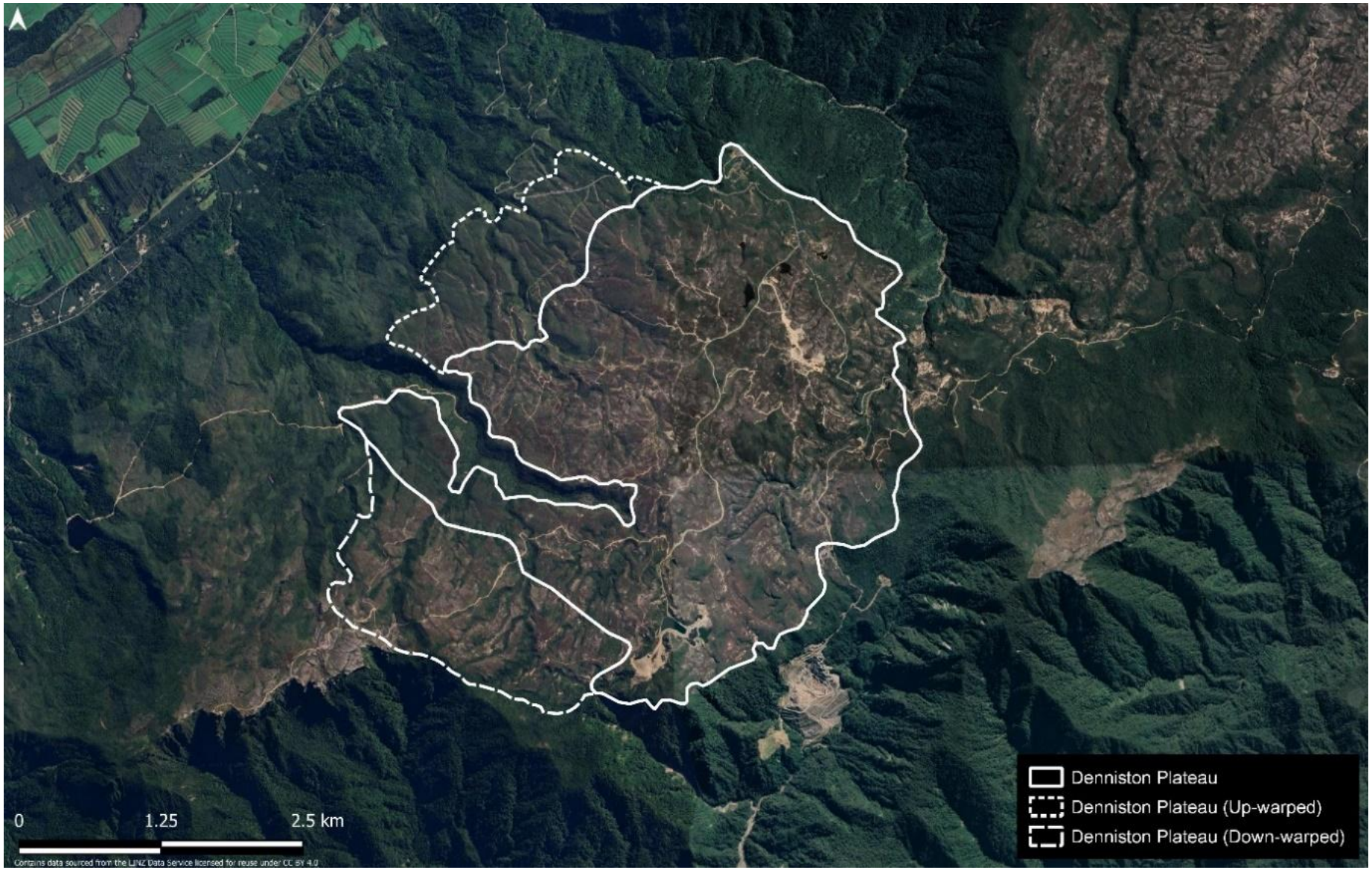


Figure 15: Denniston Plateau as defined by Mabin (2012).

3.4 Stockton Plateau

Templeton and McMorran (2020) identified five areas that they considered formed parts of the Stockton Plateau across a 11.8km stretch between the northern extent of the Denniston Plateau and Stockton Mine. These are shown in Figure 16. They defined the Stockton Plateau as being dominated by a large triangular shaped area of outcropping Brunner coal measures within which Stockton Coal Mine is located, but included smaller areas of outcropping Brunner coal measures located around the northern, eastern and southern margins of the larger area. Templeton and McMorran (2020) estimated that the Stockton Plateau covered an area of approximately 3,120ha, being 7.6km long and 4.1km wide, and forming an oval shape between Mt Augustus, the Mt William Range and Mt Stockton. The Stockton Plateau slopes 10° towards the northeast at elevations varying between 860m and 610m above sea level.

To the south of the main plateau, Templeton and McMorran (2020) identified four sub-plateau (which they called South 1 to South 4) which they considered were also part of the Stockton Plateau landform. The division of the sub-plateau is predominately due to faulting and incision of watercourses into the plateau forming valleys and gorges.

The boundaries of the Stockton Plateau were therefore described as follows:

- The western boundary of the Stockton Plateau is clearly defined by a north trending ridge including Mt Augustus and Mt Frederick, with a steep descent to the west.
- The northern boundary is an irregular shape and less well defined than the western and eastern margins. Templeton and McMorran (2020) defined the northern boundary as deviating around the steep headwaters of Granity Stream, Miller Stream and Sandy Stream. The northern boundary continues to follow distinct topographic change across the lower slopes of Mt Stockton.
- The eastern boundary of the Stockton Plateau is defined by Mount Stockton (751m) and the Mount William fault with land generally rising to the east.
- The southern boundary curves to the west from the Mt William fault where the tributaries of the Waimangaroa River incise into the Stockton Plateau causing greater relief and fragmentation.

The southern area of Stockton Plateau is incised by tributaries of the Waimangaroa River which separate the four areas referred to as South 1 to 4. These areas are described as follows and shown in Figure 16:

- South 1: The top of Mt Frederick, which comprises an area of 65ha elevated above the main Stockton Plateau. This area is underlain by Brunner coal measures and is separated from the main area of Stockton Plateau by the Mt Frederick Fault which is vertically offset by about 200m, up to the west, at Mt Frederick.
- South 2 – 4: Three additional discrete parts of the Stockton Plateau between Mt Frederick and Waimangaroa River, with areas of 150ha, 350ha and 540ha, are separated by the incised Deep Stream and pronounced vertical offsets associated with the long-term deformation along the Mt William and Mt Frederick Faults.

The extent and location of the Buller Plateaux and its component parts, as determined by Mabin (2012) and Templeton and McMorran (2020), is shown in relation to the Ngakawau ED as defined by McEwen (1987) (46,929ha) in Figure 14. The Buller Plateaux defined by Templeton and McMorran (2020) comprises approximately 5,272ha, which is approximately 11% of the Ngakawau ED.

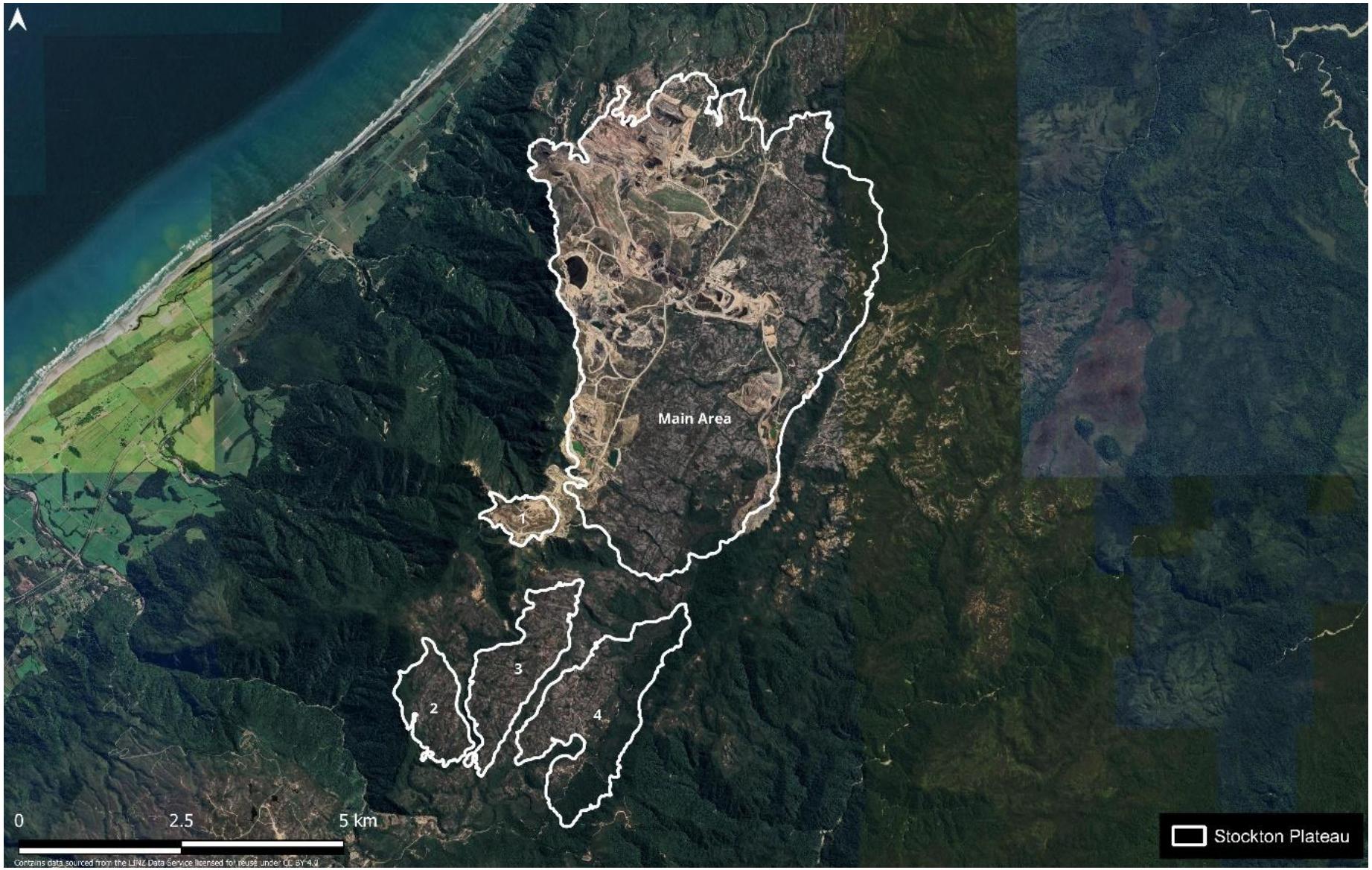


Figure 16: Stockton Plateau as defined by Templeton and McMorran (2020).

4.0 Biotic Features of the Buller Plateaux

4.1 Features of the Buller Plateaux

The Buller Plateaux is the only known area of Brunner coal measures geology which covers a large contiguous area (thousands of hectares) and where gently undulating terrain, relatively high altitude, high annual rainfall (4,000 – 6,400mm), poorly drained and infertile soils, and high westerly wind exposure have combined to create a distinctive coal measures vegetation. The Buller Plateaux is a low fertility environment with often shallow soils where plant growth is stunted, plants grow slowly and the food supply for animals is constrained. Vegetation forms an intricate mosaic with a high degree of natural edge which forms ecotones between different vegetation associations. This results in a high plant species diversity and a correspondingly high diversity of habitats for fauna. Likely, at least in part, because of the high habitat diversity, a wide range of fauna species also occur on the Buller Plateaux. In addition, the Buller Plateaux's location, well connected to surrounding habitats which are more fertile and productive (e.g. Orikaka forests to the west), enables the species present in surrounding areas to visit the plateau and contribute to the observed diversity of fauna species there.

Thirty-one vascular plant species considered either 'Threatened' or 'At Risk' by de Lange et al. (2024) have been recorded from the Buller Plateaux including locally endemic species such as coal measures tussock (*Chionochloa juncea*), *Dracophyllum densum, Euphrasia wettsteiniana* (all 'At Risk – Declining'), *Pseudowintera traversii* and *Schizacme helmsii* (both 'At Risk – Naturally Uncommon'). *Sticherus tener* and *S. urceolatus* (both 'At Risk – Naturally Uncommon') have unusual occurrences on the Buller Plateaux associated with coal measures vegetation.

Several plant species found on the Buller Plateaux have localised distributions within New Zealand including *Actinotus novae-zelandiae*, *Astelia subulata*, *Blechnum fraseri*, *Celmisia dallii*, *C. dubia*, *C. similis*, *Metrosideros parkinsonii* and *Pseudowintera traversii* (Williams and Courtney 1998, Overmars et al. 1998). The small shrub *Dracophyllum pubsecens* is also endemic to the northern West Coast of the South Island with a patchy distribution including high altitude sites on the Buller Plateaux.

4.2 Vascular Vegetation

The vascular vegetation of the Buller Plateaux has been well documented since the early 1990's. Early studies focussed on species inventories and description of vegetation associations in the Ngakawau ED (Druce 1993, Overmars et al. 1998), along with more localised studies on altitudinal gradients (Newell 1990) and descriptions of specific vegetation types (e.g., pākihi, Rigg 1962). Many studies have been undertaken as part of ecological impact assessments associated with coal mining and associated infrastructure on the Buller Plateaux. Walk through surveys, along with RECCE plots (Hurst and Allen 2007) or an equivalent plot-based species inventory methods, have typically been used to describe and map vegetation types. Four of these studies have independently attempted to classify vegetation into types using ordination or similar multivariate analysis including Newell (1990), Overmars et al. (1998), Nichol and Overmars (2008), and Overmars and Lloyd (2012). These classifications, along with those of Wildland Consultants Limited (2010) are summarised in Appendix F.

As part of the surveys to inform the Protected Natural Areas report, Overmars et al. (1998) used ordination to identify 14 vegetation associations that occur in the Ngakawau ED associated with different geological and physiographical environments. Data was derived from 179 plots established across 31 transects at selected locations across the Ngakawau ED.

Wildland Consultants Limited (2010) mapped the vegetation across the Buller Plateaux and surrounds for the Department of Conservation, identifying 22 vegetation types through desktop survey and limited field mapping. Wildland Consultants Limited (2010) did not use plots or any type of multivariate statistics to inform their vegetation mapping.

More recently, vegetation survey of the Escarpment Mine area (Overmars and Lloyd 2012) used multivariate analysis applied to data from 65 plots to distinguish vegetation types based on height tiers and species dominance, resulting in discrimination of eight distinct vegetation types. In an effort to achieve consistency, vegetation descriptions from Wildland Consultants Limited (2010) have been applied to more recent baseline vegetation surveys, including the Sullivan Coal Mining Licence (e.g. The Ecology Company Limited 2020). Most recently, high resolution drone photographs collected between 2021 and 2024 and a RECCE plot-based survey have been used to discriminate, describe and map the vegetation types across the Buller Plateaux in high resolution (Ecological Solutions Limited 2026a).

A vascular species list for the Buller Plateaux derived from sixteen botanical surveys undertaken since 1990 and including data collected by Ecological Solutions Limited (2026a, 2026b) is provided in Appendix A. A total of approximately 542 vascular plant taxa have been recorded from the Buller Plateaux since 1990. The majority (469 (87%)) of those species were indigenous, and 70 (13%) were exotic species. Thirty-one species (c. 6%) are of conservation concern as shown in Table 2.

Mānuka is one of the dominant species across the Buller Plateaux and reflects the extensive disturbance history as well as the infertile soil and harsh environmental conditions. Julius von Haast, in his 1861 description of his exploration of the western Nelson province, describes the plateau being 'covered with mānuka and sub-alpine scrubs' when viewed from Mt Rochfort (Haast 1861). There is abundant evidence of fires across the plateau as seen in seral vegetation communities of pākihi vegetation (typically [mānuka]/wire rush-tangle fern), mānuka scrub, and low Southern rātā-broadleaf forest (Overmars et al. 1998, Nichol and Overmars 2008, Overmars and Lloyd 2012, Wildland Consultants Limited 2010). Mountain flax and *Gahnia* spp. are common associates of these ecosystems. Nichol and Overmars (2008) estimated that 60% of their 148ha southern Denniston Plateau survey area had a fire history. Mānuka formed a key component of scrub and shrubland communities typically found on forest margins and in gullies, and prostrate forms are common on sandstone pavement (Nichol & Overmars 2008).

Southern rātā-mountain beech forest is the most common forest type across the Buller Plateaux, mainly concentrated in gullies on the Denniston Plateau (Wildland Consultants Limited 2010). Variants can have a broadleaved (kāmahi and quintinia) or podocarp (pink pine, yellow-silver pine) subdominant component (Overmars et al. 1998, Wildland Consultants Limited 2010). Shrublands with assemblages of beech, podocarps, mānuka, *Dracophyllum* spp. and *Pseudopanax linearis* with *Gahnia* spp. and wire rush undergrowth is also common in gullies and fault scarps, being a common ecotone between forest and tussockland communities.

Tussock and wire rush communities form a mosaic within the sandstone pavement ecosystem in poorly drained areas with accumulations of re-deposited loessial soil (Given and Park 1975). Coal measures tussock is a dominant component of vegetation communities on the Denniston Plateau where there has been less recent disturbance (Overmars et al. 1998). There are several variants of this vegetation type, with common associates being stunted shrubs of mānuka, *Dracophyllum* spp. and bog pine (*Halocarpus bidwillii*), as well as a variety of plants typical of sub-alpine bogs and seepages (Overmars et al. 1998, Wildland Consultants Limited 2010). This vegetation type supports 'At Risk' species including *Astelia subulata* and *Schizacme helmsii* (both 'At Risk – Naturally Uncommon'). This habitat has been broadly identified as *Chionochloa juncea* grassland and was the most abundant vegetation type across the Buller Plateaux (Wildland

Consultants Limited 2010). Red tussock grasslands are less common and are patchily distributed across the Buller Plateaux, being found on wet, fertile sites on alluvial and colluvial flats (Overmars et al. 1998). Although dominated by red tussock, these communities can be diverse in species, particularly within seepages and flushes where sub-alpine bog species thrive (Overmars et al. 1998).

Short stature mountain beech and/or silver beech forest with pink pine, *Archeria traversii* and *Dracophyllum* spp. (*D. elegantissimum*, *D. traversii*) occupies high altitude sites, including the upper slopes of mountains and steep forested gullies on high areas of the Buller Plateaux (Overmars et al. 1998, Wildland Consultants Limited 2010). This community supports the shrub *Pseudowintera traversii* (Overmars et al. 1998) which is regarded as 'At Risk – Naturally Uncommon' (de Lange et al. 2024). Leatherwood scrub occurs above the treeline on exposed peaks and scarps at high altitudes. This diverse vegetation type typically contains leatherwood species (e.g., *Brachyglottis eleagnifolia*, *Macrolearia colensoi*), stunted silver beech, mountain flax, *Dracophyllum* spp. and tussock species (red tussock, *Chionochloa flavescens*).

Mountain beech-pāhautea forest, normally uncommon in the Ngakawau ED, occurs on alluvial terraces mainly along the upper Waimangaroa River (Given & Park 1975, Overmars et al. 1998). The locally uncommon mountain cabbage tree (*Cordyline indivisa*) has been observed in this vegetation type (Given & Park 1975).

Of the 67 orchid species known to occur in the Western Nelson botanical province, 32 species (six with an 'At Risk' status and one with a 'Threatened' status) have been recorded from the Buller Plateaux.

The Buller Plateaux is a stronghold for the 'At Risk – Declining' *Dracophyllum densum,* endemic to the Western Nelson botanical province and occurring as far south as at least Mt Davy (G. Bramley unpublished data 2010).

Table 2: 'Threatened' and 'At Risk' Plant species recorded at the Buller Plateaux.

	Reference(s)	Common name	Scientific name	Habitat	Threat Status (de Lange et al. 2024)
Trees and shrubs	Overmars & Lloyd (2012), Mitchell Partnerships (2012), Bramley & Aguillar (2020), Ecological Solutions Ltd (2026a).		*Dracophyllum densum*	Montane to subalpine on sandstone pavement and sparse tussock-shrubland	At Risk – Declining
	Overmars et al. (1998), Lambert & Fenwick (2013)	Streamside tree daisy	*Olearia cheesemanii*	Rocky river gorges in or near the flood zone	At Risk - Declining
	Overmars et al. (1998), Nichol & Overmars (2008).	Red mistletoe	*Peraxilla tetrapetala*	Montane forest (beech is a host species)	At Risk – Declining
	Druce (1993), Overmars et al. (1998)	Long-leaved pimelea	*Pimelea longifolia*	Montane shrubland, in open sites in forest and forest margins. Also near rock outcrops	At Risk – Declining
	Newell (1990), Druce (1993), Kingett Mitchell (1996, 1997, 1998), Overmars et al. (1998), Nichol & Overmars (2008), Overmars (2010), Overmars & Lloyd (2012), Ecological Solutions Ltd (2026a).	Travers horopito	*Pseudowintera traversii*	Montane and subalpine forest and shrubland, typically stunted beech	At Risk – Naturally Uncommon
Dicotyledon herbs	Kingett Mitchell (1996).		*Myosotis antarctica* subsp. *traillii*	Grassland, herbfield, rocky/sandy places	Threatened – Nationally Vulnerable
	Mitchell Partnerships (2012), Lambert & Fenwick (2013), Bramley & Aguillar (2020), Ecological Solutions Ltd (2026a).		*Euphrasia wettsteiniana*	Wet tussock grassland, cushion bogs, open channels and pans of cobbles	At Risk - Declining
	Druce (1993).		*Lobelia fatiscens*	Tarns, stream banks, damp sparse mānuka shrubland. Also in modified habitats such as roadside ditches and pasture.	At Risk – Naturally Uncommon
	Overmars et al. (1998).		*Lobelia ionantha*	Tarns, ephemeral wetlands, streambanks, seepages in tussock grassland	At Risk - Declining
	Kingett Mitchell (1998), Ecological Solutions Ltd (2026a).		*Brachyglottis traversii*	Stunted tussock grassland, sandstone pavement	At Risk – Naturally Uncommon
	Mitchell Partnerships (2012).	Gibb's mountain daisy	*Celmisia gibbsii*	Subalpine to alpine fellfield and moist rocky places	At Risk – Naturally Uncommon
	Druce (1993), Overmars et al. (1998), Kingett Mitchell (1996, 1997, 1998).	Slender-flowered eyebright	*Euphrasia disperma*	Cushion bogs, seepages and flushes	At Risk – Naturally Uncommon
	Druce (1993).		*Gentianella decumbens*	Summit fellfields, ridgelines, on skeletal or stony soils	At Risk – Naturally Uncommon
	Druce (1993), Overmars et al. (1998), Nichol & Overmars (2008), Lambert & Fenwick (2013).		*Schizacme helmsii*	Wet *Chionochloa juncea* grassland, cushion bogs, sparsely vegetated heathland	At Risk – Naturally Uncommon

Monocotyledons	Druce (1993), Overmars et al. (1998).	Bearded orchid	*Calochilus paludosus*	Pākihi vegetation and tussock-grassland	Threatened – Nationally Vulnerable
	Kingett Mitchell (1996, 1997, 1998).	leafless rush	*Juncus pauciflorus*	Shrubland, swamp margins	Threatened – Nationally Vulnerable
	Overmars et al. (1998).		*Bulbinella modesta*	Pākihi vegetation	At Risk - Declining
	Druce (1993), Kingett Mitchell (1996, 1997, 1998), Overmars et al. (1998), Nichol & Overmars (2008), Overmars & Lloyd (2012), Mitchell Partnerships (2012), Ecological Solutions Ltd (2026a).	Coal measures tussock	*Chionochloa juncea*	Sandstone pavement and poor-draining low tussock-shrubland on coal measures	At Risk – Declining
	Druce (1993), Overmars et al. (1998), Ecological Solutions Ltd (2026a).		*Astelia subulata*	Cushion bogs, seepages, flushes	At Risk – Naturally Uncommon
	Overmars et al. (1998).		*Caladenia alata*	Tall mānuka shrubland, pākihi vegetation	At Risk – Naturally Uncommon
	Druce (1993).		*Caladenia bartlettii*	Scrub, track sides, infertile soils	At Risk – Naturally Uncommon
	Kingett Mitchell (1998), Lambert & Fenwick (2013), Ecological Solutions Ltd (2025).	Carse's sedge	*Carex carsei*	Boggy ground, found in mānuka scrub and mountain beech-pahautea forest	At Risk – Naturally Uncommon
	Druce (1993), Overmars et al. (1998), Ecological Solutions (2025).	Dall's sedge	*Carex dallii*	Damp depressions in forest and scrub	At Risk – Naturally Uncommon
	Overmars et al. (1998), Wildland Consultants Ltd (2010), Ecological Solutions Ltd (2026a).	Snow tussock	*Chionochloa flavescens* subsp. *lupeola*	Exposed, well-drained, high elevation sites	At Risk – Naturally Uncommon
	Overmars et al. (1998).	Dwarf rush	*Juncus pusillus*	Open, swampy ground, in cushion bogs and tarns	At Risk – Naturally Uncommon
	Druce (2008).		*Pterostylis humilis*	Montane to subalpine beech forest, scrub, boulderfield shrubland	At Risk – Naturally Uncommon
	Druce (1993), Overmars et al. (1998), Overmars (2010).		*Townsonia deflexa*	Mossy areas often within beech forest	At Risk – Naturally Uncommon
Ferns and allied plants	Overmars et al. (1998).	filmy fern	*Hymenophyllum australe*	Rivers, waterfalls and seepages. Found in dark dripping wet overhangs and holes within flood zone	At Risk – Naturally Uncommon
	Perrie et al. (2013).	filmy fern	*Hymenophyllum pluviatile*	Shaded, dry places near watercourses	At Risk – Naturally Uncommon
	Brownsey et al. (2013), Lambert & Fenwick (2013).	Umbrella fern	*Sticherus tener*	Semi-open mixed forest or scrub on ridgetops with poor soils	At Risk – Naturally Uncommon
	Brownsey et al. (2013), Overmars & Bodmin (2013).	Umbrella fern	*Sticherus urceolatus*	Rocky overhangs on cliffs, streamsides and track/road sides	At Risk – Naturally Uncommon

4.3 Bryophytes and Lichens

4.3.1 Background

Bryophytes form a major component of the flora of the Buller Plateaux, accounting for ~30% of the species diversity (Meagher 2020a). Glenny (2015) considered the habitats of the Buller Plateaux to be of "exceptional" value for bryophytes, highlighting bryophytes as a key

biodiversity feature there (Glenny 2012, 2015, Meagher 2020a).

The bryophyte flora of the Buller Plateaux has species in common with the Tasmanian flora (e.g., *Neogrollea notabillis, Telaranea inaequalis*), with the Rakiura/Stewart Island flora (e.g., *Acromastigum verticale, Allisoniella scottii*) and with the Fiordland flora (e.g., *Pseudolophocolea denticulata* and *Saccogynidium decurvum*) (Engel and Glenny 2008, 2019a, b, Glenny 2015). The Buller Plateaux supports many liverwort genera endemic to New Zealand, including *Herzogianthus*, *Lembidium*, *Megalembidium* and *Pseudolophocolea*. The liverwort *Bazzania engelii* was discovered there in the early 2000s (Glenny and Bartlett 2008).

Fifty of the bryophyte species that have been recorded on the Buller Plateaux are currently listed as 'Threatened' or 'At Risk' (de Lange et al. 2020, Michel et al. 2026) including 39 liverworts, 10 mosses, and one hornwort (as listed in Table 3 and described further below). Another 13 liverwort species and one hornwort are assigned as 'Data Deficient', and two liverwort species are listed as 'Not Threatened – taxonomically unresolved'.

Terrestrial Bryophytes

Some liverworts have very specific ecological requirements including in relation to light availability, soil acidity, vascular vegetation communities, aspect, humidity, seepage conditions, stream depth, width and geology (Glenny 2003, 2012, 2015, Glenny & Dawson 2011, Glenny & Engel 2008, Meagher 2020a, b). The combination of habitat conditions which makes the Buller Plateaux important for bryophytes includes high and fairly constant rainfall, sandstone geology (acidic erosion pavement), low soil fertility (which reduces vascular plant competition), high light levels (due to the relatively low and open vascular plant canopy), cold climate (which impedes vascular plant growth), and the historic role of fire in creating the non-forested vegetation communities (Glenny 2012). The same habitat factors also apply to lichens.

These favourable conditions can be localised or rare, providing only a narrow opportunity for occupancy. This habitat rarity can contribute to scarcity, particularly if that particular species is already naturally uncommon and/or has disjunct distributions or is taxonomically isolated.

Specific important bryophyte habitats on the Buller Plateaux include vertical banks and overhangs, bedrock bluff seepages and perpetual wet walls under low forest, forming sheets of bryophytes and bryophyte 'stalactites', stream beds with bedrock substate and lack of granite gravel, ditch habitat, banks of flood-deposited sand, and deep ravines (Glenny 2008a, 2012, 2015, Glenny and Kusabs 2005, Meagher 2020a, b).

Glenny (2015) described 'forested blockfield[7]', shown in Figure 17, as a landscape comprised of large sandstone bedrock and boulder block forest with deep pits that provided 'exceptional' conditions for bryophytes. Such blockfield is known from three locations including Te Kuha, south of Mt Rochfort and Stockton Plateau (Glenny 2015, Terry 2017a, Ecological Solutions Limited 2026a). Similar eroded bedrock and boulder landscapes exist at Denniston, but forest vegetation on these areas was burnt, and the regenerating vegetation comprises mānuka shrubland types rather than forest (Glenny 2015, Ecological Solutions Limited 2026a). At Stockton the forest vegetation comprised Southern rātā / mountain beech-pink pine low forest[8] (Ecological Solutions Limited 2026a).

[7] Described as: yellow-silver pine – pink pine – mountain beech – *Quinitinia serrata* forest about 8m tall (Glenny 2015).
[8] Situated on a ridgeline under 8m tall cloud forest, characterised with pits and caverns up to 3m deep, lined with bryophyte 'sheets and stalactites'.



Figure 17: 'Forested blockfield' at Stockton Plateau.

As described in Section 2.4 above, Glenny (1999, 2005, 2012, 2015), Glenny & Fife (2001) and Meagher (2020a) have identified seven vegetation communities within the Ngakawau ED as being of very high value for bryophytes including:

- Red tussockland (dominated by *Chionochloa rubra*). This vegetation is uncommon within the Ngakawau ED (four known localities[9]);
- Pākihi ecotones (low heathlands, fernlands, sedgelands, and cushionfield);
- Mānuka shrublands with open sandstone pavement;
- Stunted conifer forest/scrub on ridgelines (cloud forest);
- Forest / forest patches on nutrient poor soils with impeded drainage (e.g. yellow-silver pine forest/scrub);
- Forested blockfield; and
- Diverse (Southern rātā) / tall-beech forest with mountain toatoa.

All of these vegetation communities occur on the Buller Plateaux.

4.3.2 Liverworts and Hornworts

The 'Threatened' and 'At Risk' species known to occur on the Buller Plateaux are listed in Table 3. Six liverwort species found on the Buller Plateaux are currently considered 'Threatened' including four 'Threatened – Nationally Critical' and two 'Threatened – Nationally Vulnerable'. A further two are considered to be 'At Risk – Declining', one 'At Risk – Relict', and 41 to be 'At Risk – Naturally Uncommon' (de Lange et al. 2020, Michel et al. 2026). Fourteen species are considered 'Data deficient' (i.e., not enough is known to assign a threat ranking) and two species are 'taxonomically unresolved'.

One liverwort, *Lepidozia acantha* (listed as 'At Risk – Naturally Uncommon') may be present on the Stockton Plateau, but this remains unconfirmed[10].

[9] Stockton Plateau: Cypress Stream (Glenny 1999; pers. obs. 2 Nov 2023); southern saddle of Mt Frederick (Wildland Consultants Ltd 2010, pers. obs. 13 Feb 2024), Upper Waimangaroa Valley (Wildland Consultants Ltd 2010, Bramley & Aguillar 2020, pers. obs. 14 Dec 2023), and the head of Billo Stream (pers. obs. 6 Dec 2023).

[10] D. Glenny (2012). Questions arising from the Mangatini Stream survey.

Table 3: Bryophytes of conservation concern previously recorded on the Buller Plateaux.

Species (nomenclature follows Gibb et al. 2022)	Known locations	New Zealand Conservation Status (de Lange et al. 2020, Michel et al. 2026)
Allisoniella scottii	Two locations at Denniston Plateau. Perhaps Stockton Plateau.	Threatened – Nationally Critical
Isolembidium anomalum var. *anomalum*	Four locations at Denniston Plateau. Two locations at Stockton Plateau. Two locations in the vicinity of St Patrick Stream. One location from Mangatini Stream.	Threatened – Nationally Critical
Neogrollea notabilis	Seven locations from Denniston Plateau. Two locations from Stockton Plateau (includes one location in VDT). Three locations from Mt William Range. One location from Blackburn Stream. One location from Orikaka Pākihi. One location from Ngakawau River.	Threatened – Nationally Critical
Pseudolophocolea denticulata	Three records from Te Kuha. Perhaps Stockton Plateau.	Threatened – Nationally Critical
Acromastigum verticale	Six locations from Stockton Plateau. Five locations from Denniston Plateau. Two locations from Te Kuha. Two locations from Mangatini Stream. Two locations from A.J Stream. One location from Blackburn Stream. One location from Mt William Range.	Threatened – Nationally Vulnerable
Telaranea inaequalis	Seven locations from Denniston Plateau. 11 locations from Stockton Plateau. Three locations from Mangatini Stream. Two locations from A.J Stream. Two locations from Mt William Range. Two locations from Blackburn Stream. Two locations in the vicinity of St Patrick Stream. One location from Darcy Stream. One location from Erin Stream.	Threatened – Nationally Vulnerable
Acromastigum interstisiale	Stockton / Denniston Plateaux	At Risk – Declining
Saccogynidium decurvum	Stockton / Denniston Plateaux and Te Kuha	At Risk – Declining
Goebelobryum vermiculare	Stockton / Denniston Plateaux	At Risk – Relict
Acromastigum mooreanum	Stockton / Denniston Plateaux (and Mt. William Ra.)	At Risk – Naturally Uncommon
Andreaea acuminata	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon
Andreaea subulata	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon
Andrewsianthus perigonialis	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon
Archeophylla schusteri	Stockton Plateau	At Risk – Naturally Uncommon
Bazzania exempta	Stockton Plateau	At Risk – Naturally Uncommon
Blindia immersa	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon
Campylopus kirkii	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon

Cryptolophocolea tuberculata	Stockton Plateau (and Mt. William Ra.)	At Risk – Naturally Uncommon
Dicnemon dixonianum	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon
Ditrichum strictum	Stockton Plateau	At Risk – Naturally Uncommon
Fissidens oblongifolius	Stockton Plateau?	At Risk – Naturally Uncommon
Herzogianthus sanguineus	Denniston Plateau and Te Kuha	At Risk – Naturally Uncommon
Herzogianthus vaginatus	Denniston Plateau	At Risk – Naturally Uncommon
Heteroscyphus billardierei	Stockton / Denniston Plateaux, Te Kuha	At Risk – Naturally Uncommon
Isotachis westlandica	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon
Kurzia nivicola	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon
Lembidium longifolium	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon
Lepidolaena novae-zelandiae	Stockton / Denniston Plateaux, Mt William Ra. and Te Kuha	At Risk – Naturally Uncommon
Lepidozia acantha	Stockton Plateau?	At Risk – Naturally Uncommon
Lepidozia fugax	Denniston Plateau	At Risk – Naturally Uncommon
Lepidozia serrulata	Stockton Plateau	At Risk – Naturally Uncommon
Lepidozia glaucophylla	Stockton Plateau	At Risk – Naturally Uncommon
Metzgeria scobina	Stockton Plateau	At Risk – Naturally Uncommon
Mnioloma novaezelandiae	Te Kuha	At Risk – Naturally Uncommon
Nothoceros giganteus	Stockton Plateau	At Risk – Naturally Uncommon
Pachyschistochila trispiralis	Stockton Plateau	At Risk – Naturally Uncommon
Pachyschistochila virescens	Stockton Plateau	At Risk – Naturally Uncommon
Pallavicinia rubristipa	Stockton / Denniston Plateaux	At Risk – Naturally Uncommon
Pleurophascum ovalifolium	Stockton / Denniston Plateaux, Mt. William Ra. and Te Kuha	At Risk – Naturally Uncommon
Pyrrhobryum paramattense	Stockton Plateau	At Risk – Naturally Uncommon
Riccardia furtiva	Stockton / Denniston Plateaux, Te Kuha	At Risk – Naturally Uncommon
Riccardia multicorpora	Stockton / Denniston Plateaux, Te Kuha	At Risk – Naturally Uncommon
Schistochila pluriciliata	Denniston Plateau	At Risk – Naturally Uncommon
Tayloria callophylla	Stockton Plateau	At Risk – Naturally Uncommon
Trichotemnoma corrugatum	Stockton / Denniston Plateaux, Te Kuha	At Risk – Naturally Uncommon
Verdoornia succulenta	Stockton Plateau	At Risk – Naturally Uncommon
Zoopsis bicruris	Stockton / Denniston Plateaux, Te Kuha	At Risk – Naturally Uncommon
Zoopsis ceratophylla	Denniston Plateau and Te Kuha	At Risk – Naturally Uncommon
Zoopsis matawaia	Stockton / Denniston Plateaux, Te Kuha	At Risk – Naturally Uncommon
Zoopsis nitida	Te Kuha	At Risk – Naturally Uncommon
Allisoniella nigra subsp. *novae-zelandiae*	Stockton Plateau	Data Deficient
Aneura pinguis	Stockton Plateau and Mt. William Ra.	Data Deficient
Ceramanus tuberifera	Stockton / Denniston Plateaux (and Mt. William Ra.)	Data Deficient
Cephaloziella exigua	Stockton Plateau	Data Deficient
Cheilolejeunea novae-zelandiae	Stockton / Denniston plateaux, Te Kuha	Data Deficient
Cryptolophocolea leucophylla	Stockton Plateau	Data Deficient
Heteroscyphus fissistipus var. *repandus*	Stockton Plateau	Data Deficient
Kurzia fragilifolia	Stockton Plateau and Mt. William Ra.	Data Deficient
Lepidozia novae-zelandiae var. *minima*	Stockton Plateau	Data Deficient
Phaeomegaceros coriaceus	Stockton Plateau and Mt. William Ra.	Data Deficient

Plagiochila incurvicolla	Stockton Plateau	Data Deficient
Temnoma quadripartitum var. *pseudopungens*	Stockton Plateau	Data Deficient
Riccardia alcicornis	Stockton Plateau?	Data Deficient
Riccardia exilis	Denniston Plateau? / Stockton Plateau	Data Deficient
Andrewsianthus (a) (CHR 620064; Mt William)	Stockton Plateau	Not Threatened – Taxonomically unresolved
Paracromastigum (b) (CHR 655691; Cypress Mine)	Stockton Plateau	Not Threatened – Taxonomically unresolved

Adventive liverworts recorded on the Buller Plateaux include *Marchantia polymorpha* subsp. *polymorpha* (Terry 2017b, Ecological Solutions Limited 2026b, S Gorinski pers. obs. 2025),

4.3.3 Mosses

Two terrestrial mosses regarded as 'At Risk – Naturally Uncommon by Michel et al. (2026) are known from the Buller Plateaux:

- *Pyrrhobryum paramattense*. This record was the first from the South Island for this species (Meagher 2020a).
- *Pleurophascum ovalifolium*, an endemic species belonging to a monotypic family (Pleurophascaceae). All collections of reproductive individuals (sporophytes) are from the vicinity of Westport, Buller Plateaux, Greymouth and Paparoa Range. This species is found growing in pākihi ecotones and sandstone erosion pavement (Glenny 1999, Fife 2015).

In addition, Braggins and Kusabs (2006) may have collected *Fissidens oblongifolius*, currently listed as 'At Risk – Naturally Uncommon' (Michel et al. 2026), but its identity was not confirmed.

One species of botanical interest has also been recorded within the Buller Plateaux:

- *Pulchrinodus inflatus* a monotypic species, which has never been observed with reproductive capsules (sporophytes). This species also grows in pākihi ecotones and sandstone erosion pavement (Glenny 1999, Fife 2017).

Adventive mosses recorded on the Buller Plateaux include *Calliergonella cuspidata* (Glenny 1999, Fife 2014), *Leptobryum pyriforme* (Ecological Solutions Limited 2026b), *Physcomitrium pyriforme*, *Racomitrium elongatum* and weasel moss (*Sphagnum subnitens*) (Glenny 2015).

4.3.4 Aquatic Bryophytes

Streams within the Stockton Plateau are known to provide habitat for a diverse range of bryophytes, particularly liverworts. Braggins & Kusabs (2006) surveyed four sites and detected more than 140 species, including a number of 'Threatened' and 'At Risk' taxa. The aquatic bryophyte flora is comprised of mosses, liverworts and hornworts, and includes both obligate and facultative aquatic species that inhabit streams, riparian margins, flood zones, wet substrates, tarns and ponds.

Within the Buller Plateaux Braggins and Kusabs (2006) and Glenny (2008a, 2008b) identified seven habitats regarded as being of very high value for aquatic bryophytes including:

- Small gorges;
- Stream bed boulders and stream bed itself;

- Deep instream caverns;
- Banks of flood deposited sand (e.g. *Isotachis westlandica* is a specialist coloniser of such flood deposits);
- Riparian bedrock, gorge walls, rock-walls, 'bolsters' and overhangs (e.g. shallow caves and cave entrances that receive limited direct sunlight);
- Hanging 'stalactites' of plant roots trapped with peat, maintained by water seepage from above plateau; and
- Other areas with high humidity levels.

Overall, aquatic bryophyte communities are influenced by catchment geology, stream depth and width, land use, water quality, and the number and frequency of high-flow events / floods (Suren 1996). Community variation in composition and diversity is largely a result of differences in availability of microhabitats such as large boulders, quiet flow areas, shaded cliffs and tree trunks within the flood zone (Meagher 2020b).

Six aquatic bryophytes of conservation concern have been recorded from the Buller Plateaux, as well as three species for which there is insufficient data, including:

- *Allisoniella scottii* ('Threatened – Nationally Critical')
- *Andreaea acuminata* ('At Risk – Naturally Uncommon')
- *Andreaea subulata* ('At Risk – Naturally Uncommon')
- *Andrewsianthus perigonialis* ('At Risk – Naturally Uncommon')
- *Blindia immersa* ('At Risk – Naturally Uncommon')
- *Isotachis westlandica* ('At Risk – Naturally Uncommon')
- *Allisoniella nigra* subsp. *novaezelandiae* ('Data Deficient')
- *Heteroscyphus fissistipus* var. *repandus* ('Data Deficient')
- *Riccardia exilis* ('Data Deficient')

Before being found at Denniston, the South Island endemic liverwort, *Isotachis westlandica* was previously only known from its type location, the Taramakau River (between Greymouth and Hokitika) where it was collected in 1874 (Engel & Glenny 2019b). It was collected for the first time in 130 years at Stockton Plateau in 2004 (Glenny & Kusabs 2005). At present, this species is only known from recent collections from the Denniston and Stockton Plateaux, including the Waimangaroa River (specimen examined, 2025), Mt. William Range, and Charming Creek; a known range of only 18km (Engel & Glenny 2019b).

4.3.5 Previous Surveys

4.3.5.1 Denniston Plateau

Glenny (2012) recorded a number of 'Threatened' and 'At Risk' bryophytes within the original Escarpment Mine footprint. Species recorded included *Isolembidium anomalum, Neogrollea notabilis* (both considered 'Threatened – Nationally Critical'), *Telaranea inaequalis* ('Threatened – Nationally Vulnerable'), *Saccogynidium decurvum* ('At Risk – Declining'), *Heteroscyphus billardierei*, *Herzogianthus vaginatus* and *Pallavicinia rubristipa* (all considered 'At Risk – Naturally Uncommon'; de Lange et al. 2020). In addition, D. Glenny has collected *Acromastigum verticale* ('Threatened – Nationally Vulnerable') (CHR 606651) and *Isotachis westlandica* ('At Risk – Naturally Uncommon') (CHR 633130) at Denniston. Glenny and M. Renner also collected *A. verticale* at a second Denniston site (CHR 657832).

Glenny (2012) recorded *Lembidium longifolium*, *Lepidolaena novae-zelandiae, Pleurophascum ovalifolium*, *Trichotemnoma corrugatum* and *Zoopsis bicruris* (all listed as 'At Risk – Naturally Uncommon') and *Pulchrinodus inflatus* in surveys associated with Escarpment Mine at the Denniston Plateau.

Glenny (2009, 2012) also surveyed within the Whareatea River Gorge where he recorded *Isolembidium anomalum* var. *anomalum* (Threatened – Nationally Critical), *Acromastigum verticale* and *Telaranea inaequalis* (both considered 'Threatened – Nationally Vulnerable'), *A. interstisiale* ('At Risk – Declining'), and *Kurzia tenax, Pallavicinia rubristipa, Trichotemnoma corrugatum, Riccardia multicorpora, Zoopsis bicruris, Z. ceratophylla,* and *Z. matawaia* (all considered 'At Risk – Naturally Uncommon).

The liverwort *Allisoniella scottii* ('Threatened – Nationally Critical') is also known from the Denniston Plateau, but has only been recorded twice (once in 1997 by Glenny (2012), and again in 2019 by D. Meagher unpub., data.). Habitats such as low-gradient small streams associated with mānuka or exposed to the sun may provide suitable habitat for *A. scottii (*Engel & Glenny 2008, Glenny 2012). Other bryophytes of conservation concner recorded at Denniston include *Acromastigum mooreanum*, *Herzogianthus sanguineus*, *H. vaginatus*, *Heteroscyphus billardierei*, *Schistochila pluriciliata* and *Zoopsis ceratophylla* (all 'At Risk – Naturally Uncommon') and *Ceramanus tuberifera* ('Data Deficient') (Glenny 2012, Jellyman and Stark 2013, de Lange et al. 2020).

4.3.5.2 Waimangaroa Valley

Meagher (2020a) surveyed a proposed transport corridor between Stockton and Denniston, including along the true-left of the Waimangaroa River, in order to characterise the bryophyte flora there. During this survey, Meagher identified two 'bryosites' within the proposed route that he considered warranted further investigation due to their high diversity and potentially unique bryophyte flora. Meagher (2020a) reported the overall bryophyte diversity (171 species) along the proposed transport corridor exceeded that of Te Kuha Ridge (160 species). At one plot Meagher (2020a) recorded a total of 86 bryophytes (65 liverworts, 20 mosses, one hornwort), reflecting the high diversity of the bryophyte flora there.

Meagher (2020a) recorded eight 'At Risk' species within the then proposed route including:

- *Acromastigum interstisiale* ('At Risk – Naturally Uncommon'). There are only 10 records[11] from four widely separated locations on the South Island in New Zealand. The Stockton Plateau is the northernmost site and therefore marks the known northern limit of A. *interstisiale* (Brown and Renner 2014). There is one record from the Denniston Plateau, collected by D. Glenny (CHR 619205).
- *Campylopus kirkii* ('At Risk – Naturally Uncommon').
- *Dicnemon dixonianum* ('At Risk – Naturally Uncommon').
- *Heteroscyphus billardierei* ('At Risk – Naturally Uncommon') was recorded at two locations.
- *Lepidolaena novae-zelandiae* ('At Risk – Naturally Uncommon'), which is generally sparse, but can be relatively common at certain locations within the Buller Plateaux (D. Glenny, pers. comm. August 2024).
- *Pleurophascum ovalifolium* ('At Risk – Naturally Uncommon').
- *Pyrrhobryum paramattense* ('At Risk – Naturally Uncommon'). This record was the first from the South Island for this species (Meagher 2020a).

[11] One record from Mt Augustus (Stockton Plateau) is now presumed extinct.

- *Zoopsis matawaia* ('At Risk – Naturally Uncommon'). Meagher (2020a) recorded a new northern limit for this species on the Stockton Plateau. *Z. matawaia* has been recorded from the Denniston Plateau; Whareatea River Gorge (Glenny 2012), and Mt William (CHR 620062). It is also known from Te Kuha Ridge (Glenny 2015).

At a location near Cypress Stream, Meagher (2020b) recorded two liverworts that are currently considered to be 'At Risk – Naturally Uncommon' (*Andrewsianthus perigonialis* and *Pallavicinia rubristipa*), one 'Data Deficient' species (*Heteroscyphus fissistipus* var. *repandus*); and one moss, *Andreaea subulata* ('At Risk – Naturally Uncommon'). Meagher (2020b) also recorded *Lepidozia serrulata* ('At Risk – Naturally Uncommon') from red tussock vegetation prior to that vegetation being directly transferred as part of site rehabilitation. That vegetation has not been surveyed for bryophytes since being relocated and it remains unknown if that species has persisted. Prior to this record, *L. serrulata* had only been collected within New Zealand from five localities at Stewart Island.

Meagher (2020a) also recorded *Chiloscyphus gippslandicus* and *Porella cranfordii* which have not been recorded in New Zealand before and are not included in the checklist of the New Zealand Flora (Schönberger et al. 2024), although BiotaNZ lists *Porella cranfordii* as 'Indigenous, non-endemic; Occurrence, wild'[12].

Chiloscyphus gippslandicus is considered native to Tasmania and eastern Australia. *C. gippslandicus* and was previously recorded in New Zealand in error, with the plants in question being *C. villosus* (Beveridge & Glenny 2010, Engel & Glenny 2019a). This new record of *Chiloscyphus gippslandicus* is the only known record in New Zealand.

Porella cranfordii is regarded as an Australian endemic and prior to Meagher's (2020a) record, the only record in New Zealand was collected by M. Renner in Hawke's Bay in 2010. Meagher (2020a) suggests that other examples of *P. cranfordii* might have been overlooked due to its similarity to *P. elegantula*, which is common in New Zealand, since the differences between the two species are microscopic and subtle. Renner's Hawke's Bay record of *P. cranfordii*[13] supports Meagher's suggestion that it may have been overlooked.

An additional species, *Riccardia exilis* (considered 'Data Deficient') was recorded from the Cypress Stream catchment by Glenny in 2003 (Waimangaroa River: CHR 574580; CHR 574582), Bryne Creek, Connew Creek, and Ernest Stream (Mitchell Partnerships 2003).

4.3.5.3 Stockton Plateau

Braggins & Kusabs (2006) surveyed riparian bryophytes in the upper Deep Creek area and detected one 'Threatened', four 'At Risk' taxa and two 'Data Deficient' species. Species recorded included *Acromastigum verticale* ('Threatened – Nationally Vulnerable'), *Acromastigum mooreanum, Archeophylla schusteri, Heteroscyphus billardierei* and *Pachyschistochila virescens* (all 'At Risk – Naturally Uncommon') (de Lange et al. 2020). Two species recorded, *Cryptolophocolea leucophylla* and *Lepidozia novae-zelandiae* var. *minima* are considered 'Data Deficient' (de Lange et al. 2020). Two more species of conservation concern may have been collected (*Fissidens oblongifolius*, currently listed as 'At Risk – Naturally Uncommon' (Michel et al. 2026) and *Riccardia exilis* ('Data Deficient') (de Lange et al. 2020)), but their identities were not confirmed.

Glenny (2009) surveyed riparian bryophytes in an unnamed stream near Deep Stream and recorded one 'Threatened', five 'At Risk' species and one 'Data Deficient' species including *Telaranea inaequalis* ('Threatened – Nationally Vulnerable'), *Bazzania exempta*, *Lembidium longifolium*, *Pallavicinia rubristipa*, *Zoopsis bicuris, Z. ceratophylla* (all 'At Risk – Naturally Uncommon'), and *Ceramanus tuberifera* ('Data Deficient') (de Lange et al. 2020).

[12] Manaaki Whenua — Landcare Research (2024) https://biotaNZ.landcareresearch.co.nz. Accessed 16/10/24.
[13] Originally collected in 1929 by G. Sainsbury (CHR 523835).

Surveys undertaken by Glenny (2007) and Glenny & Dawson (2011) recorded *Cryptolophocolea tuberculata* ('At Risk – Naturally Uncommon') from stunted silver beech forest on Mt Frederick, and Southern rātā forest on Mt William Range. This species is primarily confined to the very rainy western sector of the South Island, mainly in dense rich mountain and silver beech forests, often on moist cliff faces (Engel & Glenny 2019a, Schuster 2021). Two records are from Southland. This species has also been recently recorded growing under mānuka-tussock shrubland at a planted rehabilitation site at the Stockton Plateau (Ecological Solutions Limited 2026b).

Riccardia furtiva ('At Risk – Naturally Uncommon') has been recorded from various vegetation types including: mountain beech–Southern rātā–silver pine forest (Glenny 1999), yellow-silver pine scrub/forest (630 m asl) (Glenny and Fife 2001), mountain beech-silver pine forest (740 m asl), mountain beech–pink pine–*Dracophyllum townsonii* scrub (Glenny 2002), and on twigs of mountain toatoa; among mixed riparian scrub including gorse, Southern rātā and yellow-silver pine (Glenny 2008). *R. furtiva* has also been recorded beneath pākihi shrubland (dominated by red tussock / wire rush shrubland) surrounding a natural tarn at Stockton Plateau (Ecological Solutions Limited 2026b).

4.3.6 Lichens

Lichens have seldom been separately surveyed at the Buller Plateaux. Despite the lack of extensive survey, approximately 98 species of lichens are known to occur there. A species list is provided as Appendix G., but is necessarily incomplete because of the limited previous survey effort.

Of the species listed in Appendix G, four are considered 'Threatened', eight 'At Risk', and fourteen 'Data Deficient' (de Lange et al. 2018), as shown in Table 4.

Glenny (2012) recorded *Pycnothelia caliginosa* ('Threatened – Nationally Endangered') and *Austropeltum glareosum* ('Threatened – Nationally Vulnerable'; de Lange et al. 2018) from sandstone erosion pavement at Denniston. Other lichens collected from the Denniston Plateau include: *Knightiella splachnirima* ('Threatened – Nationally Vulnerable'), *Cladia inflata* ('At Risk – Declining'), *Pseudocyphellaria lindsayi* (the type locality for which is the Denniston Plateau) and *Calycidium cuneatum* (both 'At Risk – Naturally Uncommon'). Four 'Data Deficient' species have been recorded including *Parasiphula elixii*, *P. jamesii*, *Pertusaria dennistonensis* and *Placopsis centrifuga*. Open sandstone pavement and quartzite sands provide important habitat for *Austropeltum glareosum* and *Pycnothelia caliginosa* (Glenny 2012, 2015, Terry 2017a, b). Braggins & Kusabs (2006) also recorded *Pseudocyphellaria homoeophylla* and *Sticta filix* (both considered 'Not Threatened', de Lange et al. 2018) at Denniston.

Table 4: 'Threatened' and 'At Risk' lichen species previously recorded at the Buller Plateaux.

Species (nomenclature follows de Lange et al. 2018)	Known locations	New Zealand Conservation Status (de Lange et al. 2018)
Pycnothelia caliginosa	8 locations from Denniston Plateau. 1 record from Stockton Plateau.	Threatened – Nationally Endangered
Austropeltum glareosum	12 locations from Denniston Plateau 2 locations Mt William 2 locations from Stockton 1 location from Te Kuha	Threatened – Nationally Vulnerable
Cladia fuliginosa	Two locations from Denniston Plateau	Threatened – Nationally Vulnerable

	Numerous locations from Stockton Plateau	
Knightiella splachnirima	Four locations from Denniston Plateau Two locations from Stockton Plateau	Threatened – Nationally Vulnerable
Cladia inflata	Eight locations from Stockton Plateau Two locations from Denniston Plateau	At Risk – Declining
Calycidium cuneatum	Denniston and Stockton Plateaux	At Risk – Naturally Uncommon
Degeliella rosulata	Denniston Plateau	At Risk – Naturally Uncommon
Leiorreuma exaltatum	Denniston Plateau	At Risk – Naturally Uncommon
Micarea isabellina	Denniston Plateau, Te Kuha	At Risk – Naturally Uncommon
Ochrolechia frigida	Denniston Plateau	At Risk – Naturally Uncommon
Placopsis gelidioides	Stockton Plateau	At Risk – Naturally Uncommon
Pseudocyphellaria lindsayi	Denniston and Stockton Plateaux	At Risk – Naturally Uncommon
Coccotrema porinopsis	Denniston Plateau	Data Deficient
Fuscopannaria minor	Denniston Plateau	Data Deficient
Gyalidea hyalinescens	Denniston Plateau	Data Deficient
Mazosia melanophthalma	Denniston Plateau	Data Deficient
Megalospora pupa	Stockton Plateau	Data Deficient
Mycoblastus dissimulans	Denniston Plateau	Data Deficient
Parasiphula elixii	Denniston and Stockton Plateaux	Data Deficient
Parasiphula jamesii	Denniston Plateau?	Data Deficient
Peltigera hymenina	Stockton Plateau	Data Deficient
Pertusaria dennistonensis	Denniston Plateau	Data Deficient
Placopsis centrifuga	Denniston Plateau	Data Deficient
Xanthocarpia ochracea	Denniston Plateau	Data Deficient
Xanthoparmelia isidiotegeta	Denniston Plateau	Data Deficient
Xanthoparmelia philippsiana	Denniston Plateau	Data Deficient

4.4 Fauna

4.4.1 Birds

Great spotted kiwi/Rōroa

Rōroa are continuously but sparsely distributed across the Buller Plateaux (Kingett Mitchell & Landcare Research 1997, Thomas & Toft 1997, Buckingham 1998b, Buckingham 2002, Wildlife Surveys Limited 2002, 2008, 2010, 2011, McLennan 2020).

Monitoring of rōroa (great spotted kiwi, *Apteryx maxima*) on the Buller Plateaux began in 1993 and has used call count monitoring, radio tracking, call mapping and use of trained conservation dogs. This has revealed information about the relative abundance, distribution and population trend of rōroa in the vicinity (summarised by McLennan 2020). The locations of birds detected during previous surveys are shown in Figure 18.

Based on these surveys, the rōroa population appears to be stable or undergoing a slow decline. The known population at Cypress Mining area has not changed since 1997 (McLennan 2020), even though at least three of the five monitored pairs lost parts of their territories when Cypress Mine was established. Radio-tracking in that area has revealed the loss and replacement of one adult and the presence of four sub-adults, at least three

locally bred, and confirmed that recruitment of young females has occurred.

Territories within and near the Buller Plateaux are exceptionally large (≥ 80 ha) and typically include a range of habitat types (McLennan 2020). Population stability on the plateau appears to result from a combination of:

i) High adult longevity.

ii) Naturally occurring, but infrequent reductions in stoat predation which allow recruitment in some years (i.e., some non-mast years)

iii) Episodic aerial 1080 operations which reduce stoat numbers sufficiently to allow recruitment in some years.

iv) The possible immigration of sub-adults from surrounding areas during years when 1080 operations improve their survival.

In terms of national significance, McLennan (2020) considered that the Buller Plateaux rōroa population scores highly for its probability of persistence in the absence of predator control, but low for its overall sparseness (probably because of the low fertility of the plateau habitats). Its genetic composition was considered to be of no more value than the other sub-populations.

Specific rōroa surveys on the Buller Plateaux were undertaken between 1997 and 2011 to inform proposed mining activities. Surveys have typically employed nocturnal call counts for two to four hours after dark in line with national protocols. Only one survey has used automatic recorders (Wildlife Surveys Limited 2011), but data from recorders was limited since they were set to record one hour after sunrise and one hour after sunset with the intention of targeting birds active during those hours, not just rōroa.

Kingett Mitchell & Landcare Research (1997) recorded call rates of 0.94 calls/hr to 3.28 calls/hr in the Waimangaroa Valley and the Blackburn Pākihi and Pylon Road areas, respectively. Wildlife Surveys Limited (2002) recorded call rates of 1.6 calls/hr at Cypress, and Wildlife Surveys Limited (2011) recorded call rates of 1.7 calls/hr at Mt William North. This is consistent with Toy et al. (2021), who recorded call rates in the Westport population of rōroa between 0.3 and 3 calls/hr.



Figure 18: Great spotted kiwi surveys on the Buller Plateaux.

Forest Birds

The abundance and distribution of avifauna varies considerably throughout the Buller Plateaux and surrounding areas due to the range of habitats present (e.g., coastal and subalpine forest, pākihi tussockland, rushland, wetland, coal measures shrubland and sandstone pavement) and the degree of human disturbance due to mining and other activities.

Given that they are nearly identical with respect to climate and landform, the avifauna of the Denniston and Stockton Plateaux are similar (McLennan 2012). The majority of the Denniston Plateau is characterised by prostrate shrubs and low-growing vegetation, some of which is no more than a few centimetres tall. The Denniston Plateau includes large areas without forest and the Stockton Plateau includes large areas disturbed by mining, which may explain why call rates recorded in five-minute bird counts have typically been low (e.g., a total of 3.3 – 4.4 calls per count in sparse vegetation and forest respectively at Mt Wiliam North, Wildlife Surveys Limited 2011). Low-growing vegetation and prostrate shrubland vegetation is typically home to weka (*Gallirallus australis*), South Island fernbird and pipits (*Anthus novaeseelandiae*). Rōroa may occasionally visit such areas at night (McLennan 2012), but these habitats are not generally preferred by other bird species.

The isolated patches of forest, typically restricted to gullies across the Buller Plateaux, but more widespread elsewhere in the Ngakawau ED, support grey warblers (*Gerygone igata*), silvereye (*Zosterops lateralis*), tomtits (*Petroica macrocephala*), South Island robins (*Petroica australis*) and bellbirds (*Anthornis melanura*). Tūī (*Prosthemadera novaeseelandiae*), yellow-crowned parakeet (*Cyanoramphus auriceps*), kererū (*Hemiphaga novaeseelandiae*) and kākā (*Nestor meridionalis meridionalis*) are infrequent visitors to these habitats as well (McLennan 2012, L. Maguire (MBC Contracting) and C. Robertson (Bathurst Resources Limited) pers. obs. 2020, 2023). Kea (*Nestor notabilis*) are also known from the district (McEwen 1987) and have been observed occasionally at Stockton Mine.

Highest concentrations of birds are typically found in forest habitat, while coal-measures shrubland, sandstone pavement areas and pākihi generally support comparatively few species (Overmars et al. 1998).

South Island fernbird are particularly common in dense shrublands and fernlands in parts of the Blackburn Pākihi, and in the Weka Creek catchment on the Stockton Plateau (Buckingham 1998b, R. Buckingham pers. comm. 2011).

New Zealand pipits are present in low to moderate numbers throughout open and low shrubland areas of the Buller Plateaux, including rehabilitated areas at Stockton Mine, (Wildlife Surveys Ltd 2011, Ecological Solutions 2026b in prep.).

Kea have occasionally been recorded within the Buller Plateaux, although they are thinly spread throughout the mountains of North West Nelson and the northern part of the West Coast. Kākā are likely to be no more than seasonal visitors to the area since there is a low proportion of preferred habitat for this species within the plateaux. Extensive areas of beech forest habitat with a high proportion of podocarps of the type favoured by kākā are found in the Orikaka valley, and particularly in the South Branch of the Mōkihinui River. Predators are presumed to be limiting kākā in areas such as the Mōkihinui valley where they were not as common as expected given the quality of habitat present there (Wildlife Surveys Ltd 2011).

Other ‘Threatened’ or ‘At Risk’ species which may be present within the Buller Plateaux include black shag, little shag and long-tailed cuckoo. All have been recorded, though usually infrequently, in the upper Waimangaroa area (Buckingham 1998b, Thomas & Toft 1997, Thomas et al. 1997, Mark Hamilton pers. comm. 2011).

Banded dotterel (*Charadius bicinctus*) have been observed in breeding plumage at Denniston in 2010, which appears to be the first record of this species on the Buller

Plateaux (Buckingham 2011). This species has also been observed at the bathhouse at Stockton Mine in 2023 (M. Lambert pers. comm.) and at Mt Frederick in approximately 2019 (L. Maguire (MBC Contracting), pers. comm. to G. Bramley). It is possible that they may breed in the area.

Little shag were recorded using St Patrick's Dam prior to its upgrade as part of mining in the Cypress Mining Area which commenced in approximately 2010, and are likely to use other small wetlands within the district (Overmars et al., 1998). Black shags have occasionally been recorded from the Buller Plateaux, including at Mt William North (Mitchell Partnerships Limited 2011). A pair of black shags were also recently observed using the constructed tarns at Stockton Mine near Mt Augustus (M. Lambert unpubl. data 2024).

4.4.2 Bats

4.4.2.1 Bat Distribution Within the Ngakawau Ecological District

Nine surveys contributing to the knowledge of bats within the Ngakawau Ecological District are summarised in Table 5.

To summarise, bats (presumed to be long-tailed bats) were recorded at Happy Valley in the upper Waimangaroa Valley in March 1997 (Thomas et al. 1997). However, more recent surveys have failed to detect bats there or in nearby areas (Buckingham 1998a, 2002, Wildlife Surveys 2011, Lloyd 2019). The closest bat records collected within the past decade or less suggest a resident population of long-tailed bats in the Mōkihinui River valley to the north-east of (outside) the Ngakawau Ecological District (Lloyd 2011).

More detail about each of the surveys listed in Table 5 is provided in Appendix D.

Table 5: Summary of bat surveys within/near the Ngakawau Ecological District 1997 – 2019.

Survey	Timing	Number of nights	Key survey limitations
Thomas and Toft (1997)	Oct-Mar	13	Survey limited to dusk observations. No automatic recorders used.
Thomas et al. (1997)	March	5	Automatic recorders used on a small number of sites/nights. Bats detected.
Buckingham (1998)	Feb-Mar	23	Low overnight temperatures. Automatic recorders moved nightly.
Buckingham (1999)	Sep-Jan	Unknown	Automatic recorders used but report lacked detail re the number of nights deployed. A large number of sites were surveyed, and bats were detected.
Buckingham (2002)	Feb	3	Low dusk/overnight temperatures. Short duration of survey.
Thomas & Toft (2002)	Jan	2	Degraded habitat surveyed. Short duration of survey.
Waybacks Ltd & Wildlife Surveys (2008)	Nov	5	Low overnight temperatures and short survey duration.
Wildlife Surveys (2011)	Nov	3	Low overnight temperatures and short survey duration.

Lloyd (2011)	Nov-Apr	120	The most comprehensive bat survey undertaken to date (outside of Ngakawau Ecological District). Bats detected. The wide temporal survey coverage allowed seasonal changes in activity patterns to be investigated.
Lloyd (2019)	Feb-Apr	50-51	A comprehensive survey of the upper Waimangaroa valley in terms of site number and survey duration. The period Oct-Jan during which bats are (also) considered most active was not surveyed. This could have been useful to provide a fuller picture of bat activity if they are as others have suggested seasonal visitors rather than permanent residents.

Of the four main waterways within the Ngakawau ED which bats would use when foraging or commuting, only the Waimangaroa River has received significant survey effort: six of the 10 bat surveys summarised here were within the Waimangaroa River catchment. Bat surveys have also been undertaken in the Mōkihinui River (B. Lloyd, pers comm. to M. Roper 2024), although most bat surveys there were undertaken in relation to Meridian Energy Limited's proposed Mōkihinui Hydro Scheme (Lloyd 2011) where the survey area was outside the Ngakawau ED, nearer the Mōkihinui Forks, which is approximately 5km from the Ngakawau ED boundary, but still within flight distance for bats. Buckingham (1999) surveyed the Orikaka (or Mackley) River (a tributary of the Buller River) which is also located just outside the southern part of the Ngakawau ED.

Many of the surveys identified in Table 5 are now more than 15 years old and therefore used older technology. Most of the surveys do not meet current best practice because they were of short duration, during temperatures too cool for ideal bat activity and often only surveyed at a location only once throughout the year. In terms of comprehensive, reliable survey the Ngakawau Ecological District has been relatively sparsely surveyed for bats with the most survey coverage being in the Happy Valley area.

Bats (presumed long-tailed bats) were recorded on the Buller Plateaux in 1997 (Thomas et al. 1997), but not in the nine surveys conducted since, with the most recent survey having been undertaken in 2019 (Lloyd 2019) as shown in Figure 19. Other surveys conducted farther from the Buller Plateaux, but within or near the Ngakawau Ecological District also failed to detect bats (Buckingham 1999, Thomas & Toft 2002, Waybacks & Wildlife Solutions 2008) suggesting that bats are likely to be uncommon, localised in distribution, or are perhaps seasonal/occasional visitors to the Buller Plateaux if present.



Figure 19: Acoustic bat survey results from the Buller Plateaux 1997 – 2019.

4.4.3 Lizards

The earliest lizard surveys on the Buller Plateaux were undertaken in the late 1990s (Thomas et al. 1997), but many early surveys either failed to detect lizards or located only one or a few specimens.

Survey methods for lizards undertaken within the Buller Plateaux have included manual daytime searching, nocturnal searching (spotlighting), pitfall trapping and use of artificial cover objects. Based on a review of available information, including published and unpublished reports and papers, results from lizard salvaging and relocation operations and baseline monitoring undertaken at five sites in the DPPA (refer to Table 6) at least 171 forest geckos, 80 West Coast green geckos and 9 Newmans speckled skinks have been recorded. We note that these totals do not include records listed on the Department of Conservation Database, nor do they include miscellaneous unpublished records (of which an additional 309 additional records have been identified). Records in the Department of Conservation database may be a duplication in some instances. Therefore, the numbers provided in Table 6 are indicative only and are likely a substantial underestimate. The number of records is more than from the surrounding areas, likely due in part to the greater amount of lizard survey work undertaken at the Plateaux compared to other areas.

Together, forest geckos and West Coast green geckos use the entire suite of habitat types on the Buller Plateaux. Forest geckos are nocturnal and typically occupy sandstone pavement (where they are common underneath rock slabs), bluffs and tors, shrublands, prostrate vegetation and forest. West Coast green gecko occupy shrublands, fernlands on tussock wetland areas, sandstone pavement and forest. West Coast green gecko are not known to use cover objects or crevices.

Speckled skinks are expected to use open habitats, but not forest or tall shrubland interiors because they are too shaded to provide ideal skink habitat. The detection rate is likely to underestimate the number of lizards present.

Across the Buller Plateaux, natural habitat mosaics with high physical (structural) complexity, adequate food resources throughout the year and adequate shelter/refugia from extreme weather (temperature, wind and desiccation) are likely to support a high carrying capacity of lizards. This includes habitat mosaics within topographically diverse areas such as gorges and gullies.

The lizard assemblage on the Buller Plateaux is regarded as nationally significant because of its:

- Rarity (the Ngakawau Ecological District is the only place these three species coexist and the densities are thought to be highest at the Buller Plateaux). The fourth species known from the Ngakawau ED is not known to occur at the Buller Plateaux;
- Relatively high encounter rate (notwithstanding the small sample sizes); and
- Phenotypic (and presumably genetic) variability of the populations (especially the two gecko species).

Despite the Buller Plateaux providing suitable habitat for lizards, and despite expending considerable search effort, some previous surveys have recorded few lizards, suggesting low densities. For example, in Tonkin & Taylor (2015), 55 hours of night-searches returned an encounter rate of 0.05 forest gecko/hour and 199 hours of diurnal searches returned an encounter rate of 0.06 forest gecko/hour and 0.02 West Coast green gecko/hour. Other surveys have achieved relatively high encounter rates. Survey encounter rates for lizards are influenced by multiple factors, including:

- Landscape context: the spatial configuration and ecological connectivity of surrounding habitat types. For example, geckos may be more abundant in habitat mosaics that enable them to move between different habitat types to meet seasonal resource requirements at different times of the year.
- Habitat complexity: the diversity of micro-habitat types and resources within a particular habitat type. For example, more complex habitat types are more likely to provide lizards with the full suite of resources that are necessary for survival, such as refugia that protect lizards from exposure during extreme weather.
- Habitat use: the way lizards use particular habitat types, for example forest geckos and West Coast green geckos may be more abundant in tall forest but are less likely to be encountered during surveys in prostrate habitats where geckos spend their time on or near the ground.

The combination of these factors at the Buller Plateaux, and the results of the only radio tracking study, suggest that densities may be higher than some encounter rates suggest (Tonkin & Taylor 2015).

Furthermore, the two gecko species on the Denniston Plateau (though not the Stockton Plateau) have unusual colour morphs not seen anywhere else. This polymorphism is an important species trait that is thought to confer resilience to environmental variability. Thus, the Denniston West Coast Green gecko population may be genetically distinct, but further research is required to verify this (King 2018).

Table 6: Summary of lizard surveys, level of effort and species identified on the Buller Plateaux and surrounds.

Date	Survey/ Salvaging programme	Methods / Sampling effort	Species & No.	Reference
November 1995 / January 1996 / March 1996	Surveys for Fauna in the Upper Waimangaroa Valley (Baseline surveys for the proposed Cypress Mine)	55 hours manual searches (diurnal/nocturnal unspecified)	1 forest gecko	Thomas, B. & Toft, R. 1997. Surveys for Fauna in the Upper Waimangaroa Valley. Prepared for Kingett Mitchell and Associates Ltd. Landcare Research Contract Report: LC9697/101.
2-8 March 1997	Fauna of the Proposed Northern Opencast Development, Waimangaroa Valley, Buller Coalfield (Additional survey for the proposed Cypress Mine)	21.5 hours diurnal searches, 14 hours nocturnal searches, 48 pitfall traps	1 unidentified skink (presumed to be northern grass skink as this is what was in the DOC database?)	Thomas, B., Toft, R., & Mason, R. 1997. Fauna of the Proposed Opencast Development, Waimangaroa Valley, Buller Coalfield. Prepared for Kingett Mitchell and Associates Ltd, Auckland. Landcare Research Contract Report: LC9798/41.
1998	West Coast skink survey (Reason unknown)	Unknown	2 forest gecko	van Mierlo, R. 1998. West Coast skink (Oligosoma sp.) survey: September 1997. May 1998. Unpublished report, for West Coast Conservancy, Department of Conservation, Hokitika.
1999	West Coast lizard survey (Assessment of genetic diversity)	Unknown	1 forest gecko 1 Newman's speckled skink 1 West Coast green gecko	Miller, C., Affeld, K., & Adams, L. 1999. West Coast lizard survey: taxonomy, distribution and habitat requirements. Unpublished report, West Coast Conservancy, Department of Conservation, Hokitika. 27 p.
22-24 January 2002	A Survey for Terrestrial Fauna on the Millerton Block, January 2002	10 hours diurnal searches, 3 hours nocturnal searches	1 West Coast green gecko (Incidental)	Thomas, B. & Toft, R. 2002. A survey for Terrestrial Fauna on the Millerton Block, January 2002. Prepared for Solid Energy New Zealand Limited. Landcare Research Contract Report: LC02????
Feb-Mar 2007	Lizard and Invertebrate Surveying in Stockton No. 2 South Block (Pre-vegetation clearance survey)	37 hours diurnal & nocturnal searches (total), 105 ground ACOs, 105 CFCs, 70 pitfall traps	None found	Bell, T., & Jewell, T. 2007. Lizard and Invertebrate Surveying in the Stockton No. 2 South Block, Stockton Mine, March 2007. Prepared for Solid Energy New Zealand Limited. Landcare Research Contract Report: LC0607/187.
26-29 November 2007	Terrestrial Fauna Survey of Proposed Mangatini Hydro-Electric Power Scheme	12.25 hours manual searches (diurnal/nocturnal unspecified)	4 forest geckos "numerous" Newman's speckled skink	Charteris, M. & Buckingham, R. 2008. Terrestrial Fauna Survey of the Proposed Mangatini Hydro-Electric

				Power Scheme. Prepared for Hydro Developments Ltd.
January-February 2008	Millerton East - Priorities 2 & 7 (Part 2) Flora & Fauna Survey Report (Pre-vegetation clearance survey)	Diurnal searches (unspecified level of sampling effort)	2 forest geckos	Roxburgh, S. & Hamilton, M. 2008. Millerton East - Priorities 2 & 7 (Part 2) Flora & Fauna Survey Report June 2008. Survey report for Solid Energy New Zealand Ltd.
February-March 2008	Priority 6 - Millerton North Flora and Fauna Survey Report (Pre-vegetation clearance survey)	Diurnal searches (unspecified level of sampling effort)	4 forest geckos	Roxburgh, S. & Hamilton, M. 2008. Priority 6 - Millerton North Flora and Fauna Survey Report July 2008. Survey report for Solid Energy New Zealand Ltd.
March 2010	Stockton Hydro Project Flora & Fauna Survey - Final Report	Incidental. Unspecified level of sampling effort.	Unspecified number of forest geckos.	Hamilton, M. 2010. Stockton Hydro Project Flora & Fauna Survey – Final Report. Survey report for Mitchell Partnerships & Solid Energy New Zealand Limited.
6-9 November 2010	Lizard Survey of Mt William North proposed mining area	24 hours diurnal searches, 2.5 hours manual searches	3 forest geckos 1 West Coast green gecko	Lettink, M. 2011. Lizard survey of Mt William North. Prepared for Wildlife Surveys Ltd by Fauna Finders. 9pp.
2-4 March 2012	Denniston Bioblitz	Unspecified level of sampling effort	9 forest geckos 1 West Coast green gecko	N/A
19-23 March 2012	Lizard Survey of Proposed Escarpment Mine	26 hours diurnal searches, Conservation Dog	8 forest geckos 1 West Coast green gecko 2 Newman's speckled skinks	Lettink, M. 2012. Lizard survey of the footprint of the proposed Escarpment Mine, Denniston Plateau, North Westland. Unpublished Report prepared by Fauna Finders for the Royal Forest & Bird Protection Society of New Zealand Inc. 10 pp.
3-4 March / 29 March / 18-19 April 2012	Escarpment Mine Haul Road Assessment of Ecological Effects	12 hours (diurnal & nocturnal)	2 West Coast green geckos	Hall, K. & Chapman, S. 2012. Escarpment Mine Haul Road: Assessment of Ecological Effects. Report prepared by Boffa Miskell Limited for Buller Coal Limited.
June 2012	Statement of Evidence of Simon Chapman for the proposed Escarpment Mine	36 hours diurnal searches, 16 hours nocturnal searches	1 forest gecko 4 West Coast green geckos	Chapman, S. 2012. Statement of Evidence of Simon Chapman. West Coast Environmental Network Incorporated and Royal Forest and Bird Society of New Zealand Incorporated vs Buller Coal Limited. Environment Court.
11-14 March	Lizard survey of proposed Te Kuha	29 hours manual searches	3 forest geckos	Mitchell Partnerships 2013. Baseline

2013	mine	(diurnal/nocturnal unspecified)	1 Newman's speckled skink	ecological surveys for the proposed Te Kuha mine. October 2013.
2014-2015	Miscellaneous Lizard Surveys at Stockton Mine (Salvaging)	462 ground ACOs, 90.75 hours diurnal searches	16 forest geckos 8 skinks (species unspecified)	N/A
Jan-Feb 2014	Escarpment mine salvaging programme	360 ground ACOs x 4 checks, 199.15 hours diurnal searches, 55 hours nocturnal searches	21 forest geckos 4 West Coast green geckos	Baber, M. & King, S. 2014. Draft Escarpment Mine Lizard Salvage and Monitoring Report September 2014.
Jan-Mar 2015	Escarpment mine salvaging programme	125 ACOs checked 4 times, 283.3 hours diurnal searches	22 forest geckos 11 West Coast green geckos 1 Newman's speckled skink	Baber, M., King, S. 2015. Escarpment Mine Lizard Salvage and Monitoring Report. Prepared for Bathurst Resource Ltd by Tonkin & Taylor Ltd and MBC Contracting Ltd. 38 pp.
Feb-June 2015	DPPA Baseline Monitoring	1,891 ACOs checked, 434.1 hours manual searches	62 forest geckos 48 West Coast green geckos 1 Newman's speckled skink	Baber, M., King, S. 2015. Escarpment Mine Lizard Salvage and Monitoring Report. Prepared for Bathurst Resource Ltd by Tonkin & Taylor Ltd and MBC Contracting Ltd. 38 pp.
15-16 Jan / 13-15 March 2020	Proposed Sullivan Coal Mining Licence Area and proposed Buller Coal Continuation Project Haul Road (earlier iteration)	42 hours diurnal searches and 8.5 hours person hours nocturnal searches	10 forest geckos 6 West Coast green geckos 3 Newman's speckled skinks	Baber, M. 2020. Buller Plateau Project: Baseline Lizard Report. Prepared for Bathurst Resources Ltd by Alliance Ecology Ltd. 37 pp.
Miscellaneous	Unpublished data: Various records from opportunistic surveys by herpetologists	Manual searching or Nocturnal spotlighting	161 forest geckos 49 Newman's speckled skinks 92 West Coast green geckos 7 Northern grass skinks	N/A
DOC Herpetofauna Records	Unpublished data: Records from the DOC Herpetofauna database	Unknown	4 forest geckos 2 Newman's speckled skinks 69 West Coast green geckos 1 unidentified gecko	N/A

4.4.4 Snails

Powelliphanta patrickensis' type locality is the very head of St Patricks Stream, however, shells are found as far south as Mt Rochfort (Walker 2003). *Powelliphanta patrickensis* is also listed as 'Threatened – Nationally Critical' (Walker et al. 2024). Walker (2018) speculated that there was genetic variation between *P. patrickensis* snails found on the Denniston and Stockton plateaux and proposed that snails from the two areas be classified as separate subspecies and given the tag names *P*. "*patrickensis*" *patrickensis* and *P*. "*patrickensis* Denniston" respectively, although this approach has not been adopted.

Powelliphanta patrickensis is patchily distributed across the Buller Plateaux. Snail densities are low in most areas, with fewer than 100 snails/ha found during sub-surface plot searches (Bathurst Resources 2015a) although snail densities can vary greatly over distances of only a few metres, likely due to microhabitat variation. The stronghold of *Powelliphanta patrickensis* is considered to be within the upper Waimangaroa River and Deep Stream catchment (Buckingham 1998c, Walker 2003, 2004).

Surveys for *Powelliphanta patrickensis* on the Buller Plateaux have used a variety of methods including diurnal searches (Buckingham 2005, Wildlife Surveys 2011), nocturnal searches (Thomas et al., 1997, Waybacks Ltd 2006), plot searches (Wildlife Surveys 1998, Wildlife Surveys 2002, Lloyd 2012), intensive habitat searches (Wildlife Surveys 2002) and walk-through searches (Waybacks Ltd 2006).

Hamilton (2015) explored the effectiveness of mark-recapture as a monitoring method for *Powelliphanta augusta,* which at the time was a species relatively new to science. Findings from the mark-recapture study suggested that it is a much more reliable alternative to traditional monitoring methods in which between 10% to more than 50% of snails may be overlooked in any plot.

Other snails present on the Buller Plateaux include *Rhytida* spp. *Rhytida meesoni perampla* is a small- to medium-sized snail that occurs widely through the North Westland-Nelson area, including the Buller Plateaux. For some years specialists in this group have suspected that *R. m. perampla* and some of the other smaller *Rhytida* species actually represent species complexes (Powell 1946). The species *Rhytida perampla* has been used as a catch-all for a variety of species in the upper South Island (F. Brook, pers. comms.) and taxonomic research into *Rhytida* specimens collected at Mt William, Mt Davy and Te Kuha suggest they were all the unnamed species 'A2' (Toft 2017). Other specimens collected from Cypress Stream and the Denniston Plateau are also believed to be the unnamed species 'A2' (Toft 2017). No recent surveys have been undertaken for *Rhytida* spp. on the Buller Plateaux.

4.4.5 Other Terrestrial Invertebrates

Thomas and Toft (1997) undertook terrestrial invertebrate surveys in the Upper Waimangaroa Valley sampling open coal measures vegetation, shrubland and red tussock grassland. Search effort was concentrated on invertebrates of conservation concern (i.e., *Powelliphanta* snails, leaf-veined slugs (*Amphikonophora* spp.) and the West Coast bush wētā (*Hemideina broughi*). The results of that survey revealed an invertebrate fauna dominated by species that occupy wet and spongy ground conditions, such as the giant bush dragonfly (*Uropetela carovei*), the grasshopper *Sigaus crassicauda* and the crane flies *Austrotipula hudsoni*, *Gynoplistia* spp., and *Zelandotipula novarae*.

A more recent survey by Toft (2011) at the proposed Mt William North mining area found similarly high diversity of indigenous invertebrate fauna. The grasshopper *Sigaus crassicauda* was recorded, and a large brown vagrant spider (*Uliodon* spp.) was commonly found beneath loose rocks on sandstone pavements. Vagrant spiders are thought to be widespread through the Buller Plateaux (Thomas & Toft 1997) and an undescribed species

(shown in Figure 20) has been observed at Stockton Mine and on the Denniston Plateau under loose rocks (Kingett Mitchell 1996, M. Lambert. pers. obs. 2024). The taxonomy of this genus is currently undergoing revision (D. Hegg, pers. comm to M. Lambert, 2024). An unusual find during the Mt William North survey was the assassin spider *Aotearoa* sp., which was collected from forested sites (Toft 2011).

Previous invertebrate surveys have often collected 'new' species, i.e., those that have not been encountered in the area before and occasionally undescribed species which are new to science. This is likely due to the high invertebrate diversity which is characteristic of the Buller Plateaux and associated with the diverse vegetation mosaic which occurs there and consequently the high diversity of habitats it provides. These include species such as the white-faced cave wētā (*Occultastella morgana*), which was described in 2024 (Trewick 2024), and is yet to be assigned a threat status. Furthermore, coal measures vegetation has a number of features in common with higher altitude vegetation, and as such supports an invertebrate fauna that also includes elements of higher altitude invertebrate communities. For example, alpine grasshoppers, the screaming cicada (*Maoricicada cassiope*), the stick insect *Mimarchus tarsatus*, the snow tussock wainscot (*Ichneutica ceraunias*) and Harris's tussock butterfly (*Argyrophenga harrisi*) have all been collected from the Buller Plateaux and are typical of wet, alpine environments where they occur elsewhere.

At the southern end of the Ngakawau ED, the invertebrate assemblage at Te Kuha contained many large-bodied and flightless species across different invertebrate orders, including tree wētā, ground wētā, cave wētā, stag beetles, stick insects, spiders, slugs and snails (Patrick 2017).

The forest ringlet butterfly has also been observed at several locations at or around the Denniston Plateau, although only in very small numbers (Patrick 2017).

Helms's stag beetle (*Geodorcus helmsi*) are likely present at the Buller Plateaux. Te Kuha arguably hosts an important population of this species (Patrick 2017).

Despite relatively extensive terrestrial invertebrate surveys on the Buller Plateaux, only five species of conservation concern have been recorded as shown in Table 7. This number includes *Geodorcus helmsi*, which has no official threat status as of Leschen (2012), but is considered an 'Animal' under the Wildlife Act 1953. The lack of species identified may be due, at least in part, to the limited ecological knowledge with respect to the species detected, particularly the undescribed species.

Table 7: Invertebrate species of conservation concern previously recorded on the Buller Plateaux.

Species	Common Name	Conservation Status	Listed by
Arctesthes avatar	Avatar moth	Threatened – Nationally Critical	Williams (2024).
Powelliphanta augusta	Mt Augustus snail	Threatened – Nationally Critical	Walker et al. (2024) (and others).
Powelliphanta patrickensis	Land snail	Threatened – Nationally Critical	Walker et al. (2024) (and others).
Dodonidia helmsii	Forest ringlet butterfly	At Risk – Relict	Patrick (2017).
Ichneutica blenheimensis	Owlet moth	At Risk – Naturally Uncommon	Williams (2024).



Figure 20: Undescribed vagrant spider (*Uliodon* sp.) at Stockton Mine.

The plant hopper *Paracephaleus curtus* (also known as the waka bug) was also collected at Mt William North. This species is also known from Mt Augustus, Denniston, and Mt Ruapehu in the North Island (Larivière et al. 2010). The waka bug has previously been collected from red tussock (*Chionochloa rubra*) and moss/matt plants (Larivière et al. 2010) which are locally common at some locations on the coal plateau, including the Cypress Mining Area. The waka bug was previously thought to be restricted to the Denniston Plateau, but it appears to be widely distributed across the Buller Plateaux, particularly in areas with extensive wire rush (M. Lambert. pers. obs. 2024).

Feeding sign of forest ringlet butterfly (*Dodonidia helmsii*) was observed at Te Kuha c. 15 km south of Denniston in 2014, which stimulated additional searching for this 'At Risk' butterfly elsewhere within the Buller Plateaux (Entecol Limited 2016). Patrick (2021) considered that Te Kuha held the largest population of forest ringlet butterfly in New Zealand, but it is known that populations move around the landscape to avoid parasitism, so the coal plateau and surrounding areas, rather than Te Kuha itself, is likely to be important for forest ringlet butterfly. This species has also been found at Denniston in smaller numbers. Patrick (2021) considered that forest ringlet butterflies were restricted to natural, unmodified, and isolated sites, although their presence at Burnett's Face in 2019 suggests this is incorrect. The locations of additional forest ringlet records obtained in summer 2019 are shown in Figure 21.

Another interesting find on the Buller Plateaux was the discovery of a geometer moth during the Denniston Bioblitz in 2012 (Patrick & Patrick 2015). The moth, now formally described as *Arctesthes avatar,* is found on the Denniston Plateau and nearby Mt Rochfort, though still localised and confined to wetland sites (Patrick et al. 2019).

An invertebrate survey of the Upper Waimangaroa valley by Ecological Solutions Limited in 2023 collected predominantly indigenous species broadly similar to the other natural communities described on the Buller Plateaux. The various microclimates within the

Waimangaroa valley provide suitable habitat for a range of invertebrate species, many of which are undescribed. For example, the *Neoferonia* and *Ctenognathus* carabid ground beetles which have been collected previously (e.g., Overmars et al. 1998), and the native dung beetles *Saphobius* sp. have always been surprisingly abundant in pitfall samples from the plateau and surrounds.

Invertebrates collected on the Buller Plateaux are reflective of the climate, topography and land-use. Most of the invertebrate species collected have been indigenous due to the predominantly indigenous vegetation and isolation of the site, as well as the diverse range of habitats available. Many of the invertebrate species found on the Buller Plateaux are large-bodied and flightless, rendering them effectively immobile and poorly able to adapt to any land use changes.

An invertebrate group often overlooked when conducting invertebrate surveys is earthworms (Oligochaeta). Earthworms on the Buller Plateaux are critical in the diet of *Powelliphanta* snails (Walker et al. 2008), and a significant food item for great spotted kiwi. Previous surveys of earthworms at the Denniston Plateau identified 31 species of which at least seven have been recorded from the Stockton Plateau as well (Boyer & Wratten 2012).

Ecological Solutions Limited collected soil samples from locations near Deep Stream in 2024 to be analysed for soil invertebrates with earthworms of particular interest. However, the samples contained no earthworms. It is possible that the time of year (late summer) and relatively warm, dry weather prior to the survey could have been a factor in the lack of earthworms collected.

Figure 22 shows the locations of previous terrestrial invertebrate surveys on the Buller Plateaux including Ecological Solutions Limited (2024).

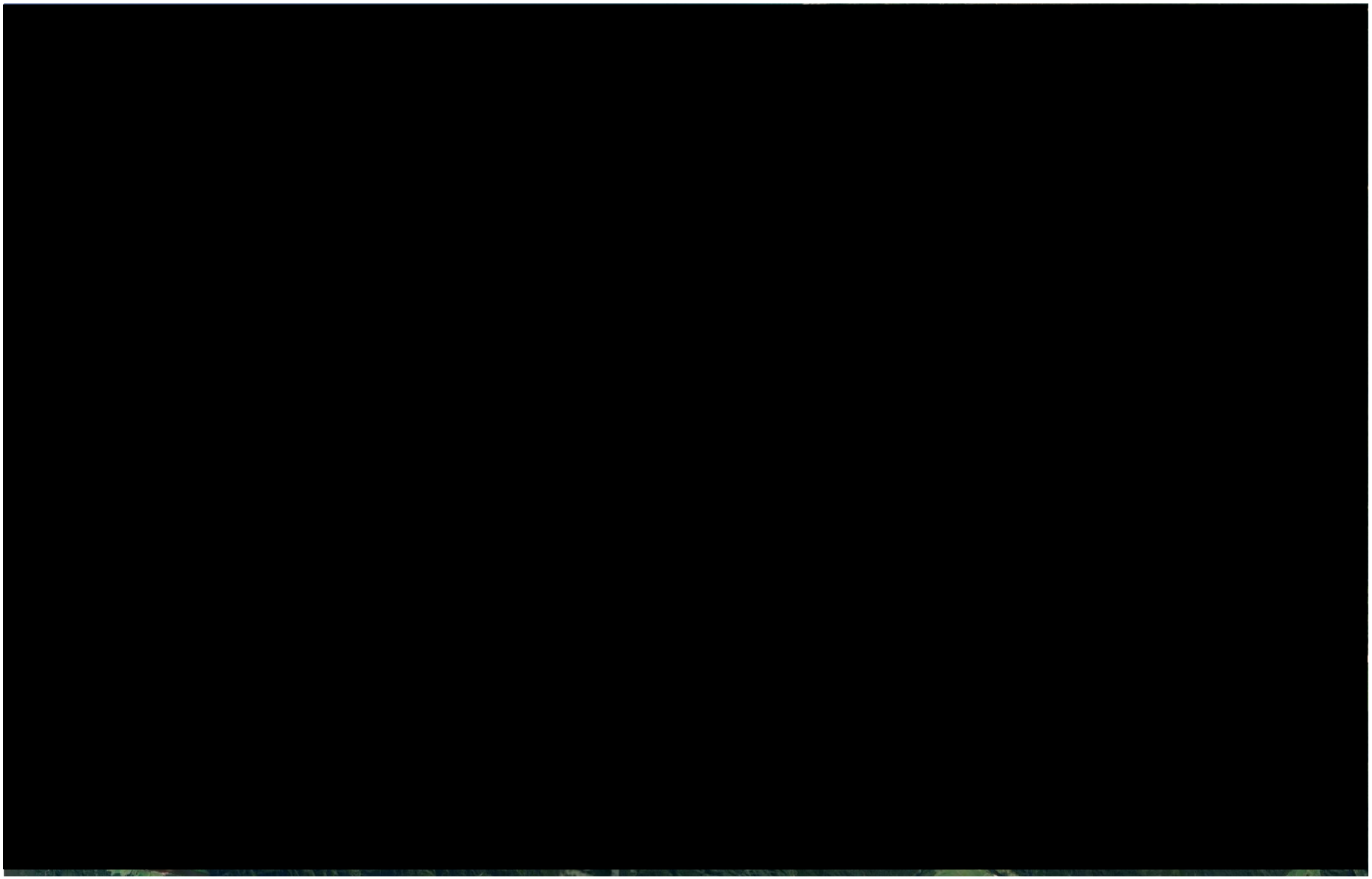


Figure 21: Location of Forest Ringlet butterfly feeding sign on *Gahnia* January - February 2019 (Bramley 2022).

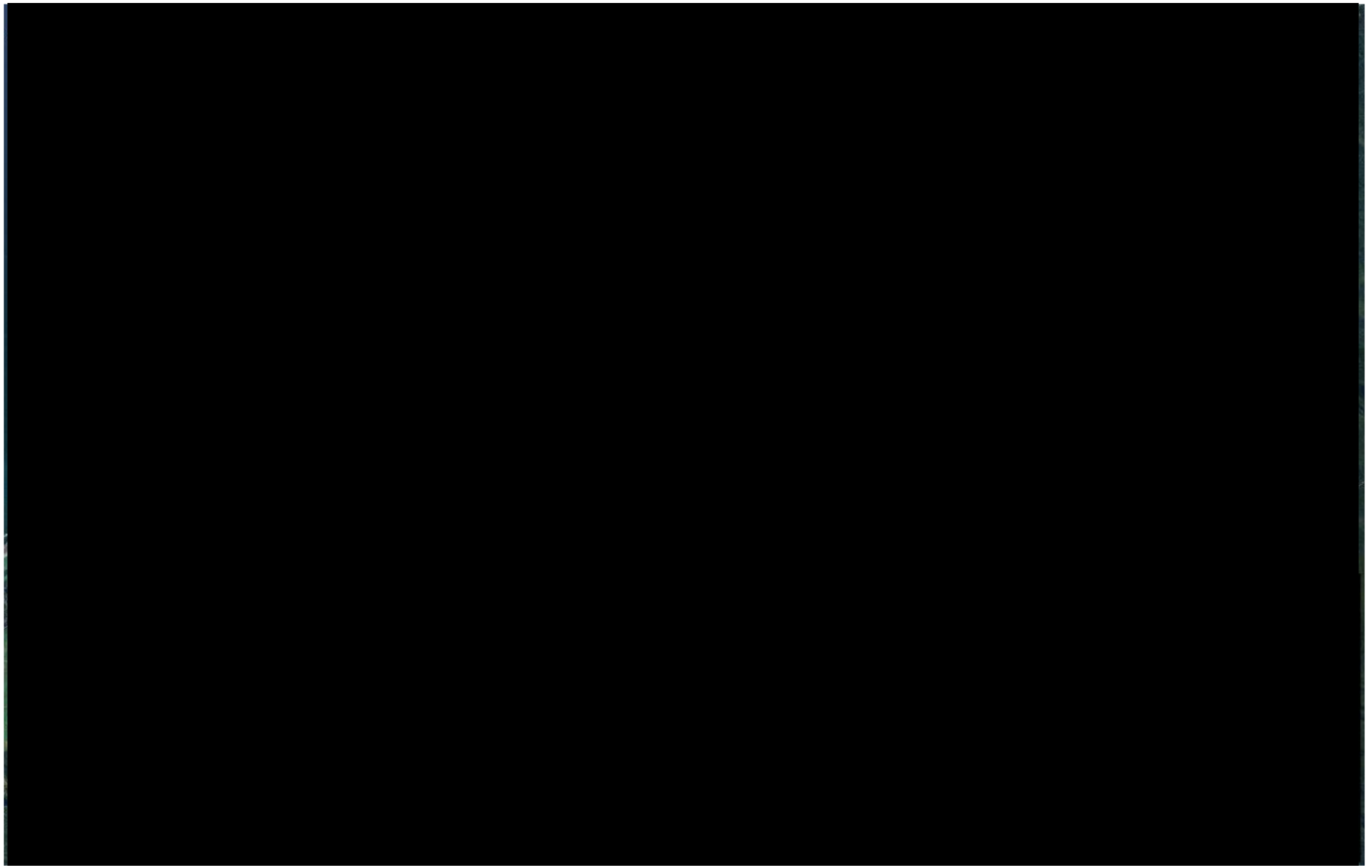


Figure 22: Terrestrial invertebrate surveys on the Buller Plateaux.

4.5 Aquatic Ecology

4.5.1 New Zealand Freshwater Fish Database

Because of the geological processes which created the Buller Plateaux, natural blockages to fish passage between the sea and the more elevated sites are common.

Three surveys within Stockton Mine have been documented in the NZZFDB including two records from Herbert Stream and one at Whirlwind Stream. No fish were recorded. NIWA surveyed the headwaters of Herbert Stream in 1998 following and captured no fish during an electric fishing survey.

Granity Creek lacks both fish and invertebrates but in contrast, the forested and lower altitude of Chasm Creek (partially affected by coal measures) has kōaro, eels and the shortjaw kōkopu.

4.5.2 Kōura

Kōura are aquatic invertebrates commonly reported in the NZFFDB records and have been found throughout the Buller Plateaux in tributaries and the main stem of the major rivers. Although not threatened, kōura are a taonga species for Māori and are a keystone species within aquatic ecosystems, influencing community and trophic structure through their various ecological roles as detritivores, shredders and predators[14].

NIWA surveyed ten sites draining the Stockton Plateau in 1998 (Boubée 1999). Kōura were recorded at five of those sites.

Kōura are present in lakes and streams on the Denniston Plateau and are an important component of Bathurst's Aquatic Ecology Monitoring Programme. As part of this programme there are seven sites that must be monitored, but Jellyman and Stark (2013) sampled an additional two sites in 2013 (i.e., nine in total) to provide a comparison with previous data.

In 2013 the only site where kōura were not found was the Whareatea River near State Highway 67. The highest kōura biomass (7.5 gm/m^2) and density (0.789 individuals/ m^2) was recorded in S Creek within the Escarpment Mining Project.

4.5.3 Previous Surveys

Freshwater Fish

NIWA surveyed ten sites draining the Stockton Plateau in 1998 (Boubée 1999). No fish were collected at any of the sites surveyed.

There are two eDNA records of upland galaxiid (*Galaxias prognathous*) from Deep Stream and one record of kōaro from the Whareatea River (NIWA 2026a).

[14] https://niwa.co.nz/te-kuwaha-and-maori/taonga-species-series

Benthic Macroinvertebrates

NIWA was commissioned to assess macroinvertebrates on the Stockton Plateau by Solid Energy in 1998. Their surveys involved the collection of samples from nine sites in the upper reaches of the Ngakawau and Waimangaroa Rivers at the locations shown in Figure 23. Results were consistent with previous surveys where depauperate invertebrate communities were found in the main rivers and tributaries characterised by low pH.

Jellyman and Stark (2013) produced a baseline report of aquatic quality for the Escarpment Mine Project (EMP) within the Whareatea River Catchment and summarised historical sampling effort in the vicinity. There have been extensive macroinvertebrate surveys in the Cascade Creek (Buller River catchment), Deadman's Creek, Whareatea River, and Waimangaroa River catchments. Jellyman and Stark (2013) reported that 165 samples had been collected from more than 70 locations resulting in records of 168 invertebrate taxa as summarised in Table 8Table 8. Of these 168 taxa, 87% (137) are known from the Whareatea River catchment. Trichoptera (caddisflies), Diptera (true flies), and Plecoptera (stoneflies) dominated the taxa list. Jellyman and Stark (2013) considered that all of the taxa collected within areas affected by the Escarpment Mine Project were known to occur at other sites.

Surveys conducted between 2010 and 2013 by Stark Environmental along with additional samples collected by Envirolink and REM in 2008 and 2012 resulted in seven of those sites being selected for ongoing biological monitoring of effects due to the Escarpment Mining Project as shown in Figure 23.

Of the freshwater invertebrates collected as part of monitoring the Escarpment Mining Project, Trichoptera (caddisflies) are the most diverse group (24 taxa), with true flies (Diptera: 20 taxa), stoneflies (Plecoptera: 15 taxa), and mayflies (Ephemeroptera: 9 taxa) also having relatively high diversity at the monitoring sites.

As well as using the MCI and other macroinvertebrate community metrics, Jellyman and Stark (2013) also employed the Acid Mine Drainage Index (AMDI), which is specific to acid mine drainage affected streams, to evaluate community composition. Scores greater than 40 indicate sites unaffected by acid mine drainage, affected sites have scores between 20 and 40 and sites with scores < 20 are considered to be severely affected (Gray and Harding 2012). Using the mean AMDI scores, the upper Trent Stream was the only site considered unaffected by acid mine drainage. Severely affected sites included both S Creek sites and the lower Trent Stream site. The other sites were affected with scores between 20 and 40. Based on maximum scores, all sites excluding both S Creek sites and the lower Trent Stream site had scores above 40.

NIWA was commissioned to assess macroinvertebrates on the Stockton Plateau within natural and artificially created tarns, by Bathurst Resources Limited in 2024. NIWA (2026) found that macroinvertebrate communities did not differ significantly in richness, abundance or structure between constructed and natural tarn types. Some of the most abundant taxa in tarns were characterised as widespread common dispersers (e.g., *Liodessus*) or widespread haphazard dispersers (i.e., no spatiotemporal patterns of aerial dispersal), such as *Chironomus*. They concluded that constructed tarns may provide new and important habitats for native species similar to nearby natural tarns (NIWA 2026).



Figure 23: Location of Buller Plateaux macroinvertebrate survey sites.

Table 8: Summary of Buller Plateaux macroinvertebrate community indices.

Report	Year(s) of survey	Number of sites	Location	Mean taxa richness (range)	Individuals	Mean density per 0.3² (range)	MCI	Mean EPT richness (range)	Mean % EPT (range)	Mean % Diptera (range)
Kingett Mitchell & Associates Ltd. (1997a)	1995	6	Waimangaroa River	0.6 – 2.6	100	1.8 – 11.4	26-98	0-1.5	0-65	0-85
	1995	6	Waimangaroa tributaries	1 – 15.4	1,763	24 – 181.5	40-131	0-9.8	0-87	9-100
	1996	7	Waimangaroa River	0.6 – 5.4	670	5.6 – 22.8	16-106	0.4-4	35-91	3.8-52
	1996	12	Waimangaroa tributaries	0.8 – 15.4	2909	1.4 - 180	24-148	0-11.8	3-95	0-59
Kingett Mitchell & Associates Ltd. (1997b)	1997	2	Whareatea River	6.4 – 13.6	692	22.2 – 116	-	-	-	-
Jellyman and Stark (2013)	2010 - 2013	7	Conglomerate Stream	14 (13-15)	-	-	144 (137-151)	71.8 (66-76)[15]	72 (72-72)	-
			Trent Stream upper	14.5 (10-19)	-	-	144 (133-155)	58.9(57-60)	77 (77-77)	-
			Trent Stream lower	7 (1-12)	-	-	99 (40-131)	30 (0-63)	59 (57-61)	-
			S Creek upper	8.5 (2-15)	-	-	115 (100-131)	23 (0-46)	21 (21-21)	-
			S Creek lower	8 (4-20)	-	-	128 (85-165)	43 (25-75)	53 (31-75)	-
			Whareatea River upper	12.8 (7-21)	-	-	135 (121-150)	64 (53-83)	70 (62-78)	-
			Whareatea River lower	12.8 (4-21)	-	-	119 (95-130)	45 (25-57)	36 (26-50)	-
Boubée (1999)	1998	9	Herbert Stream	1.8 (1-4)	4.4 (2-9)	-	45 (30-75)	0.2 (0-1)	2.2 (0-11)	85.8 (40–100)
			Cypress Stream	21.6 (21-24)	331.8 (132-544)	-	125 (22-130)	14.2 (11-15)	52.7 (38-68)	32.2 (31-46)
			Upper St. Pats.	20.6 (17-28)	224.4 (123-422)	-	121 (113-129)	12.2 (10-16)	61.7 (42-76)	28.7 (13-51)
			St. Pats headwater (1)	15 (12-20)	173.6 (34-428)	-	104 (90-117)	6.2 (4-9)	23.9 (10-38)	48.8 (21-70)
			St. Pats headwater (2)	21.6 (18-26)	298.2 (133-438)	-	113 (108-119)	10.6 (7-15)	16.5 (7.5-30)	62.2 (40-74)
			St. Pats dam	4.6 (1-12)	19 (2-72)	-	92 (20-190)	2.8 (0-8)	50.9 (0-100)	23.6 (0-75)
			St. Pats below dam	17.4 (12-20)	211.6 (142-268)	-	120 (107-128)	11.2 (7-13)	23.3 (12-30)	50 (42-68)
			Plover stream	2.8 (2-3)	12.4 (4-32)	-	33 (30-33)	0.8 (0-1)	20.6 (0-50)	53.1 (25-78)
			St. Pats below bridge	2 (2)	17.4 (7-29)	-	40 (30-70)	0.4 (0-1)	5.4 (0-14)	71.2 (52-88)

[15] % EPT richness

4.6 Pest Species

4.6.1 Pest Animals

Possums, rodents and stoats have been monitored annually at Denniston since 2014 (Parkes 2020, Williams 2024). Possums have been monitored using wax-tags prior to- and post-aerial baiting with 1080 (sodium monofluoroacetate) in 2015, 2017, 2019, 2020 and 2023. Tracking tunnels have been used to monitor rodent populations generally four times a year, with emphasis placed on periods that cover mast events (2014, 2016, 2019), and stoats have also been monitored using tracking tunnels since 2017. These monitoring surveys have demonstrated that mice, rats (primarily ship rats), possums and stoats are present in most habitats at varying densities depending on a number of factors including habitat, seasonal influences, recent pest control operations and mast seeding events (Bathurst Resources 2015b). Specifically, the fertility of the habitats on the Buller Plateaux determines pest densities, with sandstone pavement areas supporting lower densities compared to dense forests and gully systems (Parkes 2020).

Rodent monitoring using tracking tunnels in the Denniston Biodiversity Enhancement area since 2014 has shown that indices regularly exceed the 5% threshold at which rodents are expected to be adversely affecting indigenous biodiversity as shown in Figure 24 and Figure 25. These pest animals are common in the forests surrounding the plateau, particularly following beech masts, but also reach higher than ideal abundances on the Buller Plateaux. Food supplies on the poorly vegetated Buller Plateaux is likely to limit numbers of rodents living there.

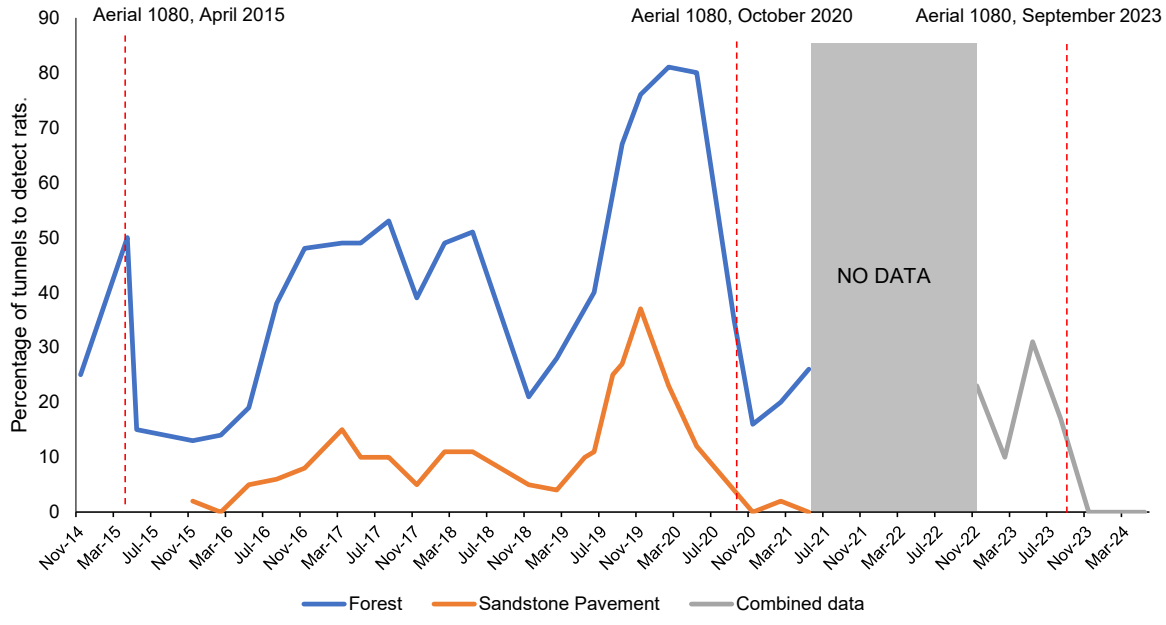


Figure 24: Approximate rodent tracking indices (rats) since 2014 in the Denniston Biodiversity Enhancement Area (data from Department of Conservation annual reports).

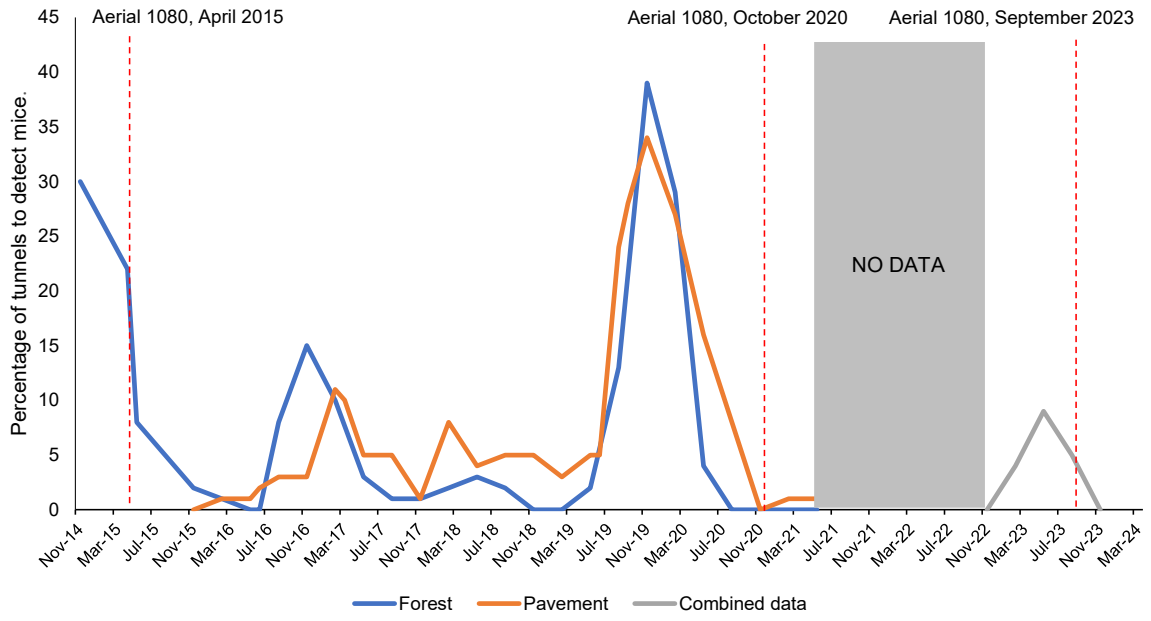


Figure 25: Approximate rodent tracking indices (mice) since 2014 in the Denniston Biodiversity Enhancement Area (data from Department of Conservation annual reports).

There are no known records of rabbits, weasels or ferrets from the Buller Plateaux. Goats are known to occur over some areas of the Buller Plateaux but are more common in the surrounding forested areas, particularly to the east (including Cascade Mine). Deer (primarily red deer), hares and feral cats have not been recorded at or near the Denniston Plateau recently. An ungulate hoofprint was observed near Escarpment Mine recently, however this could not be identified to species (M. Lambert unpubl. data, 2024). Goats are known to visit Escarpment Mine at least occasionally (G. Bramley pers. obs. 2024). These species are thought to be present in the general area and hares are present within the Stockton Mine site on the Stockton Plateau. A hare was seen at Denniston in 2025 (G. Bramley, pers. obs.).

Overall, pest animals are more common in forested habitats within the Buller Plateaux and the forested slopes which surround the plateau. These surrounding forests are warmer and more fertile and, therefore, provide better habitat and resources (e.g., food) for fauna, including introduced mammals. Other species such as ungulates, hares, and feral cats are likely to be present in these areas as well, but do not appear to have been specifically surveyed.

Vespulid wasps are common in lower altitude beech forests surrounding the Buller Plateaux, but have only occasionally been recorded in low numbers (single individuals) within the plateau itself. No other invertebrate pests are known to occur there.

4.6.2 Pest Plants

Weeds are largely confined to disturbed areas on the Buller Plateaux, including active and retired mining areas, roads and tracks. Forty-seven weed species have been identified across the wider Denniston Plateau (Department of Conservation 2015). The most common weed species are gorse (*Ulex europaeus*) and heath rush (*Juncus squarrosus*), both of which are able to survive in the sub-alpine zone. Other exotic weed species have been identified in isolated areas, normally as a result of previous disturbance or human occupation. These includes blackberry (*Rubus fruiticosus* agg.), Himalayan honeysuckle (*Leycesteria formosa*), pampas grass (*Cortaderia jubata* and *C. selloana*), wild broom

(*Cytisus scoparius*), ragwort (*Jacobaea vulgaris*) and montbretia (*Crocosmia* × *crocosmiiflora*) (Bathurst Resources 2015b).

4.7 Naturally Uncommon Ecosystems

As set out in Section 2.3, five naturally uncommon ecosystem occur on the Buller Plateaux.

4.8 Ecological Intactness and Connectivity

Historic burning, as discussed in Section 4.2, has affected species habitats on the plateaux, removing diverse forest communities and altering successional trajectories. It is unclear whether fire-induced pākihi vegetation will revert back to forest vegetation in the future, since the dense vegetation cover and typically shallow soil cover appears to inhibit regeneration of larger tree species (Rigg 1962).

Ecological intactness and connectivity vary across the Buller Plateaux, with some areas largely intact and others either historically and/or currently subject to major disturbances which have decreased intactness and disconnected indigenous habitats. Notable areas of high intactness and ecological connectivity include the south-western areas of both the Denniston and Stockton plateaux, particularly the Whareatea area at Denniston. The upper parts of the Deep Stream catchment are similarly intact, but the areas closer to the Waimangaroa River within that catchment have been affected by previous mining.

The Whareatea Gorge separates the more “developed” parts of the Denniston Plateau from the more intact parts nearer Mt Rochfort, and the larger Waimangaroa Gorge separates the Denniston Plateau from the Stockton Plateau to the north. The Buller Plateaux is well-connected to surrounding intact habitats to the east (Mt William Range and Orikaka catchment), south (Te Kuha) and north (Ngakawau River catchment and Mōkihinui Forest). These productive habitats contribute to the high species diversity seen on the plateau.

Open-cast mining and associated infrastructure, particularly on the Stockton Plateau, has been a major disturbance that has reduced intactness and connectivity. The Denniston Plateau has been disturbed to a lesser extent since mining there has mainly been underground, with two relatively small open-cast mines near the southern boundary of the plateau. Roads and mountain bike tracks that traverse the plateau on areas of sandstone pavement are highly disturbed and are likely a source of weeds for more intact areas. Although relatively small when compared to the scale of the surrounding ecosystems, these tracks and road may interrupt ecological connection for poorly mobile species such as snails. Gullies and the larger river gorges, which contain tall forest vegetation, are largely intact due to their inaccessibility.

4.9 Rehabilitated Habitats

The coal mined from the Buller Plateaux generally sits within one mineable seam that is 4 to 15m thick beneath up to 35m of quartzose sandstones, grits and topsoil (collectively called ‘overburden’) (Wright 2009).

During opencast mining, vegetation and topsoils are removed and either placed in overburden storage areas or directly at specific rehabilitation areas, depending on the availability of sites ready to receive them. Similarly, the underlying sandstone is then fractured using explosives, removed by excavator and truck, and placed ready for use in rehabilitation.

Once the coal has been removed rehabilitation normally follows a four-stage process as follows:

i) Backfilling the void with overburden material, which is managed to reduce the

potential for acidic metalliferous drainage (also known as acid mine drainage) and reshaping of material dumps.

ii) Creation of a geotechnically stable engineered landform (ELF).

iii) Adding soil and topsoil to the ELF surface to provide a substrate for vegetation growth, followed by vegetation establishment.

iv) Civil works, construction of roads and water channels.

Vegetation establishment can involve planting of locally sourced or nursery grown plants, slurry hydroseeding and/or vegetation direct transfer (DT or VDT). The ELF does not typically replicate the original detailed topography of the site, but is intended to create a landscape that is consistent with that present before mining began (Wright 2009).

VDT is also known as "habitat translocation" or "community translocation" and involves the removal and relocation of intact mats or sods of vegetation and attached soil (Rogers et al. 2011). The technique was first used at Stockton in the mid-1990s, although the practice has been refined since those initial attempts. VDT provides an immediate ground cover of locally adapted plants and is the only way of conserving examples of plants which are not propagated by nurseries. It is also useful for translocating individuals of poorly mobile species such as snails and other invertebrates and lizards (Rogers et al. 2011, Lloyd's Ecological Consulting 2024, Ecological Solutions Limited 2026b). VDT soils contain an earthworm biomass and diversity slightly lower and more variable than undisturbed soils, but significantly higher than stripped and stored soils (Boyer et al. 2011). Not all vegetation types are suitable for VDT, with taller vegetation (> 1.5m in height) and rocky or shallow soils being less suitable than shorter vegetation on deeper or more consistent soils. Disturbed soils are also prone to invasion by weeds, including *Juncus squarrosus* (Rogers et al. 2011, Ecological Solutions Limited 2026b).

Underground mining leaves little visible footprint on the land surface, although cracks, fissures and subsidence are all common above historic underground mines and underground fires have also affected vegetation at some locations, including near Millerton and at Ironbridge near Burnett's Face.

At Denniston, mining has historically been mostly underground, although Cascade Mine (located off the Denniston Plateau in the adjoining Cascade Stream catchment at an elevation of approximately 300m asl) and the Escarpment Mining Project were both open cast mines and there was some surface vegetation removal at Sullivan Mine associated with the adit, roading and other infrastructure. Rehabilitation at Denniston has occurred to varying degrees at the former Cascade Mine and the former Sullivan Mine. Cascade Mine's plantings are still relatively young, whilst rehabilitation outcomes at Sullivan Mine have been poor because the rehabilitated areas are now dominated by either exotic species or species not typical of the Buller Plateaux.

At Stockton Mine, mining has been opencast, including working over areas that had previously been underground mined. In 2009 the Parliamentary Commissioner for the Environment commended then site operator, Solid Energy for "tangible environmental improvements including reduced total suspended solids in Mangatini Stream and reduced acidity in the Ngakawau River". At that time approximately 140 hectares were at various stages of remediation and site rehabilitation has been ongoing. As at December 2023, approximately 451ha has been rehabilitated to varying degrees, including 49.44ha of VDT as shown in Figure 26. This represents approximately 37% of the active site (1,203.53ha).

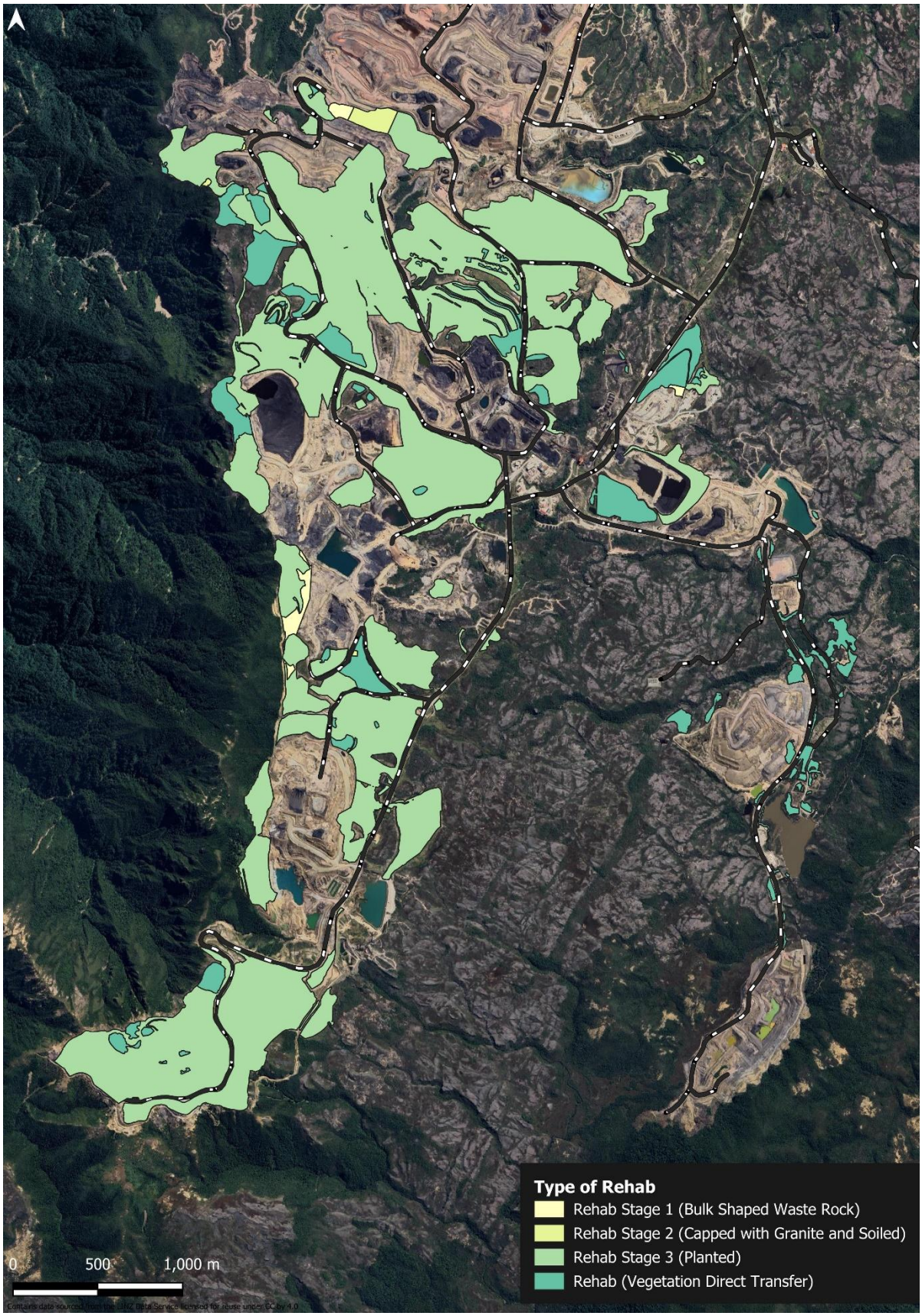


Figure 26: Stockton Mine Rehabilitation Status as at December 2023.

Rogers et al. (2011) measured the effectiveness of VDT by measuring the quality of runoff from rehabilitated and non-rehabilitated sites, vegetation cover and diversity and the abundance of earthworms and *Powelliphanta* snails in DT vegetation. More recent surveys of vegetation and fauna in rehabilitated habitats have included birds, terrestrial invertebrates and lizards (Ecological Solutions 2026b).

5.0 Summary

5.1 Vascular Plants

5.1.1 Species Presence and Diversity

A species list for the Buller Plateaux derived from sixteen previous botanical surveys since 1990 includes approximately 542 vascular plant species. The majority, 469 (87%), of these species were indigenous, with 70 (13%) exotic species. 31 species (6%) are considered 'Threatened' or 'At Risk'. This is a high diversity of species and reflects the varied nature of the habitats and microhabitats present across the plateau.

5.1.2 Vegetation Types

Previous authors have described between eight and 22 distinct vegetation types across the Buller Plateaux. High resolution drone photographs collected between 2021 and 2024 and a recce-plot based survey combined with multivariate analysis was used to discriminate, describe and map the vegetation types across the Buller Plateaux in high resolution and identified 13 different vegetation types and three non-vegetated landcovers (Ecological Solutions Limited 2026a).

Vegetation communities include sandstone pavement with a low proportion of vegetation cover, low growing pākihi and shrubland communities, shrublands and forest. Mānuka is a widespread and common element of many of the vegetation communities and many of the communities would qualify as wetlands in terms of the National Policy Statement for Freshwater Management which took effect in September 2020 because of the high proportion of obligate and facultative hydrophytes present.

5.2 Bryophytes

5.2.1 Terrestrial Bryophytes

Bryophytes form a major component of the flora of the Buller Plateaux, accounting for ~30% of the species diversity (Meagher 2020a). Glenny (2015) considered the habitats of the Buller Plateaux to be of "exceptional" value for bryophytes. The bryophyte flora has affinities with the bryophyte floras of Tasmania, Rakiura and Fiordland and also includes unique elements and unique combinations of species.

There are 50 species of bryophytes currently listed as 'Threatened' or 'At Risk' that have been recorded on the Buller Plateaux, including 39 liverworts, 10 mosses, and one hornwort.

High value habitats for terrestrial bryophytes include:

- Red tussockland (dominated by *Chionochloa rubra*);
- Pākihi ecotones (low heathlands, fernlands, sedgelands, and cushionfield);
- Mānuka shrublands with open sandstone pavement;
- Stunted conifer forest/scrub on ridgelines (cloud forest);

- Forest / forest patches on nutrient poor soils with impeded drainage (e.g. yellow-silver pine forest/scrub);
- Forested blockfield; and
- Diverse (Southern rātā) / tall-beech forest with mountain toatoa.

Six adventive bryophytes have been recorded from the Buller Plateaux.

5.2.2 Aquatic Bryophytes

Streams within the Buller Plateaux provide good quality habitat for aquatic bryophytes including both obligate and facultative aquatic species that inhabit streams, riparian margins, flood zones, wet substrates, tarns and lakes.

One 'Threatened' and five 'At Risk' aquatic bryophytes have been recorded, along with three 'Data Deficient' species.

High value habitats for aquatic bryophytes include:

- Small gorges;
- Stream bed boulders and stream bed itself;
- Deep instream caverns;
- Banks of flood deposited sand (e.g. *Isotachis westlandica* is a specialist coloniser of such flood deposits);
- Riparian bedrock, gorge walls, rock-walls, 'bolsters' and overhangs (e.g. shallow caves and cave entrances that receive limited direct sunlight);
- Hanging 'stalactites' of plant roots trapped with peat, maintained by water seepage from above plateau; and
- Other areas with high humidity levels.

These areas provide habitat for a high diversity of common aquatic bryophytes as well as habitat for threatened and at-risk species.

5.3 Lichens

Despite the lack of extensive specific survey, approximately 98 species of lichens are known from the Buller Plateaux. Of these, four are considered 'Threatened', eight 'At Risk', and fourteen 'Data Deficient'. Open sandstone pavement and quartzite sands provide important habitat for the threatened species *Austropeltum glareosum* and *Pycnothelia caliginosa*.

5.4 Birds

5.4.1 Rōroa

Rōroa are continuously but sparsely distributed across the Buller Plateaux. Territories on and near the plateau are exceptionally large (≥ 80 ha) and typically include a range of habitat types. The apparent population stability of rōroa on the plateau appears to result from a combination of:

i) High adult longevity.

ii) Naturally occurring, but infrequent reductions in stoat predation which allow recruitment in some years.

iii) Reductions in stoat predation associated with stoat and rodent control via aerial 1080 application which allow recruitment in some years.

iv) The possible immigration of sub-adults from surrounding areas during years when 1080 operations improve their survival.

The reported call rates of between 0.94 calls/hr and 3.28 calls/hr in the Waimangaroa Valley and the Blackburn Pākihi and Pylon Road, 1.6 calls/hr at Cypress and 1.7 calls/hr at Mt William North are consistent with Toy et al. (2021), who recorded call rates in the Westport population of rōroa between 0.3 and 3 calls/hr.

In terms of national significance, McLennan (2020) considered that the Buller Plateaux rōroa population scores highly for its probability of persistence in the absence of predator control, but low for its overall sparseness (probably because of the low fertility of the plateau habitats).

5.4.2 Forest Birds

Fifty-six species of birds have been recorded in the Ngakawau Ecological District including coastal, wetland and terrestrial birds. Species present include those adapted to forests, shrublands and open areas. Thirty-nine species of birds have been recorded from throughout the Buller Plateaux, including 10 introduced and naturalised species. The abundance and distribution of birds varies considerably due to the range of habitats present (e.g., subalpine forest, pākihi, tussockland, rushland, wetland, coal measures shrubland and sandstone pavement) and the degree of human disturbance due to mining and other activities.

Highest concentrations of birds are typically found in forest habitat, while coal-measures shrubland, sandstone pavement areas and pākihi generally support comparatively few species.

Nine ‘Threatened’ or ‘At Risk’ species are known to be present which include rōroa, South Island fernbird, New Zealand pipit, kea, New Zealand falcon, black shag, little shag and long-tailed cuckoo and banded dotterel. The shrubland and rushland habitats present throughout the Buller Plateaux provide good habitat for particularly South Island fernbird and New Zealand pipit.

5.5 Bats

The Buller Plateaux is unlikely to be home to a resident population of bats. Ten bat surveys undertaken within or near the Ngakawau Ecological District over the 22 years between 1997 and 2019 have primarily focussed on the upper Waimangaroa valley which lies to the east of the Buller Plateaux. None of these surveys have detected bat passes since the original records in 1997.

Only two populations of long-tailed bats (and none of short-tailed bats) are known to exist in close proximity to the Buller Plateaux – upstream of the Mōkihinui River Forks and at Lake Matiri (Lloyd 2018). Further, current national bat distribution data suggests that in the South Island there is one relatively large offshore population of long-tailed bats (on D’Urville Island) and at least five relatively large mainland populations (in Eglinton, Kepler, Maruia, Mōkihinui and Pelorus-Rai) as well as low densities of long-tailed bats spread over wide areas elsewhere, especially in lowland West Coast forests (Lloyd 2013).

5.6 Lizards

The Buller Plateaux is home to three species of lizard including West Coast green gecko, forest gecko and speckled skink.

Natural habitat mosaics with high physical (structural) complexity, adequate food resources throughout the year and adequate shelter/refugia from extreme weather (temperature, wind and desiccation) throughout the Buller Plateaux are likely to support a high carrying capacity of lizards. This includes habitat mosaics within topographically diverse areas such as gorges and gullies.

The lizard assemblage on the Buller Plateaux is regarded as nationally significant because of its:

- Rarity (the Ngakawau Ecological District is the only place these three species coexist);
- Relatively high encounter rate (notwithstanding the small sample sizes); and
- Phenotypic (and presumably genetic) variability of the populations (especially the two gecko species).

5.7 Invertebrates

5.7.1 *Powelliphanta* Snails

Two species of *Powelliphanta* snails, both regarded as 'Threatened – Nationally Critical', are present on the Buller Plateaux. *Powelliphanta augusta* is restricted to an area of approximately 8.5ha at Mt Augustus and an area where it has been introduced at Denniston.

Powelliphanta patrickensis is patchily distributed across the Buller Plateaux. Snail densities are low in most areas. This low density is likely to be due, at least in part, to predation by rodents and weka. The stronghold of *Powelliphanta patrickensis* is considered to lie within the upper Waimangaroa River and Deep Stream catchment.

5.7.2 Other Terrestrial Invertebrates

Terrestrial invertebrates found in the West Coast region comprise at least three distinct faunal elements:

- Widespread species found throughout New Zealand;
- Species typical of north-west South Island;
- Localised species adapted to the main divide, alpine or wetland habitats.

Invertebrates collected from the Buller Plateaux are reflective of the climate, topography and land-use. In general, indigenous invertebrate communities dominate at sites with indigenous vegetation and there is higher species richness at sites with more diverse vegetation. Invertebrate surveys of the Buller Plateaux have invariably collected predominantly indigenous species broadly similar throughout. Previous invertebrate surveys have often collected 'new' species, i.e., either those that have not been encountered in the area before or, occasionally, species which are new to science. This is likely due the high diversity of habitats the Buller Plateaux provides. Many of the invertebrate species found on the Buller Plateaux are large-bodied and flightless. As well as distinct elements, such as the avatar moth, the invertebrate community also includes 'At Risk – Relict' species such as the forest ringlet butterfly. Nine species of conservation concern have been recorded to date. Because of the limited knowledge with respect to the ecology and habits of most invertebrate species, the discovery of 'new' species is likely to be a feature of surveys for some years to come and the challenge will be demonstrating that these species are not put at risk by particular proposals.

5.8 Aquatic Ecology

Surveys from the Buller Plateaux have typically recorded the presence of kōura and macroinvertebrate communities typical of healthy aquatic communities, but no fish. This is thought to be due to natural barriers downstream as well as natural and mine affected poor water quality, in the upper catchment.

5.9 Pests

5.9.1 Mammals

Overall, pest animals, particularly possums, rodents and stoats are more common in forested habitats within the Buller Plateaux and the forested slopes which surround the plateau. These surrounding forests are warmer and more fertile and, therefore, provide better habitat and resources (e.g., food) for fauna, including introduced mammals. Hares are present on Stockton Plateau, and ungulates (mainly goats) are also common in the surrounding forested catchments, but have seldom been recorded using the plateau habitats.

These pest species are present in densities sufficient to adversely affect sensitive indigenous fauna populations, at least occasionally, but the regular use of aerial 1080, and the existing ecological management in place in the WHEA, SEA and DPPA mean that the value of additional pest control on the Buller Plateaux itself would be arguable.

5.9.2 Weeds

Weeds are largely confined to disturbed areas on the Buller Plateaux, including active and retired mining areas, roads and tracks. Forty-seven weed species have been identified across the wider Denniston Plateau. The most common weed species are gorse and heath rush, both of which are able to survive in the sub-alpine zone. Heath rush in particular has the potential to exclude native species and affect natural succession.

5.10 Naturally Uncommon Ecosystems

Five naturally uncommon ecosystem occur on the Buller Plateaux:

- Boulderfields of acidic rock;
- Sandstone erosion pavement;
- Tarns;
- Pākihi wetlands; and
- Seepages and flushes.

Sandstone erosion pavements are a key feature of the Buller Plateaux and Wildland Consultants Limited (2010) estimated approximately 1,474ha of sandstone pavement remained.

Due to the difficultly in mapping small, sometimes ephemeral features like seepages, Wildland Consultants Limited's estimate of 1.1ha across the Buller Plateaux is likely an underestimate, however a portion of the seepages present in the Wildland Consultants Limited (2010) study have since been removed due to development of the Cypress Mine.

5.11 Rehabilitated Sites

There are small rehabilitated sites at Denniston. As at December 2023, approximately 451ha had been rehabilitated to varying degrees at Stockton, including 49.44ha of VDT.

This represents approximately 37% of the active site (1,203.53ha).

6.0 References

Alliance Ecology Limited. 2020. Buller Plateau Project: Baseline Lizard Report. Unpublished report prepared by Alliance Ecology Limited for Bathurst Resources Limited. August 2020. 22pp + appendices. Alliance Ecology Limited, Auckland.

Bathurst Resources Limited. 2015a. Escarpment Mine Powelliphanta patrickensis Management Plan.

Bathurst Resources Limited. 2015b. Escarpment Mine: Weeds and Animal Pests Management Plan.

Beveridge, P., Glenny, D. 2010. *Chiloscyphus gippslandicus* J.J. Engel & R.M. Schust. new to New Zealand. Australasian Bryological Newsletter 58: 9–10.

Boubée, J. 1999. Macro-invertebrate and Fish Communities of the Stockton Plateau. Unpublished report prepared for Solid Energy New Zealand Ltd. National Institute of Water and Atmospheric Research, Hamilton.

Boyer, S., Wratten, S., Pizey, M. and Weber, P. 2011. Impact of soil stockpiling and mining rehabilitation on earthworm communities. Pedobiologia, 54, S99-S102.

Boyer, S. and Wratten, S. 2012. Earthworm community assessment on the Denniston Plateau. Unpublished report for prepared Buller Coal Ltd, Lincoln University, June 2012.

Braggins, J.E. and Kusabs, A. 2006. Report on a survey to locate alternative populations of endangered bryophytes adjacent to the Stockton mine site. Prepared for Michell Partnerships.

Bramley, G.N. 2012. Statement of Evidence of Gary Bramley. West Coast ENT INC V Buller Coal Ltd (SC 75/2012).

Bramley, G.N. 2022. First Statement of Rebuttal Evidence of Gary Bramley. Between Royal Forest and Bird Protection Society of New Zealand Inc and West Coast Regional Council and Buller District Council and Stevenson Mining Ltd (ENV-2017-CHC-090).

Bramley, G.N. and Aguillar, G. 2020. Baseline vegetation survey of the Sullivan Mining Licence and proposed Upper Waimangaroa Haul Road. Unpublished report by The Ecology Company prepared for Bathurst Resources Limited. December 2020. 67pp + appendices.

Brooks, D. 2012. Secret Life of Denniston. Forest and Bird 344: 22 – 25.

Brown, E.A., and Renner, M.A.M. 2014. The genus *Acromastigum* in Australia. Telopea 17: 251–293.

Brownsey, P.J., Ewans, R., Rance, B., Walls, S., and Perrie, L.R. 2013. A review of the fern genus *Sticherus* (Gleicheniaceae) in New Zealand with confirmation of two new species records. New Zealand Journal of Botany, 51(2):104–115.

Buckingham, R.P. 1998a. Surveys for endemic bats in the Upper Waimangaroa Exploration Permit Area, and surrounding areas, South Island West Coast, New Zealand. Prepared for Solid Energy International.

Buckingham, R.P. 1998b. Distribution of birds in the Upper Waimangaroa Exploration Permit Area, and surrounding areas, South Island West Coast, New Zealand. Prepared for Solid Energy International.

Buckingham, R.P. 1998c. Surveys for *Powelliphanta* land snails in the upper Waimangaroa Valley, Blackburn-Orikaka pākihi, Mount Stockton and Mount Rochfort localities, South Island West Coast, New Zealand. Contract report No. 24/1 prepared for Solid Energy International by Wildlife Surveys. 11 pp. Plus maps.

Buckingham, R.P. 1999. A survey for birds and bats in Inangahua Working Circle (Beech Working Circle 2). Wildlife Surveys contract report No. 25/2 for Timberlands West Coast New Zealand Limited, Greymouth. 146 pp plus maps.

Buckingham, R.P. 2002. Cypress Mine Survey for Kiwi and Bats (Report 20). Prepared by Wildlife Surveys for Solid Energy New Zealand Ltd. Reviewed and updated August 2003.

Buckingham, R.P. 2005. Survey for *Powelliphanta* land snails, Mt Frederick, Stockton Plateau, West Coast.

Buckingham, R.P. 2011. Statement of Evidence of Rhys Philip Buckingham. Escarpment Mine Project.

Cassola, F. and Moravec, J. 2010. New records of tiger beetles from New Zealand with taxonomic and nomenclatural notes on the genus Neocicindela (Coleoptera: Cicindelidae). Fragmenta Entomologica, Roma, 42 (1): 1-22.

Chapple, D.G., Bell, T.P., Chapple, S.N., Miller, K.A., Daugherty, C.H. and Patterson, G.B., 2011. Phylogeography and taxonomic revision of the New Zealand cryptic skink (*Oligosoma inconspicuum*; Reptilia: Scincidae) species complex. Zootaxa, 2782(1), pp.1-33.

de Lange, P., Blanchon, D., Knight, A., Elix, J., Lucking, R., Frogley, K., Harris, A., Cooper, J. and Rolfe, J. 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27. Department of Conservation, Wellington. 64 pp.

de Lange, P. J., Galloway, D. J., Blanchon, D. J., Knight, A., Rolfe, J. R., Crowcroft, G. M., and Hitchmough, R. 2012. Conservation status of New Zealand lichens. New Zealand Journal of Botany, 50(3), 303–363.

de Lange, P.J., Glenny, D., Frogley, K., Renner, M.A.M., von Konrat, M., Engel, J.J., Reeb, C. and Rolfe, J.R. 2020. Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31. Department of Conservation, Wellington. 30 pp.

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

Department of Conservation. 2015. Denniston Plateau Weed Control Plan 2015 – 2020.

Druce, A.P. 1993. Indigenous vascular plants of Denniston and Stockton Plateaux (including Mts Augustus, Frederick and Rochfort), N.W. Nelson. Species List 208, Botany Division, DSIR, Lower Hutt.

Druce, A.P. 2008. Plant species list Coalbrookdale WW Denniston (CBDW). APD 258 PCN716 AP Druce. Retrieved from https://www.nzpcn.org.nz/publications/plant-lists/plant-lists-by-region/coalbrookdale-ww-denniston-cbdw/

Dunn, N. R., Allibone, R. M., Closs, G. P., Crow, S. K., David, B. O., Goodman, J. M., Griffiths, M., Jack, D. C., Ling, N., Waters, J. M., & Rolfe, J. R. 2018. Conservation status of New Zealand freshwater fishes, 2017. New Zealand Threat Classification Series 24. Department of Conservation.

Dunn, N.R., Closs, G.P., Crow, S.K., David, B.O., Goodman, J.M., Griffiths, M., Hicks, A.S., Hickford, M.J.H., Jack, D.C., Kitson, J.C., Ling, N., Waters, J.M., Wylie, M.J., Hitchmough, R.A., Makan, T. 2025. Conservation status of New Zealand freshwater fishes, 2023. New Zealand Threat Classification Series 46. Department of Conservation, Wellington. 66 p.

Dwyer, P. D. 1962. Studies on the two New Zealand bats. Zoological Publications from Victoria University of Wellington 28:1-28.

Ecological Solutions Limited. 2023. Upper Waimangaroa haul road terrestrial invertebrate survey. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. October 2023. Ecological Solutions Limited, Kāeo. 18 pp + appendices.

Ecological Solutions Limited. 2026a. Buller Plateaux Vegetation Mapping. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. November 2025. Ecological Solutions Limited, Kāeo. 76 pp + appendices.

Ecological Solutions Limited. 2026b. Assessment of Rehabilitation Outcomes at Stockton Mine. Unpublished report prepared for BT Mining Limited. In prep. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2025. Cypress Mining Area Annual Vegetation Monitoring Report. Unpublished report prepared for BT Mining Limited. Ecological Solutions Limited, Kāeo. August 2024. 37pp + appendices.

Efford, M. 1998. Distribution and status of native carnivorous land snails in the genera *Wainuia* and *Rhytida.* Science for Conservation:101. Published by the Department of Conservation.

Engel, J.J. and Glenny, D. 2008. A Flora of the Liverworts and Hornworts of New Zealand. Vol. 1. Monographs in Systematic Botany from the Missouri Botanical Garden. Vol. 110. Missouri Botanical Garden, St. Louis.

Engel, J.J. and Glenny, D. 2019a. A Flora of the Liverworts and Hornworts of New Zealand. Vol. 2. Monographs in Systematic Botany from the Missouri Botanical Garden. Vol. 134. Missouri Botanical Garden, St. Louis.

Engel, J.J. and Glenny, D. 2019b. A Flora of the Liverworts and Hornworts of New Zealand. Vol. 3. Monographs in Systematic Botany from the Missouri Botanical Garden. Vol. 135. Missouri Botanical Garden, St. Louis.

Entecol Limited. 2013. Terrestrial Invertebrates in the Te Kuha Project Area. Prepared by Ian Millar, June 2013, ENT-030. Report prepared for Stevenson Mining Te Kuha Ltd.

Entecol Limited. 2016. Follow-up Invertebrate Survey at the Te Kuha Mine Site. Prepared by Ian Millar & Brian Patrick, July 2016, ENT-045. Report prepared for Stevenson Mining Te Kuha Ltd.

Feasey, G. 1986. Upper Waimangaroa Project Environment Strategy June 1986. Page 24. SCM 86 UW/1, State Coal Mines, Wellington, New Zealand.

Fife, A.J. 2014. Amblystegiaceae. In: Heenan, P.B., Breitwieser, I., Wilton, A.D. (ed.). Flora of New Zealand — Mosses. Fascicle 1. Manaaki Whenua Press, Lincoln.

Fife, A.J. 2015. Pleurophascaceae. In: Heenan, P.B., Breitwieser, I. and Wilton, A.D. (ed.). Flora of New Zealand — Mosses. Fascicle 25. Manaaki Whenua Press, Lincoln.

Fife, A.J. 2017. Pulchrinodaceae. In: Breitwieser, I. and Wilton, A.D. (ed.). Flora of New Zealand — Mosses. Fascicle 32. Manaaki Whenua Press, Lincoln.

Fife, A.J. 2019. Dicranaceae. In: Smissen, R. and Wilton, A.D. (ed.). Flora of New Zealand — Mosses. Fascicle 42, Edition 2. Manaaki Whenua Press, Lincoln.

Fife, A.J., Glenny, D., Beever, J.E., Braggins J.E., Brownsey, P.J., Renner, M.A.M. and Hitchmough, R. 2010. New Zealand's threatened bryophytes: conservation efforts. Phytotaxa 9: 275 –278. Published: 30 Sep. 2010.

Galloway, D.J. 1985. Flora of New Zealand: Lichens. Government Printer.

Galloway, D.J. 2007. Flora of New Zealand Lichens, Revised Second Edition: Including lichen-forming and lichenicolous fungi. Manaaki Whenua Press, Landcare Research.

Galloway, D.J. and Elix, J.A. 1980. *Knightiella* Müll.Arg., a monotypic lichen genus from Australasia. New Zealand Journal of Botany 18: 481-486.

GBIF.org. April 2024. GBIF Occurrence Download https://doi.org/10.15468/dl.qaqnhw

Gibb, E.S., Wilton, A.D., Schönberger, I., Fife, A.J., Glenny, D., Beever, J.E., Boardman, K.F., Breitwieser, I., de Pauw, B., Ford, K.A., Greer, P.A., Heenan, P.B., Maule, H.G., Novis, P.M., Prebble, J.M., Smissen, R.D. and Tawiri, K. 2022. Checklist of the New Zealand Flora – Hornworts, Liverworts and Mosses. Lincoln, Manaaki Whenua-Landcare Research.

Gibbs, G.W. 1999. Four new species of giant weta, *Deinacrida* (Orthoptera: Anostostomatidae: Deinacridinae) from New Zealand. Journal of the Royal Society of New Zealand, 29(4), 307–324. https://doi.org/10.1080/03014223.1999.9517600.

Given, D.R. and Park, G.N. 1975. Proposed Buller coal-fired power station site evaluation report – botanical. Botany Division, DSIR, Christchurch.

Glenny, D. 1999. Bryophyte survey at Stockton Plateau: Happy Valley tussock-land and surrounding areas. Landcare Research Contract Report LC9899/050. Prepared for Solid Energy Ltd.

Glenny, D. 2002. Terrestrial Bryophytes – Survey (2003 revision). Landcare Research Ltd. Prepared for Solid Energy New Zealand Ltd.

Glenny, D. 2005. Report on Bryophytes on Mount Augustus Ridge, Stockton (unpublished Draft Report 19 April 2005). Prepared for Solid Energy New Zealand Ltd.

Glenny, D. 2007. Bryophytes and lichens in forests on Mount Frederick ridge, Stockton Plateau. Landcare Research Contract Report: LC0708/034. Prepared for Solid Energy New Zealand Ltd.

Glenny, D. 2008a. Effect of flow in Mangatini Stream on bryophytes in the gorge below the present road culvert. Landcare Research (unpublished). Prepared for Solid Energy

New Zealand Ltd. 3 pp.

Glenny, D. 2008b. Bryophytes survey of propped dam sites at T35 Stream and mid-Patrick Stream, Stockton Plateau. Landcare Research Contract Report LC0809/050. Prepared for Solid Energy New Zealand Ltd. 15 pp + appendices.

Glenny, D. 2009. Report on follow-up survey to T35 and St Patrick Stream bryophyte survey of October 2008. Prepared for Solid Energy New Zealand Ltd.

Glenny, D. 2012. Bryophytes and lichens in the proposed Escarpment Mine area, Denniston Plateau. Landcare Research Contract Report: LC 1131. Prepared for Buller Coal Ltd. October 2012.

Glenny, D. 2015. Bryophyte Survey of Te Kuha Ridge, Westport. Landcare Research Contract Report: LC2434. Prepared for Stevenson Group Ltd. December 2015.

Glenny, D. 2024. *Riccardia dimorpha* sp. nov. (Hepaticophyta, Aneuraceae) from Western Nelson, New Zealand, exhibiting sexually determined morphological dimorphism, an overlooked feature of some liverworts. Telopea 27: 73–83.

Glenny, D. and Bartlett, R. 2008. A new *Bazzania* species (Lepidoziaceae) from Stockton Plateau, Nelson, South Island, New Zealand. Fieldiana, Botany, new series, 47: 175–180.

Glenny, D. and Dawson, M. 2011. Bryophyte survey of northern Mt William Range. Landcare Research Contract Report: LC 281. Prepared for Solid Energy New Zealand Ltd. November 2011.

Glenny, D. and Fife, A.J. 2001. Bryophyte survey at Te Kuha Ridge. Landcare Research Contract Report LC0001/82. Prepared for Michell Partnerships Ltd.

Glenny, D. and Kusabs, A. 2005. Bryophyte Survey of Proposed Dam Sites at Mangatini Stream, Stockton Plateau. Landcare Research Contract Report LC0506/038. Prepared for Solid Energy New Zealand Ltd.

Godsen, J. 2023. Mountain Daisies: A guide to *Celmisia* in Aotearoa/New Zealand. Mānuka Press.

Grainger, N., Harding, J., Drinan, T., Collier, K., Smith, B., Death, R., Makan, T., and Rolfe, J. 2018. Conservation status of New Zealand freshwater invertebrates, 2018. New Zealand Threat Classification Series 28.

Gray, D.P., Harding JS. 2012. Acid Mine Drainage Index (AMDI): a benthic invertebrate biotic index for assessing coal mining impacts in New Zealand streams. New Zealand Journal of Marine and Freshwater Research. 46:335–352.

Harding, J.S., Gray, D., Philip, A., McIntosh, R., and H. Eikaas. 2006. Distribution of native fish in the Ngakawau and Waimangaroa Rivers. Page 15. School of Biological Sciences, University of Canterbury, Christchurch, New Zealand.

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson G.B., Reardon J.T., van Winkel, D., Makan, T., and Michel, P. 2026. Conservation status of reptiles in Aotearoa New Zealand, 2025. New Zealand Threat Classification Series 50. Department of Conservation, Wellington. 32 pp.

Hoare, R.J.B., Dugdale, J.S., Edwards, E.D., Gibbs, G.W., Patrick, B.H., Hitchmough, R.A and Rolfe, J.R. 2017. Conservation status of New Zealand butterflies and moths (Lepidoptera), 2015. New Zealand Threat Classification Series 20. Department of Conservation, Wellington. 13 pp.

Haast, J. 1861. Report of a topographical and geological exploration of the western districts of the Nelson Province, New Zealand. Printed by C. and J. Elliott. 150pp. Available at: https://archive.org/details/reporttopograph00haas

Holdaway, R.J., Wiser, S.K. and Williams, P.A. 2012. Status assessment of New Zealand's Naturally Uncommon Ecosystems. Conservation Biology 26(4):619-629.

Hurst, J.M. and Allen, R.B. 2007. The RECCE method for describing New Zealand vegetation – expanded manual, version 4. Landcare Research Contract Report (LC0708/029), Manaaki Whenua – Landcare Research, Lincoln.

Jellyman, P. and Stark, J. 2013. Escarpment Mine: Baseline Report – Aquatic Ecology. Prepared for Buller Coal Limited. November 2013.

Johnson, P. and Gerbeaux, P. 2004. Wetland types in New Zealand. Wellington, Department of Conservation.

King, S.J. 2018. Genetic and phenotypic variation used to identify populations of endangered green gecko (Naultinus) found in the north-west South Island, New Zealand : a thesis submitted in fulfilment of the requirements for the degree of Master of Science in Conservation Biology, Massey University, Albany and Palmerston North. EMBARGOED until further notice.

Kingett Mitchell Ltd. 1996. Freshwater Invertebrates of the Upper Waimangaroa Area. Page 32. S00019185, Kingett Mitchell & Associates Limited, New Zealand.

Kingett Mitchell & Associates Ltd. 1997. Vegetation of the Upper Waimangaroa Area.

Kingett Mitchell & Associates Ltd. 1997. Whareatea River Biological and Water Quality Assessment. Page 28. Kingett Mitchell & Associates Ltd, New Zealand.

Kingett Mitchell & Associated Ltd. 1998. Vegetation of the Proposed Northern Opencast Coal Mine Site.

Kingett Mitchell & Associates Ltd & Landcare Research. 1997. Great Spotted Kiwi Survey of the Upper Waimangaroa and Surrounds. Prepared for Solid Energy International. Kingett Mitchell Ltd. 1996. Upper Waimangaroa Project Environmental Baseline Studies. Page 48. Kingett Mitchell & Associates Ltd, New Zealand.

Knightbridge et al. 2002. Comparison of the vegetation of Te Kuha with the vegetation surveyed for the Ngakawau Protected Natural Areas report. Internal Department of Conservation report. Hokitika.

Lambert, P. and Fenwick, G. 2013. Key environmental factors for Denniston Plateau species of significance a compilation of literature. Prepared for Buller Coal Ltd by National Institute of Water & Atmospheric Research Ltd. NIWA Client Report: CHC2013-141.

Landcare Research 2012. Naturally Uncommon Ecosystems. https://www.landcareresearch.co.nz/publications/naturally-uncommon-ecosystems/. Accessed 1 May 2024.

Larivière, M.-C., Fletcher, M.J. and Larochelle, A. 2010. Auchenorrhyncha (Insecta: Hemiptera): catalogue. Fauna of New Zealand 63, 232 pp.

Lloyd, B.D. 2011. Statement of Evidence of Dr. Brian Donald Lloyd for Meridian Energy Limited. Dated: 18 September 2011. Mokihinui Hydro Project.

Lloyd, B.D. 2012. Analyses of *Powelliphanta* Snail Survey Data for the Escarpment Mine Project. Prepared for Buller Coal Ltd.

Lloyd, B.D. 2013. Top of the South Bat Conservation Programme: Royal Forest and Bird Protection Society, Bat Surveys Annual Report 2012-2013. Lloyds Ecological Consulting, Nelson.

Lloyd, B.D. 2018. Top of the South Bat Conservation Programme: Royal Forest and Bird Protection Society, Bat Surveys in the Rai and Pelorus Catchments 2016–2017. Lloyds Ecological Consulting, Nelson.

Lloyd, B.D. 2019. An acoustic survey for bats in the Upper Waimangaroa Catchment. Unpublished report by Lloyd's Ecological Consulting for Bathurst Resources Limited. April 2019. Lloyd's Ecological Consulting, Nelson. 10pp.

Lloyd, B.D. 2023. Taxonomy of *Powelliphanta* Snails on Buller Plateau. Unpublished report prepared by Lloyd's Ecological Consulting for Bathurst Resources Limited. December 2023. Lloyd's Ecological Consulting, Nelson. 15pp.

Lloyd, B.D. 2024. Surveys for *Powelliphanta patrickensis* snails in areas rehabilitated after mining. Unpublished report prepared by Lloyd's Ecological Consulting for Bathurst Resources Limited. October 2024. Lloyd's Ecological Consulting, Nelson. 29pp.

Lowdermilk, W.C. and Sundling, H.L. 1950. Erosion pavement, its formation and significance. Eos, Transactions American Geophysical Union, 31(1), 96-100.

Ludwig, L.R. 2015. The reproductive ecology of *Icmadophila splachnirima*, including aspects of the reproduction in additional members of Icmadophilaceae (Doctoral dissertation, University of Otago, Dunedin, New Zealand).

Mabin M. 2012. Statement of evidence of Mark Charles Grace Mabin. Prepared for West Coast Environmental Network Incorporated, Royal Forest and Bird Society of New Zealand Incorporated, West Coast Regional Council and Buller District Councils and Buller Coal Limited. Dated 7 June 2012.

Maguire, L. 2021. Survey of Rehab and VDT areas of Stockton to ascertain use of area(s) by Great Spotted Kiwi (*Apteryx haastii*) using a certified protected species conservation dog. Unpublished report by MBC Contracting Limited for Bathurst Resources Limited. April 2021. 7pp. MBC Contracting Limited, Westport.

MBC Contracting Ltd. 2008. Millerton East – Priorities 2 & 7 (Part 2). Flora and Fauna Survey Report.

MBC Contracting Ltd. 2008. Priority 6 – Millerton North. Flora and Fauna Survey Report.

McEwen, M. 1987. Ecological Regions and Districts of New Zealand. Third Revised Edition. Department of Conservation, Wellington, New Zealand.

McClellan, R., Patrick, B.H., Tocher M., Smith, D. and Borkin K. 2014. Review of fauna components of an access application for the Te Kuha Open Cast Coal Mine, Buller. Wildland Consultants Ltd. Contract Report 3470. 53 pages.

McDowall, R.M. 2010. New Zealand Freshwater Fishes, an Historical and Ecological Biogeography.

McLennan, J. 2012. Fauna of the Denniston CML 37-161 Denniston Plateau. Prepared for Solid Energy New Zealand Ltd. Draft.

McLennan, J. 2020. Great Spotted Kiwi on the Buller Plateau: Distribution, habitat-use and conservation status. Prepared for Bathurst Resources Ltd.

Meagher, D. 2020a. Proposed Road Alignment, Stockton Plateau – Bryophyte Surveys 2019 – 2020. Unpublished report by Zymurgy Consulting Limited for Bathurst Resources Limited. 15pp + appendices. Zymurgy Consulting, Surrey Hills, Australia.

Meagher, D. Cypress Stream, Stockton Plateau — bryophyte monitoring 2020. Unpublished report by Zymurgy Consulting Limited for Bathurst Resources Limited. 13pp + appendices. Zymurgy Consulting: Surrey Hills, Australia.

Michel, P., deRegnier, R., Emmitt, T., Ford, M., Perrie, L., Pritchard, A.S.E. 2026. Conservation status of mosses in Aotearoa New Zealand, 2025. Report 1155. Department of Conservation, Wellington. New Zealand Threat Classification System Series 49.

Millar I. R. and Patrick B.H. 2016. Follow-up invertebrate survey at the Te Kuha Mine site. Entecol Contract Report ENT-045. 18 pp.

Ministry for the Environment and Department of Conservation. 2007. Protecting our places: Information about the statement of national priorities for protecting rare and threatened biodiversity on private land.

Ministry for the Environment. 2022. Wetland delineation protocols. Ministry for the Environment. Wellington. 14pp.

Minns C.K. 1990. Patterns of distribution and association of freshwater fish in New Zealand. New Zealand Journal of Marine and Freshwater Research 24: 31–44.

Mitchell Partnerships. 2003. Responses to questions raised by F. Overmars 30 October 2003. Prepared for Solid Energy Ltd.

Mitchell Partnerships. 2012. Vegetation within the Sullivan CML, Denniston Plateau. Prepared for Solid Energy.

Mitchell Partnerships. 2016. Additional ecological surveys to inform a proposal to construct an open cast coal mine at Te Kuha, near Westport. 116 pp.

Nathan, S., Rattenbury, M.S., and Suggate, R.P. (compilers). 2002. Geology of the Greymouth area. Institute of Geological & Nuclear Sciences 1:250,000 geological map 12. Institute of Geological & Nuclear Sciences, Lower Hutt. 1 sheet and 58pp.

Newell, C. 1990. Vegetation classification of an area on coal measures, Buller, New Zealand. [Bachelor of Science (Honours) dissertation, University of Canterbury]. 52 pp.

Nichol, R. 2021. Mine Creek Sump Proposal – Stockton Ecological Impact Assessment. Draft report prepared by Richard Nichol Ecology.

Nichol, R. 2022. Kiwi and Weka Survey, Winter 2022 Escarpment Mine and Denniston Permanent Protection Area, Denniston Plateau. Prepared for Buller Coal Ltd.

Nichol, R. & Overmars, F. 2008. Vegetation and Flora Baseline Survey, L&M Coal Ltd Escarpment Mine Project, Buller Plateau. Prepared for Resource and Environmental Management Ltd.

Nielsen, S.V., Bauer, A.M., Jackman, T.R., Hitchmough, R.A. and Daugherty, C.H., 2011. New Zealand geckos (Diplodactylidae): Cryptic diversity in a post-Gondwanan lineage with trans-Tasman affinities. Molecular Phylogenetics and Evolution, 59(1), pp.1-22.

NIWA 2024a. in prep. Mt Fred South aquatic ecology field survey. Unpublished report prepared for Bathurst Resources Limited. National Institute of Water and Atmospheric Research, Christchurch. 37pp + appendices.

NIWA 2024b. in prep. Assessment of tarn rehabilitation success across the Stockton Mine. Unpublished report prepared for Bathurst Resources Limited. National Institute of Water and Atmospheric Research, Christchurch. 37pp + appendices.

Overmars, F.B., Kilvington, M.J. and Gibson, R.S. 1998. Ngakawau Ecological District: Survey report for the Protected Natural Areas Programme. New Zealand Protected Natural Areas Programme Series No. 11. Department of Conservation, Hokitika. 178 pp.

Overmars, F.B. and Lloyd, B. 2012. Proposed Escarpment Mine: Vegetation Survey of Trent Stream Area and Southern Denniston Plateau. Unpublished report by Sustainability Solutions Ltd and Lloyd's Ecological Consulting Ltd for Buller Coal Ltd. 100pp.

Parkes, J. 2020. Review of Pest Management on the Buller Plateau. Unpublished report 2020/021 by Kurahaupo Consulting for Bathurst Resources Limited. 28pp + appendices. Kurahaupo Consulting, Christchurch.

Patrick B.H. and Patrick H.J.H. 2015. A novel diurnal geometrid from the Denniston Plateau. Moths and Butterflies of New Zealand Trust magazine 14: 6–7.

Patrick, B.H. 2017. Statement of Evidence of Brian Hunter Patrick on Behalf of the Royal Forest and Bird Protection Society of New Zealand. ENV-2017-CHC-90.

Patrick. B.H., Patrick H.J.H. and Hoare, R.J.B. 2019. Review of the endemic New Zealand genus *Arctesthes* Meyrick (Lepidoptera, Geometridae, Larentiinae), with descriptions of two new range-restricted species. Alpine Entomology, 3, 121–136.

Patrick, B. 2021. Statement of Evidence of Brian Hunter Patrick on behalf of the Royal Forest and Bird Protection Society of New Zealand Incorporated. 30 November 2021.

Perrie, L.R., Shepherd, L.D. and Brownsey, P.J. 2012. *Gleichenia inclusisora*, a new and uncommon tangle fern from New Zealand. New Zealand Journal of Botany, 50: 401-410.

Perrie, L.R., Shepherd, L.D., de Lange, P.J., Batty, E.L., Ohlsen, D.J., Bayly, M.J. and Brownsey, P.J. 2013. *Hymenophyllum pluviatile*, a new and uncommon fern from New Zealand. New Zealand Journal of Botany, 51(4), 308–320.

Powell, A.W.B. 1946. The Paryphantidae of New Zealand. No. 5. Further new species of Paryphanta, Wainuia and Rhytida. Records of the Auckland Institute and Museum. 3: 99–136.

Rattenbury, M.S., Cooper, R.A., and Johnston, M.R. 1998. Geology of the Nelson area. Institute of Geological & Nuclear Sciences 1:250,000 geological map 9. Institute of Geological & Nuclear Sciences Limited, Lower Hutt. 1 sheet and 67 pp.

Rigg, H. 1962. The pākihi bogs of Westport, New Zealand. Trans. Bot. Soc. N.Z. (Botany) 1 (7): 91-108.

Robertson, H. A., Baird, K. A., Elliott, G., Hitchmough, R., McArthur, N., Makan, T. and Michel, P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. Department of Conservation, Te Papa Atawhai.

Rodríguez, J. P., Rodríguez-Clark, K. M., Baillie, J. E., Ash, N., Benson, J., Boucher, T. and Zamin, T. 2011. Establishing IUCN red list criteria for threatened ecosystems. Conservation Biology, 25(1): 21-29.

Rodgers, D., Bartlett, R.M., Simcock, R., Wratten, S. and Boyer, S. 2011. Benefits of vegetation direct transfer as an innovative mine rehabilitation tool. Proceedings of the Australian Mine Restoration Conference, July 2011.

Rolfe, J.R., Fife, A.J., Beever, J.E., Patrick J. Brownsey, P.J. and Hitchmough, R.A. 2016. Conservation status of New Zealand mosses, 2014. New Zealand Threat Classification Series 13. Department of Conservation, Wellington. 12 pp.

Roroa Practitioner Group. 2021. Roroa / great spotted kiwi (*Apteryx maxima*) species plan 2019–2029. Department of Conservation, Nelson. 42 p.

Rough Milne Mitchell Landscape Architects Ltd. 2021. Buller Plateaux Baseline Landscape Study December 2021. Unpublished report 19172 prepared for Bathurst Resources Limited by Rough Milne Mitchell Landscape Architects Limited, Christchurch.89pp.

Schönberger, I., Wilton, A.D., Gibb, E.S., Beever, J.E., Fife, A.J., Glenny, D.S., Breitwieser, I., de Lange, P.J., Ford, K.A., Heenan, P.B., Maule, H.G., Novis, P., Prebble, J.M., Renner, M.A.M., and Smissen, R.D. 2024. Checklist of the New Zealand Flora – Hornworts, Liverworts and Mosses. Lincoln, Manaaki Whenua-Landcare Research.

Schuster, R.M. 2000. Austral Hepaticae, Part I. Nova Hedwigia, Beiheft 118. J. Cramer.

Schuster, R.M. 2002. Austral Hepaticae, Part II. Nova Hedwigia, Beiheft 119. J. Cramer.

Schuster, R.M. 2021. Austral Hepaticae, Part III: M. von Konrat, D. Glenny, A. Hagborg, & J. D. Godfrey (Eds.). Nova Hedwigia, Beiheft 120. J. Cramer.

Sherley, G., Green, C., Owen, K. 1994. Distribution, conservation status and some features of the natural history of Dorcus stag beetles (Coleoptera: Lucanidae). Science and Research Series (75).

Simcock, R., Maguire, L., Thompson-Morrison, H. 2024. A single herbicide application to *Juncus squarrosus* delivers multi-year suppression, but elimination may require establishment of taller plants, Stockton Plateau, New Zealand. In preparation.

Strickland, R.R. 1995. Fish of the Waimangaroa River. Page 28. River Lake & Sea, Rotorua, New Zealand.

Stringer, I.A.N., Hitchmough, R.A., Dugdale, J.S., Edwards, E., Hoare, R.J.B. and Patrick, B.H. 2012. The conservation status of New Zealand Lepidoptera. New Zealand Entomologist 35(2): 120-127.

Suren, A.M. 1996. Bryophyte distribution patterns in relation to macro-, meso-, and micro-scale variables in South Island, New Zealand streams. New Zealand Journal of Marine and Freshwater Research 30(4): 501–523.

Suren, A.M and Glenny, D. 2002. Aquatic bryophyte communities of streams in the Upper Waimangaroa Valley [revised 2003]. NIWA. Prepared for Solid Energy New Zealand Ltd.

Suren, A.M and McKerchar, A. 2001. Biological and hydrological investigations of Stockton Plateau streams. NIWA: CHC01/96. Prepared for Solid Energy New Zealand Ltd.

Templeton, L. and McMorran, T. 2020. Geomorphological Assessment of the Stockton Plateau. Unpublished report prepared for Bathurst Resources Limited by Golder Associates. 15 pp.

Terry, J.A. 2017a. Bryophyte and lichen survey outside of the proposed Te Kuha coal mine footprint, near Westport, New Zealand. Unpublished report prepared by Jon Terry Ecology. Limited for Stevenson Group Limited, August 2017. Jon Terry Ecology Limited, Wellington. 19pp.

Terry, J.A. 2017b. Bryophyte and lichen survey of rehabilitated sites at Stockton Coal Mine, near Westport, New Zealand. Unpublished report prepared by Jon Terry Ecology. Limited for Stevenson Group Limited, August 2017. Jon Terry Ecology Limited, Wellington. 16pp.

Thomas, B. and Toft, R.J. 1997. Surveys for Fauna in the Upper Waimangaroa Valley. Prepared by Landcare Research for Kingett Mitchell and Associated Ltd.

Thomas, B., Toft, R.J. and Mason, R. 1997. Fauna of the Proposed Northern Opencast Development, Waimangaroa Valley, Buller Coalfield. Landcare Research.

Toft, R.J. 1997. Survey of fauna (excluding birds) on a proposed coal transportation route adjacent to Rudolph Creek, near Granity, West Coast. Landcare Research Contract Report: LC9697/099

Toft, R.J. 2011. Terrestrial Invertebrates in the Mt William North Project Area. Prepared for Solid Energy New Zealand Ltd.

Toft, R.J, 2017. DNA Sequencing of *Rhytida* land snails from Te Kuha Mine Site. Entecol Ltd. Prepared for Stevenson Mining Te Kuha Ltd.

Toy, R.J, Toy, S., Mackenzie, D., Simister, K. and Yong, S. 2021. Distribution of great spotted kiwi (*Apteryx maxima*), 2012–2021. Notornis, 2021, 69(1):1–18.

Trewick, S.A. 2024. Two new genera of tokoriro (Orthoptera: Rhaphidophoridae: Macropathinae) from Aotearoa New Zealand. Zootaxa 5481, 531–546. https://doi.org/10.11646/zootaxa.5481.5.3

Tweed, A.D. 1986. Fisheries Report No. 86/1, Fisheries Values or the Waimangaroa River, West Coast Acclimatisation Society.

Venter, S. 2009. A Taxonomic Revision of the Genus *Dracophyllum* Labill. (Ericaceae). Unpublished Doctoral thesis. School of Biological Sciences, Victoria University of Wellington.

Walker, K. J. 2003. Recovery plans for *Powelliphanta* land snails. Threatened Species Recovery Plan (Vol. 49, pp. 208). Wellington: Department of Conservation.

Walker, K.J. 2004. Evidence of Kath Walker on behalf of the Director General of Conservation. Unpublished document in the matter of Applications by Solid Energy NZ Ltd for resource consents in relation to the proposed Cypress Mine. 14pp plus plates.

Walker, K. J., Trewick, S. A. and Barker, G. M. 2008. *Powelliphanta augusta,* a new species of land snail, with a description of its former habitat, Stockton coal plateau, New Zealand. Journal of the Royal Society of New Zealand. 38(3): 163–186.

Walker, K. J. 2018. Systematics and phylogeography of the large land snail *Powelliphanta*. Ph.D., Massey University, New Zealand.

Walker, K., Walton, K., Edwards, E., Hitchmough, R., Payton, I., Barker, G. and Michel, P. 2024. Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and snails). Part 3. Rhytididae (carnivorous snails), 2022.

Wardle, P. 1991. Vegetation of New Zealand. Cambridge, Cambridge University Press.

Waybacks Limited. 2006. Powelliphanta land snails at Z12 area, Stockton mine. Prepared for Solid Energy New Zealand Ltd.

Waybacks Limited and Wildlife Surveys Unlimited. 2008. Terrestrial Fauna Survey of the Proposed Mangatini Hydro-Electric Power Scheme. Prepared for Hydro Developments Ltd.

Whitaker, T. and Lyall, J. 2004. Conservation of lizards in West Coast/Tai Poutini Conservancy. Department of Conservation, Wellington. vii + 93 p.

Wildlife Surveys Limited. 1998. Surveys for Powelliphanta land snails in the Upper Waimangaroa Valley, Blackburn-Orikaka Pākihi, Mount Stockton and Mount Rochfort localities, South Island West Coast, New Zealand. Prepared for Solid Energy International.

Wildlife Surveys Limited. 2002. Bird and Powelliphanta Snail Survey, Whareatea West Exploration permit (EP 40 591), Denniston Plateau, Buller. Prepared for Restpine Limited.

Wildlife Surveys Limited. 2008. An investigation of terrestrial ecosystems for the L&M Coal Ltd Escarpment Mine Project: Avifauna and Powelliphanta snails. Nelson. 60 Contract report for Resource and Environmental Management (Nelson) Ltd: Wildlife Surveys.

Wildlife Surveys Limited. 2010. L&M Coal Limited: Escarpment Mine Project: An investigation of terrestrial fauna (avifauna and Powelliphanta snails) within the proposed transportation routes and processing sites. Addendum: Escarpment Mine Project. Contract report for L&M Coal Ltd via Resource and Environmental Management Ltd, Nelson. (pp. 37).

Wildlife Surveys Limited. 2011. Survey for the Terrestrial Fauna at the proposed Mt William North Mining Area. Prepared for Solid Energy NZ Ltd.

Wildland Consultants Limited. 2010. Mapping of vegetation and habitats on the Stockton and Denniston plateaux, northern Westland. Wildlands contract report No. 2334. Prepared for Department of Conservation, West Coast Tai Poutini Conservancy, Hokitika.

Williams, J. 2024. Heaphy and Denniston Biodiversity Projects Annual Report 1 July 2023 – 30 June 2024. Unpublished report prepared by the Department of Conservation, Westport. 63 pp + appendices.

Williams, P.A., Wiser, S., Clarkson, B. and Stanley, M.C. 2007. New Zealand's historically rare terrestrial ecosystems set in a physical and physiognomic framework. New Zealand Journal of Ecology 31(2):119–128.

Wright, J. 2009. Stockton revisited: The mine and the regulatory minefield. Parliamentary Commissioner for the Environment. Wellington.

Venter, S. 2009. A Taxonomic Revision of the Genus *Dracophyllum* Labill. (Ericaceae). Doctoral thesis, Victoria University of Wellington. 546pp + appendices. Available at: https://openaccess.wgtn.ac.nz/articles/thesis/A_Taxonomic_Revision_of_the_Genus_Dracophyllum_Labill_Ericaceae_/16959373?file=31374496

APPENDIX A
Vascular Plant Species on the Buller Plateaux

TREES AND SHRUBS

Species	Common Name	Biostatus	Threat Status (de Lange et al. 2024)	Recognised as taoka species in the Ngai Tahu Settlement Act (1998)
Acrothamnus colensoi		Indigenous Endemic	Not Threatened	No
Alseuosmia pusilla	Mountain alseuosmia	Indigenous Endemic	Not Threatened	No
Androstoma empetrifolium	Bog mingimingi	Indigenous Endemic	Not Threatened	No
Archeria traversii		Indigenous Endemic	Not threatened (assumed)	No
Aristotelia fruticosa	Mountain wineberry	Indigenous Endemic	Not Threatened	No
Aristotelia serrata	Mako; Makomako; wineberry	Indigenous Endemic	Not Threatened	No
Ascarina lucida	Hutu	Indigenous Endemic	Not threatened (assumed)	No
Brachyglottis bidwillii		Indigenous Endemic	Not Threatened	No
Brachyglottis buchananii		Indigenous Endemic	Not Threatened	No
Brachyglottis elaeagnifolia	Muttonbird scrub	Indigenous Endemic	Not Threatened	Yes
Buddleja davidii	Buddleia; butterfly bush	Exotic	Not threatened (assumed)	No
Carpodetus serratus	Marble leaf; putaputawētā	Indigenous Endemic	Not Threatened	No
Coprosma grandiflora	Kanono	Indigenous Endemic	Not Threatened	No
Coprosma cheesemanii		Indigenous Endemic	Not Threatened	No
Coprosma ciliata		Indigenous Endemic	Not Threatened	No
Coprosma colensoi		Indigenous Endemic	Not Threatened	No
Coprosma crenulata		Indigenous Endemic	Not Threatened	No
Coprosma cuneata		Indigenous Endemic	Not Threatened	No
Coprosma dumosa		Indigenous Endemic	Not Threatened	No
Coprosma foetidissima	Hūpiro; stinkwood	Indigenous Endemic	Not Threatened	No
Coprosma elatirioides		Indigenous Endemic	Not Threatened	No
Coprosma linariifolia	Mikimiki; yellow wood	Indigenous Endemic	Not Threatened	No
Coprosma lucida	Shining karamū	Indigenous Endemic	Not Threatened	No
Coprosma microcarpa	Small-seeded coprosma	Indigenous Endemic	Not Threatened	No
Coprosma parviflora	Leafy coprosma	Indigenous Endemic	Not Threatened	No
Coprosma propinqua	Miki; mingi; mingimingi	Indigenous Endemic	Not threatened (assumed)	No
Coprosma pseudocuneata		Indigenous Endemic	Not Threatened	No
Coprosma rhamnoides	Twiggy coprosma	Indigenous Endemic	Not Threatened	No
Coprosma rigida		Indigenous Endemic	Not Threatened	No
Coprosma robusta	Glossy karamū	Indigenous Endemic	Not Threatened	Yes
Coriaria arborea	Tutu; tree tutu	Indigenous Endemic	Not threatened (assumed)	Yes
Cordyline australis	Cabbage tree; tī kōkua	Indigenous Endemic	Not Threatened	Yes
Cordyline banksii	Tī ngahere, cabbage tree, tī rakau	Indigenous Endemic	Not Threatened	No

Cordyline indivisa	Broad-leaved cabbage tree; mountain cabbage tree; tōī	Indigenous Endemic	Not threatened (assumed)	No
Cytisus scoparius	Broom; English broom; Scotch broom; wild broom;	Exotic	Not threatened (assumed)	No
Dacrydium cupressinum	Rimu; red pine	Indigenous Endemic	Not threatened (assumed)	Yes
Dacrycarpus dacrydioides	Kahikatea; white pine	Indigenous Endemic	Not Threatened	Yes
Dracophyllum densum		Indigenous Endemic	Declining	No
Dracophyllum elegantissimum	Grass tree, slender dragon tree	Indigenous Endemic	Not Threatened	No
Dracophyllum filifolium	Inanga	Indigenous Endemic	Not Threatened	No
Dracophyllum longifolium	Inanga, inaka	Indigenous Endemic	Not Threatened	No
Dracophyllum oliveri		Indigenous Endemic	Not Threatened	No
Dracophyllum palustre	Swamp neine	Indigenous Endemic	Not Threatened	No
Dracophyllum pronum	Trailing neinei	Indigenous Endemic	Not Threatened	No
Dracophyllum pubescens		Indigenous Endemic	Not Threatened	No
Dracophyllum rosmarinifolium	Common grass tree, inaka	Indigenous Endemic	Not threatened (assumed)	No
Dracophyllum townsonii		Indigenous Endemic	Not Threatened	No
Dracophyllum traversii	Mountain neinei, pineapple tree	Indigenous Endemic	Not Threatened	No
Elaeocarpus dentatus	Hīnau	Indigenous Endemic	Not threatened (assumed)	Yes
Elaeocarpus hookerianus	Pōkākā	Indigenous Endemic	Not Threatened	Yes
Epacris alpina	Nehenehe	Indigenous Endemic	Not Threatened	No
Epacris pauciflora	Bog epacris; tamingi; Tīmingi	Indigenous Endemic	Not Threatened	No
Exocarpos bidwillii		Indigenous Endemic	Not threatened (assumed)	No
Fuchsia excorticata	Kōhutuhutu; kōtukutuku; Tree fuchsia	Indigenous Endemic	Not Threatened	Yes
Fuscospora cliffortioides	Mountain beech	Indigenous Endemic	Not Threatened	Yes
Fuscospora fusca	Red beech	Indigenous Endemic	Not Threatened	Yes
Fuscospora truncata	Hard beech	Indigenous Endemic	Not Threatened	Yes
Gaultheria antipoda	Bush snowberry; Fool's beech; Koropuka	Indigenous Endemic	Not Threatened	Yes
Gaultheria antipoda × *depressa*		Indigenous Unspecified	Unknown	No
Gaultheria depressa	Snowberry	Indigenous Non-Endemic	Not threatened (assumed)	No
Gaultheria depressa **var.** *novae-zealandiae*		Indigenous Endemic	Not Threatened	No
Gaultheria macrostigma	Prostrate snowberry;	Indigenous Endemic	Not Threatened	No
Gaultheria rupestris		Indigenous Endemic	Not Threatened	No
Griselinia littoralis	Broadleaf; kāpuka;	Indigenous Endemic	Not Threatened	Yes

	papauma			
Griselinia lucida	Puka, akapuka	Indigenous Endemic	Not Threatened	No
Halocarpus bidwillii	Bog pine	Indigenous Endemic	Not Threatened	No
Halocarpus biformis	Pink pine	Indigenous Endemic	Not Threatened	No
Hedycarya arborea	Pigeonwood; Porokaiwhiri	Indigenous Endemic	Not Threatened	No
Hesperocyparis macrocarpa	Macrocarpa; Monterey cypress	Exotic	Not threatened (assumed)	No
Hoheria populnea	Hohere; lacebark	Indigenous Endemic	Not Threatened	No
Kunzea ericoides	Kānuka	Indigenous Endemic	Not Threatened	Yes
Lepidothamnus intermedius	Yellow-silver pine	Indigenous Endemic	Not Threatened	No
Lepidothamnus laxifolius	Pygmy pine	Indigenous Endemic	Not Threatened	No
Lepidothamnus laxifolius × *intermedius*		Indigenous Endemic	Not threatened (assumed)	No
Leptecophylla juniperina	Prickly mingimingi	Indigenous Endemic	Not threatened	No
Leptospermum scoparium var. *scoparium*	Mānuka	Indigenous Endemic	Not Threatened	Yes
Leucopogon fasciculatus	Tall mingimingi; soft mingimingi	Indigenous Endemic	Not Threatened	No
Leycesteria formosa	Himalayan honeysuckle	Exotic	Not threatened (assumed)	No
Libocedrus bidwillii	Pāhautea; kaikawaka; New Zealand cedar	Indigenous Endemic	Not Threatened	No
Lonicera periclymenum	English honeysuckle	Exotic	Not threatened	No
Lophozonia menziesii	Silver beech	Indigenous Endemic	Not Threatened	Yes
Macrolearia colensoi	Tupare; leatherwood	Indigenous Endemic	Not Threatened	No
Manoao colensoi	Silver pine	Indigenous Endemic	Not Threatened	No
Melicytus alpinus	Porcupine shrub	Indigenous Endemic	Not Threatened	No
Melicytus lanceolatus	Māhoe-wao, narrow-leaved māhoe	Indigenous Endemic	Not Threatened	No
Melicytus ramiflorus subsp. *ramiflorus*	Māhoe	Indigenous Endemic	Not Threatened	No
Melicope simplex	Poataniwha	Indigenous Endemic	Not Threatened	No
Metrosideros parkinsonii	Parkinson's rātā	Indigenous Endemic	Not Threatened	No
Metrosideros robusta	Northern rātā	Indigenous Endemic	Not Threatened	No
Metrosideros umbellata	Southern rātā	Indigenous Endemic	Not Threatened	Yes
Montitega dealbata		Indigenous Non-Endemic	Not Threatened	No
Myrsine australis	Red mapou; red matipo	Indigenous Endemic	Not Threatened	Yes
Myrsine divaricata	Weeping mapou; weeping matipo;	Indigenous Endemic	Not Threatened	No
Myrsine divaricata × *salicinia*		Indigenous Endemic	Not threatened (assumed)	No
Myrsine nummularia	Creeping mapou; creeping matipo	Indigenous Endemic	Not Threatened	No
Myrsine salicina		Indigenous Endemic	Not Threatened	No

Neomyrtus pedunculata	Rōhutu	Indigenous Endemic	Not Threatened	No
Olearia arborescens	Common tree daisy; glossy tree daisy	Indigenous Endemic	Not Threatened	No
Olearia avicenniifolia	Mountain akeake	Indigenous Endemic	Not Threatened	No
Olearia cheesemanii	Streamside tree daisy	Indigenous Endemic	Declining	No
Olearia × macrodonta		Indigenous Endemic	Not threatened (assumed)	No
Olearia rani	Heketara	Indigenous Endemic	Not threatened (assumed)	No
Olearia virgata	Twiggy tree daisy	Indigenous Endemic	Not Threatened	No
Ozothamnus leptophyllus	Tauhinu	Indigenous Endemic	Not Threatened	No
Ozothamnus vauvilliersii	Mountain tauhinu	Indigenous Endemic	Not Threatened	No
Pectinopitys ferruginea	Miro; brown pine	Indigenous Endemic	Not Threatened	Yes
Pentachondra pumila		Indigenous Endemic	Not Threatened	No
Peraxilla tetrapetala	Red mistletoe; pikirangi, pirita, roeroe, pirinoa	Indigenous Endemic	Declining	No
Phyllocladus alpinus	Mountain toatoa; mountain celery pine	Indigenous Endemic	Not Threatened	Yes
Phyllocladus aff. *alpinus*		Indigenous Endemic	Not Threatened	No
Pimelea gnidia	Pimelea	Indigenous Endemic	Not Threatened	No
Pimelea longifolia	Long-leaved pimelea	Indigenous Endemic	Declining	No
Pinus radiata	Radiata pine	Exotic	Not threatened (assumed)	No
Pittosporum anomalum		Indigenous Endemic	Not Threatened	No
Pittosporum colensoi		Indigenous Endemic	Not Threatened	No
Pittosporum divaricatum		Indigenous Endemic	Not Threatened	No
Pittosporum eugenioides	Tarata; lemonwood	Indigenous Endemic	Not Threatened	Yes
Pittosporum rigidum		Indigenous Endemic	Not Threatened	No
Pittosporum tenuifolium	Kohukohu, kōhūhū, black matipo	Indigenous Endemic	Not Threatened	Yes
Podocarpus acutifolius	Needle-leaved tōtara; Westland tōtara	Indigenous Endemic	Not Threatened	No
Podocarpus laetus	Mountain tōtara, Hall's tōtara	Indigenous Endemic	Not Threatened	No
Prumnopitys taxifolia	Matai; black pine	Indigenous Endemic	Not Threatened	Yes
Pseudowintera axillaris	Lowland horopito	Indigenous Endemic	Not Threatened	No
Pseudowintera colorata	Mountain horopito	Indigenous Endemic	Not Threatened	No
Pseudopanax crassifolius	Horokea; lancewood	Indigenous Endemic	Not Threatened	Yes
Pseudopanax colensoi var. *ternatus*		Indigenous Endemic	Not Threatened	No
Pseudopanax linearis		Indigenous Endemic	Not Threatened	No
Pseudowintera traversii	Traver's horopito	Indigenous Endemic	Naturally Uncommon	No

Pterophylla racemosa	Kāmahi	Indigenous Endemic	Not Threatened	Yes
Quintinia serrata	Tāwheowheo, quintinia	Indigenous Endemic	Not Threatened	No
Raukaua anomalus		Indigenous Endemic	Not Threatened	No
Raukaua anomalus × simplex		Indigenous Endemic	Unknown	No
Raukaua edgerleyi	Raukaua	Indigenous Endemic	Not Threatened	No
Raukaua simplex	Haumakoroa	Indigenous Endemic	Not Threatened	No
Salix cinerea	Grey willow	Exotic	Not threatened (assumed)	No
Salix × fragilis	Crack willow	Exotic	Not threatened (assumed)	No
Schefflera digitata	Patatē; pate; seven-finger	Indigenous Endemic	Not Threatened	No
Solanum laciniatum	Poroporo; bullibulli	Indigenous Non-Endemic	Not Threatened	No
Ulex europaeus	Gorse	Exotic	Not threatened (assumed)	No
Veronica canterburiensis		Indigenous Endemic	Not Threatened	No
Veronica subfulvida		Indigenous Endemic	Not Threatened	No
Veronica leiophylla		Indigenous Endemic	Not Threatened	No
Veronica mooreae		Indigenous Endemic	Not Threatened	No
Veronica odora		Indigenous Endemic	Not Threatened	No
Veronica pinguifolia		Indigenous Endemic	Not Threatened	No
Veronica salicifolia	Koromiko	Indigenous Non-Endemic	Not Threatened	Yes

LIANES AND VINES

Species	Common Name	Biostatus	Threat Status (de Lange et al. 2024)	Recognised as taoka species in the Ngai Tahu Settlement Act (1998)
Freycinetia banksii	Kiekie	Indigenous Endemic	Not Threatened	Yes
Hedera helix	Ivy	Exotic	Not threatened (assumed)	No
Lonicera japonica	Japanese honeysuckle	Exotic	Not threatened (assumed)	No
Metrosideros diffusa	White rātā	Indigenous Endemic	Not Threatened	No
Metrosideros fulgens	Scarlet rātā; climbing rātā	Indigenous Endemic	Not Threatened	No
Metrosideros perforata	Akatea	Indigenous Endemic	Not Threatened	Yes
Muehlenbeckia australis	Large-leaved muehlenbeckia; Pōhuehue	Indigenous Non-Endemic	Not Threatened	No
Parsonsia heterophylla	New Zealand jasmine	Indigenous Endemic	Not Threatened	No
Parsonsia species	Supplejack; kareao; pirita	Indigenous Endemic	Not Threatened	No
Ripogonum scandens	Tātarāmoa, bush lawyer, swamp lawyer	Indigenous Endemic	Not Threatened	Yes
Rubus australis	Tātarāmoa, bush lawyer	Indigenous Endemic	Not Threatened	No
Rubus cissoides	Tātarāmoa, bush lawyer, white-leaved lawyer	Indigenous Endemic	Not threatened (assumed)	No
Rubus fruticosus	Cut-leaved blackberry	Exotic	Not threatened (assumed)	No
Rubus laciniatus	Blackberry	Exotic	Not threatened (assumed)	No
Rubus schmidelioides	Tātarāmoa; bush lawyer;	Indigenous Endemic	Not threatened (assumed)	No

	white-leaved lawyer

FERNS AND ALLIED PLANTS

Species	Common Name	Biostatus	Threat Status (de Lange et al. 2024)	Recognised as taoka species in the Ngai Tahu Settlement Act (1998)
Abrodictyum elongatum	Bristle fern	Indigenous Endemic	Not Threatened	No
Abrodictyum strictum		Indigenous Endemic	Not Threatened	No
Alsophila colensoi	Mountain tree fern	Indigenous Endemic	Not Threatened	No
Alsophila smithii	Kātote, Smith's tree fern, soft tree fern	Indigenous Endemic	Not Threatened	Yes
Alsophila tricolor	Silver fern; ponga	Indigenous Endemic	Not Threatened	No
Asplenium appendiculatum **subsp.** *appendiculatum*	Ground spleenwort	Indigenous Non-Endemic	Not Threatened	No
Asplenium bulbiferum	Hen and chicken fern, pikopiko	Indigenous Endemic	Not Threatened	No
Asplenium flaccidum	Hanging spleenwort; makawe	Indigenous Non-Endemic	Not Threatened	No
Asplenium polyodon	Sickle spleenwort	Indigenous Non-Endemic	Not Threatened	No
Austroblechnum lanceolatum	Lance fern; rereti	Indigenous Non-Endemic	Not Threatened	No
Austroblechnum penna-marina **subsp.** *alpina*	Alpine hard fern; little hard fern	Indigenous Non-Endemic	Not threatened (assumed)	No
Austrolycopodium fastigiatum	Alpine clubmoss; mountain clubmoss	Indigenous Non-Endemic	Not Threatened	No
Cranfillia deltoides	Korokio; mountain hard fern	Indigenous Non-Endemic	Not Threatened	No
Cranfillia fluviatilis	Kiwikiwi, creek fern	Indigenous Non-Endemic	Not Threatened	No
Cranfillia nigra	Black hard fern	Indigenous Endemic	Not Threatened	No
Cyathea cunninghamii	Gully tree fern	Indigenous Non-Endemic	Not Threatened	No
Dicksonia squarrosa	Rough tree fern; wheki	Indigenous Endemic	Not Threatened	No
Diphasium scariosum	Creeping clubmoss	Indigenous Non-Endemic	Not Threatened	No
Diploblechnum fraseri	Wheki koao	Indigenous Non-Endemic	Not Threatened	No
Gleichenia dicarpa	Tangle fern; swamp umbrella fern	Indigenous Non-Endemic	Not Threatened	No
Gleichenia inclusisora		Indigenous Endemic	Not Threatened	No
Gleichenia microphylla	Carrier tangle fern; parasol fern	Indigenous Non-Endemic	Not Threatened	No
Histiopteris incisa	Water fern; mātātā	Indigenous Non-Endemic	Not Threatened	No
Hiya distans		Indigenous Non-Endemic	Not Threatened	No

Huperzia australiana	Fir clubmoss	Indigenous Non-Endemic	Not Threatened	No
Hymenophyllum armstrongii		Indigenous Endemic	Not Threatened	No
Hymenophyllum australe		Indigenous Non-Endemic	Naturally Uncommon	No
Hymenophyllum bivalve		Indigenous Non-Endemic	Not Threatened	No
Hymenophyllum demissum	Drooping filmy fern	Indigenous Endemic	Not Threatened	No
Hymenophyllum dilatatum		Indigenous Endemic	Not Threatened	No
Hymenophyllum frankliniae		Indigenous Endemic	Not threatened	No
Hymenophyllum flabellatum	Fan-like filmy fern	Indigenous Non-Endemic	Not Threatened	No
Hymenophyllum lyallii		Indigenous Non-Endemic	Not Threatened	No
Hymenophyllum malingii		Indigenous Endemic	Not Threatened	No
Hymenophyllum multifidum	Much-divided filmy fern	Indigenous Non-Endemic	Not Threatened	No
Hymenophyllum nephrophyllum	Kidney fern	Indigenous Endemic	Not Threatened	No
Hymenophyllum pluviatile		Indigenous Endemic	Naturally Uncommon	No
Hymenophyllum rarum	Tufted filmy fern	Indigenous Non-Endemic	Not threatened (assumed)	No
Hymenophyllum revolutum		Indigenous Endemic	Not Threatened	No
Hymenophyllum rufescens		Indigenous Endemic	Not Threatened	No
Hymenophyllum sanguinolentum		Indigenous Non-Endemic	Not Threatened	No
Hymenophyllum villosum	Hairy filmy fern	Indigenous Endemic	Not Threatened	No
Hypolepis ambigua		Indigenous Endemic	Not Threatened	No
Hypolepis rufobarbata		Indigenous Endemic	Not Threatened	No
Lastreopsis hispida	Hairy fern; pongaweka	Indigenous Non-Endemic	Not Threatened	No
Lateristachys lateralis		Indigenous Non-Endemic	Not Threatened	No
Leptopteris hymenophylloides	Crepe fern; heruheru;	Indigenous Endemic	Not Threatened	No
Leptopteris superba	Prince of Whales feathers; heruheru	Indigenous Endemic	Not Threatened	No
Leptopteris × intermedia		Indigenous Endemic	Not threatened (assumed)	No
Lindsaea trichomanoides		Indigenous Non-Endemic	Not Threatened	No
Lomaria discolor	Crown fern; petipeti, piupiu	Indigenous Endemic	Not Threatened	No
Lycopodiella diffusa		Indigenous Non-Endemic	Not Threatened	No

Notogrammitis angustifolia	Common strap fern	Indigenous Non-Endemic	Not Threatened	No
Notogrammitis billardierei		Indigenous Non-Endemic	Not Threatened	No
Notogrammitis ciliata	Dwarf strap fern	Indigenous Endemic	Not Threatened	No
Notogrammitis crassior		Indigenous Non-Endemic	Not Threatened	No
Notogrammitis givenii		Indigenous Endemic	Not Threatened	No
Notogrammitis heterophylla	Taupeka; comb fern	Indigenous Non-Endemic	Not Threatened	No
Paesia scaberula	Ring fern; lace fern; scented fern	Indigenous Endemic	Not Threatened	No
Pakau pennigera	Gully fern, piupiu	Indigenous Non-Endemic	Not Threatened	No
Palhinhaea cernua		Indigenous Non-Endemic	Not Threatened	No
Parablechnum minus	Swamp kiokio	Indigenous Non-Endemic	Not Threatened	No
Parablechnum novae-zelandiae	Kiokio	Indigenous Endemic	Not Threatened	No
Parablechnum procerum	Small kiokio	Indigenous Endemic	Not Threatened	No
Phlegmariurus billardierei	Hanging clubmoss	Indigenous Endemic	Not threatened (assumed)	No
Phlegmariurus varius		Indigenous Non-Endemic	Not Threatened	No
Polyphlebium venosum	Kidney fern	Indigenous Non-Endemic	Not Threatened	No
Polystichum vestitum	Prickly shield fern, punui	Indigenous Non-Endemic	Not Threatened	No
Pseudodiphasium volubile	Climbing clubmoss, waewaekoukou	Indigenous Non-Endemic	Not Threatened	No
Pteridium esculentum	Rarahue, bracken fern	Indigenous Non-Endemic	Not Threatened	Yes
Rumohra adiantiformis	Leathery shield fern	Indigenous Non-Endemic	Not Threatened	No
Schizaea australis	Southern comb fern	Indigenous Non-Endemic	Not Threatened	No
Schizaea fistulosa	Comb fern	Indigenous Non-Endemic	Not Threatened	No
Sphaeropteris medullaris	Mamaku, black tree fern	Indigenous Non-Endemic	Not Threatened	Yes
Sticherus cunninghamii	Umbrella fern, waekura	Indigenous Endemic	Not Threatened	No
Sticherus tener	Silky fan fern	Indigenous Endemic	Naturally Uncommon	No
Sticherus urceolatus		Indigenous Endemic	Naturally Uncommon	No
Tmesipteris elongata		Indigenous Non-Endemic	Not Threatened	No
Tmesipteris tannensis		Indigenous Endemic	Not Threatened	No
Zealandia pustulata subsp. *pustulata*	Hounds tongue fern, kōwaowao, pāraharaha	Indigenous Non-Endemic	Not Threatened	No

DICOTYLEDON HERBS (other than Composites)

Species	Common Name	Biostatus	Threat Status (de Lange et al. 2024)
Acaena anserinifolia	Bidibid; hutiwai; piripiri	Indigenous Endemic	Not Threatened
Acianthus sinclairii	Pixie cap orchid; heart-leaved orchid	Indigenous Endemic	Not Threatened
Actinotus novae-zelandiae	New Zealand flannel flower	Indigenous Endemic	Not Threatened
Anisotome aromatica	Aromatic aniseed; common aniseed; kopoti	Indigenous Endemic	Not Threatened
Anisotome flexuosa		Indigenous Endemic	Not Threatened
Anisotome haastii	Haast's carrot	Indigenous Endemic	Not Threatened
Capsella bursa-pastoris	Shepherd's purse	Exotic	Not threatened (assumed)
Centella uniflora	Centella	Indigenous Non-Endemic	Not Threatened
Cerastium fontanum	Mouse-ear chickweed	Exotic	Not threatened (assumed)
Cerastium glomeratum	Mouse-ear chickweed	Exotic	Not threatened (assumed)
Chaerophyllum ramosum		Indigenous Non-Endemic	Not Threatened
Colobanthus affinis		Indigenous Non-Endemic	Not Threatened
Colobanthus apetalus	Colobanthus	Indigenous Non-Endemic	Not Threatened
Crassula species		Indigenous Non-Endemic	Not Threatened (assumed)
Digitalis purpurea	Common foxglove; foxglove	Exotic	Not threatened (assumed)
Donatia novae-zelandiae	Cushion plant	Indigenous Endemic	Not threatened (assumed)
Drosera arcturi		Indigenous Non-Endemic	Not threatened (assumed)
Drosera binata	Forked sundew; Scented sundew	Indigenous Non-Endemic	Not Threatened
Drosera spatulata		Indigenous Non-Endemic	Not Threatened
Drosera stenopetala		Indigenous Endemic	Not Threatened
Epilobium ciliatum	Tall willowherb	Exotic	Not Threatened
Epilobium billardiereanum subsp. *billardiereanum*		Indigenous Non-Endemic	Not Threatened
Epilobium brunnescens subsp. *brunnescens*	Creeping willowherb	Indigenous Endemic	Not threatened (assumed)
Epilobium glabellum		Indigenous Endemic	Not threatened (assumed)
Epilobium melanocaulon		Indigenous Endemic	Not Threatened
Epilobium pedunculare		Indigenous Endemic	Not Threatened
Epilobium pernitens		Indigenous Endemic	Not threatened (assumed)
Euphrasia disperma	Slender flowered eyebright	Indigenous Endemic	Naturally Uncommon
Euphrasia townsonii		Indigenous Endemic	Not Threatened
Euphrasia wettsteiniana		Indigenous Endemic	Declining
Forstera mackayi		Indigenous Endemic	Not Threatened
Forstera sedifolia		Indigenous Endemic	Not Threatened
Forstera tenella		Indigenous Endemic	Not Threatened
Gamochaeta subfalcata		Exotic	Not threatened (assumed)
Gentianella bellidifolia		Indigenous Endemic	Not Threatened
Gentianella decumbens		Indigenous Endemic	Naturally Uncommon
Gentianella impressinervia		Indigenous Endemic	Not Threatened

Gentianella montana		Indigenous Endemic	Not threatened (assumed)
Gentianella montana subsp. *montana* var. *montana*		Indigenous Endemic	Not Threatened
Gentianella montana **subsp.** *montana* **var.** *stolonifera*		Indigenous Endemic	Not Threatened
Gentianella spenceri		Indigenous Endemic	Not Threatened
Gentianella sp. (aff. *G. bellidifolia*)		Unknown	Unknown
Gentianella sp. (aff. *G. montana*)		Unknown	Unknown
Gentianella vernicosa		Indigenous Endemic	Not Threatened
Geum uniflorum	Alpine avens	Indigenous Endemic	Not Threatened
Gonocarpus aggregatus		Indigenous Endemic	Not Threatened
Gonocarpus micranthus		Indigenous Non-Endemic	Not threatened (assumed)
Gunnera monoica	Native gunnera	Indigenous Endemic	Not Threatened
Gonocarpus micranthus subsp. *micranthus*		Indigenous Non-Endemic	Not Threatened
Hydrocotyle heteromeria	Waxweed	Indigenous Endemic	Not Threatened
Hydrocotyle microphylla		Indigenous Endemic	Not Threatened
Hydrocotyle moschata	Hairy pennywort	Indigenous Endemic	Not threatened (assumed)
Hydrocotyle novae-zeelandiae **var.** *montana*		Indigenous Endemic	Not Threatened
Hydrocotyle novae-zeelandiae **var.** *novae-zeelandiae*		Indigenous Endemic	Not Threatened
Hypericum pusillum	Matted Saint John's wort; Swamp hypericum	Indigenous Non-Endemic	Not threatened (assumed)
Jovellana repens		Indigenous Endemic	Not Threatened
Kelleria dieffenbachii		Indigenous Endemic	Not Threatened
Kelleria laxa		Indigenous Endemic	Not Threatened
Leptostigma setulosum		Indigenous Endemic	Not Threatened
Liparophyllum gunnii		Indigenous Non-Endemic	Not Threatened
Lobelia angulata	Pratia	Indigenous Endemic	Not Threatened
Lobelia fatiscens		Indigenous Endemic	Declining
Lobelia ionantha	Hypsela	Indigenous Endemic	Declining
Lotus pedunculatus	Birdsfoot trefoil; Lotus	Exotic	Not threatened (assumed)
Medicago nigra	Bur medick	Exotic	Not threatened (assumed)
Montia species		Unknown	Unknown
Mycelis muralis	Wall lettuce	Exotic	Not threatened (assumed)
Myosotis antarctica subsp. *traillii*		Indigenous Endemic	Nationally Vulnerable
Myriophyllum pedunculatum		Indigenous Non-Endemic	Not threatened (assumed)
Nertera balfouriana		Indigenous Endemic	Not Threatened
Nertera ciliata		Indigenous Endemic	Not Threatened
Nertera depressa	Bead plant; fruiting duckweed	Indigenous Non-Endemic	Not Threatened
Nertera scapanioides		Indigenous Endemic	Not Threatened
Nertera villosa	Hairy forest nertera	Indigenous Endemic	Not Threatened

Ornithopus perpusillus	Wild serradell	Exotic	Not threatened (assumed)
Ornithopus pinnatus	Yellow serradella	Exotic	Not threatened (assumed)
Ourisia macrocarpa	Mountain ourisia; Snowy mountain foxglove	Indigenous Endemic	Not Threatened
Ourisia macrophylla subsp. *lactea*		Indigenous Endemic	Not Threatened
Oxalis magellanica	Retireti	Indigenous Non-Endemic	Not Threatened
Persicaria maculosa	Willow weed	Exotic	Not threatened (assumed)
Phyllachne colensoi		Indigenous Non-Endemic	Not Threatened
Plantago lanceolata	Narrow-leaved plantain	Exotic	Not threatened (assumed)
Plantago lanigera		Indigenous Endemic	Not Threatened
Plantago major	Broad-leaved plantain	Exotic	Not threatened (assumed)
Plantago raoulii	Kopakopa	Indigenous Endemic	Not Threatened
Plantago triandra	Glossy plantain; starweed	Indigenous Endemic	Not Threatened
Plantago unibracteata		Indigenous Endemic	Not Threatened
Prunella vulgaris	Self-heal	Exotic	Not threatened (assumed)
Ranunculus flammula	Spearwort	Exotic	Not threatened (assumed)
Ranunculus foliosus	Grassland buttercup	Indigenous Endemic	Not Threatened
Ranunculus glabrifolius		Indigenous Non-Endemic	Not Threatened
Ranunculus gracilipes		Indigenous Endemic	Not Threatened
Ranunculus repens	Creeping buttercup	Exotic	Not threatened (assumed)
Rumex acetosella	Sheep's sorrel	Exotic	Not threatened (assumed)
Schizacme helmsii		Indigenous Endemic	Naturally Uncommon
Schizacme novae-zelandiae		Indigenous Endemic	Not Threatened
Selliera radicans	Raumangu; rekoreko; remuremu	Indigenous Non-Endemic	Not Threatened
Stellaria media	Fireweed	Exotic	Not threatened (assumed)
Stylidium subulatum	Chickweed; Kohukohu	Exotic	Not threatened (assumed)
Trifolium pratense	Red clover	Exotic	Not threatened (assumed)
Trifolium repens	White clover	Exotic	Not threatened (assumed)
Trifolium species	Clover	Exotic	Not Threatened (assumed)
Utricularia dichotoma subsp. *novae-zelandiae*	Fairy apron	Indigenous Non-Endemic	Not threatened
Veronica lyallii		Indigenous Endemic	Not Threatened
Vicia sativa	Narrow-leaved vetch; tare; vetch	Exotic	Not threatened (assumed)
Viola cunninghamii	Mountain violet; white violet	Indigenous Non-Endemic	Not Threatened
Viola filicaulis	Forest violet	Indigenous Endemic	Not Threatened

DICOTYLEDON HERBS (Composites)

Species	**Common Name**	**Biostatus**	**Threat Status (de Lange et al. 2024)**
Abrotanella linearis		Indigenous Endemic	Not Threatened
Achillea millefolium	Common yarrow	Exotic	Not threatened (assumed)

Anaphalioides bellidioides	Hells bells	Indigenous Endemic	Not Threatened
Anaphalioides trinervis	Puatea	Indigenous Endemic	Not Threatened
Anthemis cotula	Stinking mayweed	Exotic	Not threatened (assumed)
Brachyglottis aff. *bellidioides* var. *crassa*		Indigenous Endemic	Unknown
Brachyglottis traversii		Indigenous Endemic	Naturally Uncommon
Celmisia alpina		Indigenous Endemic	Not Threatened
Celmisia sp. aff. *alpina*		Indigenous Endemic	Unknown
Celmisia dallii		Indigenous Endemic	Not Threatened
Celmisia dubia		Indigenous Endemic	Not Threatened
Celmisia gibbsii	Gibb's mountain daisy	Indigenous Endemic	Naturally Uncommon
Celmisia gracilenta	Common mountain daisy; pekapeka	Indigenous Endemic	Not Threatened
Celmisia incana	White mountain musk; woolly mountain daisy	Indigenous Endemic	Not Threatened
Celmisia laricifolia	Needle-leaved mountain daisy	Indigenous Endemic	Not Threatened
Celmisia lateralis	Shrub daisy	Indigenous Endemic	Not Threatened
Celmisia parva		Indigenous Endemic	Not Threatened
Celmisia sessiliflora	White cushion mountain daisy	Indigenous Endemic	Not Threatened
Celmisia similis		Indigenous Endemic	Not Threatened
Cirsium vulgare	Scotch thistle; boar thistle	Exotic	Not Threatened
Craspedia minor	Small craspedia; woollyhead	Indigenous Endemic	Not Threatened
Craspedia uniflora **var.** *uniflora*	Woollyhead	Indigenous Endemic	Not Threatened
Craspedia species		Indigenous Non-Endemic	Not Threatened (assumed)
Crepis capillaris	Smooth hawksbeard	Exotic	Not threatened (assumed)
Euchiton audax	Creeping cudweed	Indigenous Endemic	Not Threatened
Euchiton limosus	Creeping cudweed	Indigenous Endemic	Not Threatened
Euchiton sp.		Indigenous Non-Endemic	Not Threatened (assumed)
Gamochaeta americana		Exotic	Not threatened (assumed)
Gamochaeta subfalcata	Silky cudweed	Exotic	Not Threatened
Gnaphalium sp.		Exotic	Not Threatened (assumed)
Helichrysum filicaule	Creeping everlasting daisy	Indigenous Endemic	Not Threatened
Hypochaeris radicata	Catsear; flatweed	Exotic	Not threatened (assumed)
Leontodon saxatilis	Hawkbit	Exotic	Not threatened (assumed)
Leptinella squalida **subsp.** *mediana*		Indigenous Endemic	Not Threatened
Microseris scapigera		Indigenous Non-Endemic	Not Threatened
Pseudognaphalium luteoalbum	Jersey cudweed; poukatea	Indigenous Non-Endemic	Not Threatened
Raoulia eximia	Vegetable sheep	Indigenous Endemic	Not Threatened
Raoulia glabra	Mat daisy	Indigenous Endemic	Not Threatened
Raoulia grandiflora	Large-flowered mat daisy	Indigenous Endemic	Not Threatened
Raoulia tenuicaulis	Tutahuna	Indigenous Endemic	Not Threatened
Senecio minimus	Fireweed	Indigenous Non-Endemic	Not Threatened

Senecio wairauensis	Mountain fireweed	Indigenous Endemic	Not Threatened
Sonchus asper	Prickly sow thistle; kautara	Exotic	Not threatened (assumed)
Sonchus oleraceus	Common sow thistle	Exotic	Not threatened (assumed)

MONOCOTYLEDON HERBS

Species	**Common Name**	**Biostatus**	**Threat Status (de Lange et al. 2024)**	**Recognised as taoka species in the Ngai Tahu Settlement Act (1998)**
Aporostylis bifolia	Odd-leaved orchid	Indigenous Endemic	Not Threatened	No
Astelia fragrans	Bush flax; bush lily; kakaha	Indigenous Endemic	Not Threatened	No
Astelia grandis	Swamp astelia	Indigenous Endemic	Not Threatened	No
Astelia linearis		Indigenous Endemic	Not threatened	No
Astelia nervosa	Mountain astelia	Indigenous Endemic	Not Threatened	No
Astelia nivicola **var.** *moriceae*	Isobel's lily, Morice's astelia, Morice's kakaha	Indigenous Endemic	Not Threatened	No
Astelia solandri	Perching lily, kōwharawhara	Indigenous Endemic	Not Threatened	No
Astelia **sp. aff.** *nervosa*		Indigenous Endemic	Unknown	No
Astelia subulata		Indigenous Endemic	Naturally Uncommon	No
Astelia trinervia	Kauri grass	Indigenous Endemic	Not Threatened	No
Bulbinella modesta		Indigenous Endemic	Declining	No
Bulbophyllum pygmaeum	Piripiri	Indigenous Endemic	Not Threatened	No
Caladenia alata		Indigenous Non-Endemic	Naturally Uncommon	No
Caladenia bartlettii		Indigenous Endemic	Naturally Uncommon	No
Calochilus paludosus	Copper beard orchid	Indigenous Non-Endemic	Nationally Vulnerable	No
Chiloglottis cornuta	Green bird orchid	Indigenous Non-Endemic	Not Threatened	No
Corybas acuminatus		Indigenous Endemic	Not Threatened	No
Corybas macranthus	Silver-back spider orchid	Indigenous Endemic	Not Threatened	No
Corybas oblongus		Indigenous Endemic	Not Threatened	No
Corybas trilobus		Indigenous Endemic	Not Threatened	No
Crocosmia × *crocosmiiflora*	Crocosmia; montbretia	Exotic	Not threatened (assumed)	No
Dendrobium cunninghamii	Winika, pekapeka, Christmas orchid	Indigenous Endemic	Not Threatened	No
Dianella nigra	New Zealand blueberry, turutu	Indigenous Endemic	Not Threatened	No
Earina autumnalis	Easter orchid; raupeka	Indigenous Endemic	Not Threatened	No
Earina mucronata	New Zealand bamboo orchid; peka-a-waka	Indigenous Endemic	Not Threatened	No
Gastrodia cunninghamii	Black orchid, perei	Indigenous Endemic	Not Threatened	No

Herpolirion novae-zelandiae	Grass lily; sky lily	Indigenous Non-Endemic	Not Threatened	No
Libertia micrantha	Native iris, mikoikoi	Indigenous Endemic	Not Threatened	No
Lilium lancifolium	Tiger lily	Exotic	Not Threatened	No
Luzuriaga parviflora	Lantern berry	Indigenous Non-Endemic	Not Threatened	No
Microtis oligantha	Small onion orchid	Indigenous Endemic	Not Threatened	No
Microtis unifolia	Common onion orchid	Indigenous Non-Endemic	Not Threatened	No
Orthoceras novae-zeelandiae	Horned orchid	Indigenous Endemic	Not Threatened	No
Phormium cookianum	Mountain flax; wharareke	Indigenous Endemic	Not threatened	Yes
Phormium tenax	Swamp flax; flax; harakeke	Indigenous Endemic	Not Threatened	Yes
Prasophyllum colensoi	Leek orchid	Indigenous Endemic	Not Threatened	No
Pterostylis banksii	Tutukiwi	Indigenous Endemic	Not Threatened	No
Pterostylis graminea	Grass-leaved greenhood	Indigenous Endemic	Not Threatened	No
Pterostylis humilis		Indigenous Endemic	Naturally Uncommon	No
Pterostylis irsoniana		Indigenous Endemic	Not Threatened	No
Pterostylis montana		Indigenous Endemic	Not Threatened	No
Pterostylis venosa		Indigenous Endemic	Not Threatened	No
Thelymitra cyanea	Striped sun orchid; veined sun orchid	Indigenous Non-Endemic	Not Threatened	No
Thelymitra longifolia	Māikuku; white sun orchid;	Indigenous Non-Endemic	Not Threatened	No
Thelymitra pauciflora		Indigenous Non-Endemic	Not Threatened	No
Thelymitra pulchella	Striped sun orchid	Indigenous Endemic	Not Threatened	No
Thelymitra species		Unknown	Unknown	No
Townsonia deflexa		Indigenous Endemic	Naturally Uncommon	No
Triglochin striata	Triglochin	Indigenous Non-Endemic	Not Threatened	No
Waireia stenopetala	Horizontal orchid, yellow beaked orchid	Indigenous Endemic	Not Threatened	No

GRASSES, SEDGES & RUSHES

Species	**Common Name**	**Biostatus**	**Threat Status (de Lange et al. 2024)**	**Recognised as taoka species in the Ngai Tahu Settlement Act (1998)**
Agrostis capillaris	Browntop bent	Exotic	Not threatened (assumed)	No
Agrostis dyeri		Indigenous Endemic	Not Threatened	No
Agrostis personata		Indigenous Endemic	Not Threatened	No
Anthoxanthum	Sweet vernal	Exotic	Not threatened (assumed)	No

odoratum				
Austroderia richardii	Toetoe	Indigenous Endemic	Not Threatened	Yes
Carex acicularis		Indigenous Endemic	Not Threatened	No
Carex banksiana	Fine-leaved bastard grass	Indigenous Endemic	Not Threatened	No
Carex carsei	Carse's sedge	Indigenous Endemic	Naturally Uncommon	No
Carex cheesemaniana	Cheeseman's sedge	Indigenous Non-Endemic	Not Threatened	No
Carex cockayneana	Cockayne's sedge	Indigenous Endemic	Not Threatened	No
Carex coriacea	Cutty grass; rautahi	Indigenous Endemic	Not Threatened	No
Carex crispa		Indigenous Endemic	Not Threatened	No
Carex dallii	Dall's sedge	Indigenous Endemic	Naturally Uncommon	No
Carex dissita	Forest sedge	Indigenous Endemic	Not Threatened	No
Carex flagellifera	Glen Murray sedge	Indigenous Endemic	Not Threatened	Yes
Carex gaudichaudiana	Gaudichaud's sedge	Indigenous Non-Endemic	Not Threatened	No
Carex geminata	Cutty grass; rautahi	Indigenous Endemic	Not Threatened	No
Carex horizontalis		Indigenous Endemic	Not Threatened	No
Carex imbecilla	Feeble bastard grass	Indigenous Endemic	Not Threatened	No
Carex lectissima	Fine-leaved bastard grass	Indigenous Endemic	Not Threatened	No
Carex leporina	Oval sedge	Exotic	Not threatened (assumed)	No
Carex lessoniana	Rautahi; cutty grass	Indigenous Endemic	Not Threatened	No
Carex libera		Indigenous Endemic	Not Threatened	No
Carex megalepis		Indigenous Endemic	Not Threatened	No
Carex minor		Indigenous Endemic	Not Threatened	No
Carex sinclairii	Sinclair's sedge	Indigenous Endemic	Not Threatened	No
Carex uncinata	Kamu, matau-a-maui	Indigenous Non-Endemic	Not Threatened	No
Carex zotovii	Zotov's bastard grass	Indigenous Endemic	Not Threatened	No
Carpha alpina		Indigenous Non-Endemic	Not Threatened	No
Centrolepis ciliata		Indigenous Endemic	Not Threatened	No
Chionochloa australis	Carpet grass	Indigenous Endemic	Not Threatened	No
Chionochloa conspicua **subsp.** *conspicua*		Indigenous Endemic	Not Threatened	No
Chionochloa flavescens **subsp.** *brevis*		Indigenous Endemic	Not Threatened	No
Chionochloa flavescens **subsp.** *lupeola*		Indigenous Endemic	Naturally Uncommon	No
Chionochloa juncea	Coal measures tussock	Indigenous Endemic	Declining	No
Chionochloa juncea × *rubra*		Indigenous Endemic	Unknown	No
Chionochloa rubra	Red tussock	Indigenous Endemic	Not threatened (assumed)	No
Chionochloa rubra **subsp.** *occulta*	Red tussock	Indigenous Endemic	Not Threatened	No
Deschampsia		Exotic	Not threatened (assumed)	No

flexuosa				
Eleocharis gracilis	Slender spike sedge	Indigenous Non-Endemic	Not Threatened	No
Empodisma minus	Wire rush	Indigenous Non-Endemic	Not Threatened	No
Festuca rubra **subsp.** *commutata*	Chewings fescue	Exotic	Not threatened (assumed)	No
Gahnia pauciflora	Cutting sedge	Indigenous Endemic	Not Threatened	No
Gahnia procera	Giant sedge	Indigenous Endemic	Not Threatened	No
Gahnia rigida		Indigenous Endemic	Not Threatened	No
Gahnia setifolia	Māpere, giant gahnia	Indigenous Endemic	Not Threatened	No
Gahnia xanthocarpa	Māpere	Indigenous Endemic	Not Threatened	No
Gaimardia setacea		Indigenous Non-Endemic	Not Threatened	No
Glyceria declinata	Blue sweet grass; floating sweet grass	Exotic	Not threatened (assumed)	No
Hierochloe novae-zelandiae	Alpine holy grass	Indigenous Endemic	Not Threatened	No
Holcus lanatus	Yorkshire fog	Exotic	Not threatened (assumed)	No
Holcus mollis	Creeping fog; creeping soft grass	Exotic	Not threatened (assumed)	No
Isolepis aucklandica		Indigenous Non-Endemic	Not Threatened	No
Isolepis reticularis		Indigenous Endemic	Not Threatened	No
Isolepis subtilissima		Indigenous Non-Endemic	Not Threatened	No
Isolepis species		Unknown	Unknown	No
Juncus acuminatus	Sharp-fruited rush	Exotic	Not threatened (assumed)	Yes
Juncus antarcticus	Dwarf rush	Indigenous Non-Endemic	Not Threatened	Yes
Juncus articulatus	Jointed rush	Exotic	Not threatened (assumed)	No
Juncus bufonius	Toad rush	Exotic	Not threatened (assumed)	No
Juncus bulbosus	Bulbous rush	Exotic	Not threatened (assumed)	No
Juncus canadensis	Tailed-seed rush	Exotic	Not threatened (assumed)	No
Juncus edgariae	Wiwi, Edgar's rush	Indigenous Endemic	Not Threatened	Yes
Juncus effusus	Soft rush; leafless rush	Exotic	Not threatened (assumed)	No
Juncus novae-zelandiae	Dwarf rush	Indigenous Endemic	Not Threatened	Yes
Juncus pauciflorus	Common rush; leafless rush	Indigenous Non-Endemic	Nationally Vulnerable	Yes
Juncus planifolius	Flat-leaved rush; grass-leaved rush	Indigenous Non-Endemic	Not Threatened	Yes
Juncus pusillus	Dwarf rush	Indigenous Non-Endemic	Naturally Uncommon	Yes
Juncus sarophorus	Leafless rush	Indigenous Non-Endemic	Not Threatened	Yes
Juncus squarrosus	Heath rush	Exotic	Not threatened (assumed)	No
Juncus tenuis	Track rush	Exotic	Not threatened (assumed)	No
Lachnagrostis lyallii	Mountain wind grass	Indigenous Endemic	Not Threatened	No

Lachnagrostis species		Indigenous Unspecified	Unknown	No
Lepidosperma australe	Square sedge	Indigenous Endemic	Not Threatened	No
Luzula banksiana **var.** *migrata*		Indigenous Endemic	Not Threatened	No
Luzula colensoi	Dwarf alpine woodrush	Indigenous Endemic	Not Threatened	No
Luzula congesta		Exotic	Not threatened (assumed)	No
Luzula picta **var.** *limosa*		Indigenous Endemic	Not Threatened	No
Luzula rufa		Indigenous Endemic	Not threatened (assumed)	No
Machaerina rubiginosa	Baumea	Indigenous Non-Endemic	Not Threatened	No
Machaerina tenax		Indigenous Endemic	Not Threatened	No
Machaerina teretifolia	Pākihi rush	Indigenous Non-Endemic	Not Threatened	No
Microlaena avenacea	Bush rice grass; oat grass	Indigenous Non-Endemic	Not Threatened	No
Nardus stricta	Mat grass	Exotic	Not threatened (assumed)	No
Netrostylis capillaris		Indigenous Non-Endemic	Not Threatened	No
Oreobolus impar	Comb sedge	Indigenous Endemic	Not Threatened	No
Oreobolus pectinatus	Cushion sedge; flat-leaved combsedge	Indigenous Endemic	Not Threatened	No
Oreobolus strictus	Comb sedge	Indigenous Endemic	Not Threatened	No
Pentapogon aucklandicus		Indigenous Endemic	Not Threatened	No
Pentapogon avenoides	Mountain oat grass	Indigenous Endemic	Not Threatened	No
Poa annua	Annual poa; winter grass	Exotic	Not threatened (assumed)	No
Poa colensoi	Blue tussock	Indigenous Endemic	Not Threatened	No
Poa trivialis	Rough meadow grass; rough-stalked meadow grass	Exotic	Not threatened (assumed)	No
Rytidosperma gracile	Dainty bristle grass	Indigenous Non-Endemic	Not Threatened	No
Rytidosperma nigricans	Bristle grass	Indigenous Endemic	Not Threatened	No
Rytidosperma setifolium	Bristle tussock; mountain danthonia	Indigenous Endemic	Not Threatened	No
Schoenus maschalinus	Dwarf bog rush	Indigenous Non-Endemic	Not Threatened	No
Schoenus pauciflorus	Bog rush; false snowgrass; sedge tussock	Indigenous Endemic	Not Threatened	No
Zotovia colensoi		Indigenous Endemic	Not Threatened	No
Zotovia thomsonii		Indigenous Endemic	Not Threatened	No

APPENDIX B
Bryophytes recorded from the Ngakawau ED

Hornworts (5)
Anthoceros laminiferus
Megaceros flagellaris
Megaceros pellucidus
Nothoceros giganteus (At Risk – Naturally Uncommon)
Phaeomegaceros coriaceus (Data Deficient)
Liverworts (345)
Acrobolbus cinerascens
Acrobolbus concinnus
Acrobolbus epiphytus
Acrobolbus knightii
Acrobolbus lophocoleoides
Acrobolbus saccatus
Acrobolbus surculosus
Acrobolbus tenellus var. *tenellus*
Acrobolbus tenellus var. *diversifolius*
Acrolophozia pectinata
Acromastigum aff. *rigidum*
Acromastigum anisostomum / *Acromastigum brachyphyllum*
Acromastigum cavifolium
Acromastigum colensoanum
Acromastigum cunninghamii
Acromastigum interstisiale (At Risk – Declining)
Acromastigum marginatum
Acromastigum mooreanum (At Risk – Naturally Uncommon)
Acromastigum sp. '1'
Acromastigum sp. '2'
Acromastigum verticale (Threatened – Nationally Vulnerable)
Adelanthus falcatus
Adelanthus occlusus
Allisonia cockaynei
Allisoniella nigra subsp. *novaezelandiae (Data Deficient)*
Allisoniella scottii (Threatened – Nationally Critical)
Anastrophyllopsis subcomplicata
Andrewsianthus (a) (CHR 620064; Mt William) *(Not Threatened – Taxonomically unresolved)*
Andrewsianthus marionensis
Andrewsianthus perigonialis (At Risk – Naturally Uncommon)
Aneura aff. novaguineensis
Aneura pinguis (Data Deficient)
Archeophylla schusteri (At Risk – Naturally Uncommon)
Balantiopsis convexiuscula
Balantiopsis diplophylla
Balantiopsis montana
Balantiopsis rosea.
Balantiopsis tumida
Balantiopsis verrucosa
Bazzania adnexa
Bazzania engelii
Bazzania exempta (At Risk – Naturally Uncommon)
Bazzania hochstetteri
Bazzania involuta var. *involuta*
Bazzania involuta var. *submutica*
Bazzania mittenii
Bazzania monilinervis
Bazzania nitida
Bazzania novae-zelandiae
Bazzania tayloriana
Blepharidophyllum vertebrale
Cephalomitrion aterrimum
Cephaloziella exigua (Data Deficient)
Cephaloziella pulcherrima subsp. *pulcherrima*
Cephaloziella sp. 'red'
Ceramanus tuberifera (Data Deficient)
Chandonanthus squarrosus
Cheilolejeunea aff. *mimosa*
Cheilolejeunea albovirens
Cheilolejeunea campbelliensis
Cheilolejeunea mimosa
Cheilolejeunea novaezelandiae (Data Deficient)
Cheilolejeunea sp.
Chiastocaulon biserialis
Chiastocaulon conjugatum
Chiastocaulon proliferum
Chiloscyphus aperticaulis
Chiloscyphus austrigenus
Chiloscyphus austrigenus subsp. *okaritanus*
Chiloscyphus gippslandicus

Chiloscyphus herzogii
Chiloscyphus muricatus
Chiloscyphus novae-zeelandiae
Chiloscyphus parvispineus
Chiloscyphus semiteres
Chiloscyphus sp. '1'
Chiloscyphus sp. '2'
Clandarium xiphophyllum
Clasmatocolea crassiretis
Clasmatocolea humilis
Clasmatocolea notophylla
Clasmatocolea strongylophylla
Clasmatocolea vermicularis
Colura pulcherrima var. *bartlettii*
Colura saccophylla
Cryptolophocolea leucophylla (Data Deficient)
Cryptolophocolea mitteniana var. *mitteniana*
Cryptolophocolea mitteniana var. *symmetrica*
Cryptolophocolea spinifera
Cryptolophocolea trialata
Cryptolophocolea tuberculata (At Risk – Naturally Uncommon)
Cuspidatula kirkii
Cuspidatula monodon
Dendromastigophora flagellifera
Dinckleria fruticella
Dinckleria pleurata
Diplasiolejeunea plicatiloba
Diplasiolejeunea sp.
Diplophyllum sp.
Drepanolejeunea aucklandica
Eotrichocolea polyacantha
Fossombronia australis
Frullania aterrima
Frullania ptychantha
Frullania rostrata
Gackstroemia alpina
Gackstroemia weindorferi
Geocalyx caledonicus
Goebeliella cornigera
Goebelobryum vermiculare (At Risk – Relict)
Gottschea conchophylla
Gottschea multidentata
Gottschea pinnatifolia
Gottschea tuloides
Haplomitrium gibbsiae
Hepatostolonophora paucistipula
Hepatostolonophora rotata var. *perssonii*
Hepatostolonophora rotata var. *rotata*
Herbertus oldfieldianus
Herzogianthus sanguineus (At Risk – Naturally Uncommon)
Herzogianthus vaginatus (At Risk – Naturally Uncommon)
Heteroscyphus ammophilus
Heteroscyphus billardierei (At Risk – Naturally Uncommon)
Heteroscyphus ciliatus
Heteroscyphus coalitus
Heteroscyphus cuneistipulus
Heteroscyphus dentammophilus
Heteroscyphus echinellus var. *hyalinus*
Heteroscyphus fissistipus var. *fissistipus*
Heteroscyphus fissistipus var. *multispinus*
Heteroscyphus fissistipus var. *repandus (Data Deficient)*
Heteroscyphus menziesii
Heteroscyphus mononuculus
Heteroscyphus planiusculus
Heteroscyphus sinuosus
Heteroscyphus sp. '1'
Heteroscyphus sp. '2'
Heteroscyphus triacanthus
Hygrolembidium acrocladum
Hygrolembidium australe
Hygrolembidium rigidum
Hymenophyton flabellatum
Hymenophyton leptopodum
Isolembidium anomalum var. *anomalum (Threatened – Nationally Critical)*
Isotachis intortifolia
Isotachis lyallii
Isotachis montana
Isotachis westlandica (At Risk – Naturally Uncommon)
Jensenia connivens

Kurzia calcarata
Kurzia compacta
Kurzia fragilifolia
Kurzia helophila
Kurzia hippuroides var. *hippuroides*
Kurzia nivicola (At Risk – Naturally Uncommon)
Kurzia pallescens
Kurzia quinquespina
Kurzia tenax
Kurzia trilobata
Lamellocolea granditexta
Lejeunea sp.
Lembidium longifolium (At Risk – Naturally Uncommon)
Lembidium nutans
Lepicolea attenuata
Lepicolea scolopendra
Lepidogyna hodgsoniae
Lepidolaena clavigera
Lepidolaena novae-zelandiae (At Risk – Naturally Uncommon)
Lepidolaena palpebrifolia
Lepidolaena reticulata
Lepidolaena sp.
Lepidolaena taylorii
Lepidozia acantha? (At Risk – Naturally Uncommon)
Lepidozia bidens
Lepidozia bisbifida
Lepidozia bragginsiana
Lepidozia concinna
Lepidozia digitata
Lepidozia elobata
Lepidozia fugax (At Risk – Naturally Uncommon)
Lepidozia glaucophylla (At Risk – Naturally Uncommon)
Lepidozia hirta
Lepidozia kirkii
Lepidozia laevifolia var. *laevifolia*
Lepidozia microphylla
Lepidozia novae-zelandiae var. *minima (Data Deficient)*
Lepidozia novae-zelandiae
Lepidozia pendulina
Lepidozia procera
Lepidozia pumila
Lepidozia serrulata (At Risk – Naturally Uncommon)
Lepidozia setigera
Lepidozia sp.
Lepidozia sp. 'Whareatea River Gorge'
Lepidozia spinosissima
Lepidozia ulothrix
Leptoscyphus australis
Lobatiriccardia alterniloba
Lopholejeunea plicatiscypha
Lophozia sp.
Marchantia foliacea
Marchantia polymorpha subsp. *polymorpha*
Megalembidium insulanum
Metalejeunea cucullata
Metzgeria decipiens
Metzgeria furcata
Metzgeria leptoneura
Metzgeria saccata
Metzgeria scobina (At Risk – Naturally Uncommon)
Mnioloma novaezelandiae (At Risk – Naturally Uncommon)
Monoclea forsteri
Neogrollea notabilis (Threatened – Nationally Critical)
Neolepidozia meridiana
Neolepidozia patentissima
Neolepidozia praenitens
Neolepidozia tetrapila
Nothogymnomitrion erosum
Pachyglossa tenacifolia
Pachyschistochila altissima
Pachyschistochila latiloba
Pachyschistochila parvistipula
Pachyschistochila subhyalina
Pachyschistochila succulenta
Pachyschistochila trispiralis (At Risk – Naturally Uncommon)
Pachyschistochila virescens (At Risk – Naturally Uncommon)
Pallavicinia innovans
Pallavicinia lyellii
Pallavicinia rubristipa (At Risk – Naturally Uncommon)

Pallavicinia tenuinervis
Pallavicinia xiphoides
Paracromastigum (b) (CHR 655691; Cypress Mine) *(Not Threatened – Taxonomically unresolved)*
Plagiochila banksiana
Plagiochila circinalis
Plagiochila circumdentata
Plagiochila deltoidea
Plagiochila fuscella
Plagiochila gigantea
Plagiochila incurvicolla (Data Deficient)
Plagiochila ramosissima
Plagiochila stephensoniana
Plagiochila subfasciculata
Plagiochila trispicata
Podomitrium phyllanthus
Porella cranfordii
Porella elegantula
Pseudocephalozia lepidozioides
Pseudocephalozia paludicola
Pseudolophocolea denticulata (Threatened – Nationally Critical)
Pseudomarsupidium piliferum
Psiloclada clandestina
Radula ?splendida
Radula aff. *physoloba*
Radula buccinifera complex
Radula cuspidata
Radula demissa
Radula multiamentula
Radula physoloba
Radula pseudoscripta
Radula sainsburiana
Radula strangulata
Radula tasmanica
Radula uvifera
Riccardia aequicellularis
Riccardia aequitexta
Riccardia alcicornis (Data Deficient)
Riccardia asperulata
Riccardia bipinnatifida
Riccardia browniae
Riccardia aff. *cochleata*
Riccardia cochleata
Riccardia colensoi
Riccardia crassa
Riccardia dimorpha [assumed not threatened]
Riccardia eriocaula
Riccardia exilis (Data Deficient)
Riccardia filicina
Riccardia furtiva (At Risk – Naturally Uncommon)
Riccardia lobulata
Riccardia multicorpora (At Risk – Naturally Uncommon)
Riccardia nitida
Riccardia pennata
Riccardia perspicua
Riccardia sp.
Saccogynidium australe
Saccogynidium decurvum (At Risk – Declining)
Schistochila aff. *pseudociliata*
Schistochila balfouriana
Schistochila chlorophylla
Schistochila ciliata
Schistochila glaucescens
Schistochila kirkiana
Schistochila lehmanniana
Schistochila muricata
Schistochila nobilis
Schistochila pluriciliata (At Risk – Naturally Uncommon)
Schistochila pseudociliata
Schistochila repleta
Schistochila sp. 'lithophila'
Siphonolejeunea conchophylla
Siphonolejeunea sp.
Solenostoma inundatum
Solenostoma novazelandiae
Solenostoma orbiculatum
Solenostoma totipapillosum
Symphyogyna subsimplex
Symphyogyna undulata
Syzygiella colorata

Syzygiella nigrescens
Syzygiella pseudocclusa
Syzygiella sonderi
Syzygiella sp.
Syzygiella tasmanica
Telaranea granulata
Telaranea herzogii
Telaranea inaequalis (Threatened – Nationally Vulnerable)
Telaranea sp.
Telaranea sp. '1'
Temnoma paucisetigerum
Temnoma quadrifidum
Temnoma quadripartitum var. *quadripartitum*
Temnoma quadripartitum var. *pseudopungens (Data Deficient)*
Tetracymbaliella cymbalifera
Tetracymbaliella decipiens
Thysananthus anguiformis
Treubia lacunosa
Triandrophyllum subtrifidum
Trichocolea hatcheri
Trichocolea mollissima
Trichocolea rigida
Tricholepidozia lindenbergii
Tricholepidozia martinii
Tricholepidozia pulcherrima var. *pulcherrima*
Tricholepidozia remotifolia
Tricholepidozia tetradactyla
Trichotemnoma corrugatum (At Risk – Naturally Uncommon)
Tritomaria sp. 'Mt William'
Verdoornia succulenta (At Risk – Naturally Uncommon)
Zoopsis argentea var. *argentea*
Zoopsis bicruris (At Risk – Naturally Uncommon)
Zoopsis ceratophylla (At Risk – Naturally Uncommon)
Zoopsis leitgebiana
Zoopsis macrophylla
Zoopsis matawaia (At Risk – Naturally Uncommon)
Zoopsis nitida (At Risk – Naturally Uncommon)
Zoopsis setulosa

Mosses (123)

Achrophyllum dentatum
Achrophyllum quadrifarium
Acrocladium chlamydophyllum
Andreaea acuminata (At Risk – Naturally Uncommon)
Andreaea acutifolia
Andreaea subulata (At Risk – Naturally Uncommon)
Arctoa pumila
Atrichum androgynum
Blindia immersa (At Risk – Naturally Uncommon)
Blindia lewinskyae
Blindia magellanica
Blindia robusta
Brachythecium rutabulum
Breutelia elongata
Breutelia pendula
Bryum laevigatum
Bryum sp.
Calliergonella cuspidata (Introduced and Naturalised)
Calyptopogon mnioides
Calyptrochaeta cristata
Campylopus bicolor
Campylopus clavatus
Campylopus introflexus
Campylopus kirkii (At Risk – Naturally Uncommon)
Campylopus purpureocaulis
Canalohypopterygium tamariscinum
Ceratodon purpureus
Chrysoblastella chilensis
Cladomnion ericoides
Cratoneuropsis relaxa
Cryptopodium bartramioides
Cyathophorum bulbosum
Dendroligotrichum tongariroense
Dicnemon calycinum
Dicnemon dixonianum (At Risk – Naturally Uncommon)
Dicnemon semicryptum
Dicnemon sp.
Dicranella cardotii
Dicranella vaginata
Dicranoloma billardierei

Dicranoloma menziesii
Dicranoloma platycaulon
Dicranoloma robustum
Dicranum billardierei
Distichophyllum crispulum (At Risk – Naturally Uncommon)
Distichophyllum pulchellum
Distichophyllum rotundifolium
Ditrichum cylindricarpum
Ditrichum difficile
Ditrichum flexicaule
Ditrichum punctulatum
Ditrichum strictum (At Risk – Naturally Uncommon)
Drepanocladus sp.
Echinodium hispidum
Fissidens asplenioides
Fissidens oblongifolius ? (At Risk – Naturally Uncommon)
Fissidens rigidulus
Hennediella ?
Holomitrium perichaetiale
Holomitrium trichopodum
Hypnodendron arcuatum
Hypnodendron spininervium
Hypnum chrysogaster
Hypnum cupressiforme var. *cupressiforme*
Hypopterygium rotulatum
Lembophyllum clandestinum
Leptostomum inclinans
Leptotheca gaudichaudii
Lepyrodon lagurus
Leucobryum javense
Lopidium concinnum
Macromitrium gracile
Macromitrium longipes
Macromitrium sp.
Mesotus celatus
Mittenia plumula
Mniodendron cf. *comosum*
Mniodendron colensoi
Mniodendron comatum
Mniodendron comosum
Notoligotrichum australe
Pleuridium arnoldii
Pleurophascum ovalifolium (At Risk – Naturally Uncommon)
Pohlia cruda
Pohlia sp.
Pohlia wahlenbergii
Polytrichadelphus magellanicus
Ptychomnion aciculare
Pulchrinodus inflatus
Pyrrhobryum bifarium
Pyrrhobryum mnioides
Pyrrhobryum paramattense (At Risk – Naturally Uncommon)
Racomitrium crispulum
Racomitrium pruinosum
Rhacocarpus purpurascens
Rhaphidorrhynchium amoenum
Rhizogonium distichum
Rhizogonium pennatum
Schistidium apocarpum
Schlotheimia knightii
Sciadocladus cf. *kerrii*
Sciadocladus kerrii
Sciadocladus menziesii
Sematophyllum sp.
Sematophyllum subhumile var. *contiguum*
Sematophyllum uncinatum
Sphagnum australe
Sphagnum cristatum
Sphagnum falcatulum
Sphagnum novo-zelandicum
Sphagnum subnitens (Introduced and Naturalised)
Tayloria callophylla (At Risk – Naturally Uncommon)
Thamnobryum pandum
Thuidiopsis furfurosa
Thuidium laeviusculum
Tridontium tasmanicum
Ulota lutea
Warnstorfia fluitans
Weymouthia cochlearifolia

Weymouthia mollis
Wijkia extenuata
Zygodon intermedius
Zygodon menziesii

APPENDIX C
eBird Records from the Ngakawau ED

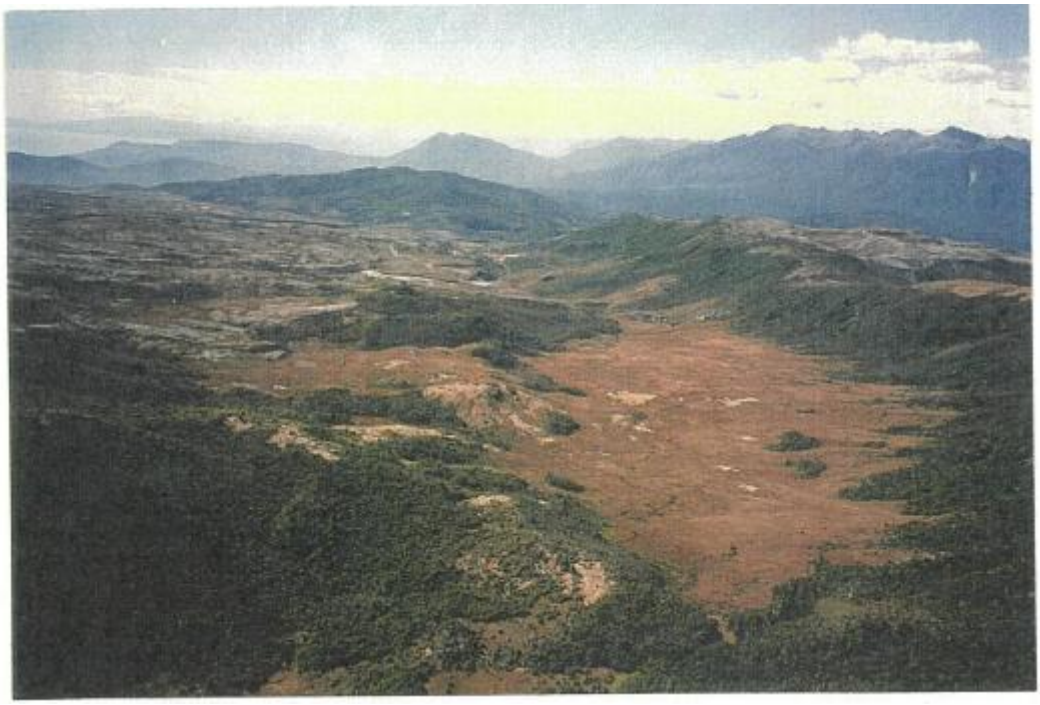
Common Name	Scientific Name	Recognised as taoka species in the Ngai Tahu Settlement Act (1998)
Banded Dotterel	*Anarhynchus bicinctus*	No
Black Shag	*Phalacrocorax carbo*	Yes
Blue Duck	*Hymenolaimus malacorhynchos*	Yes
Brown Creeper	*Mohoua novaeseelandiae*	No
Caspian Tern	*Hydroprogne caspia*	Yes
Common Chaffinch	*Fringilla coelebs*	No
Dunnock	*Prunella modularis*	No
Eurasian Blackbird	*Turdus merula*	No
Eurasian Skylark	*Alauda arvensis*	No
European Goldfinch	*Carduelis carduelis*	No
European Greenfinch	*Chloris chloris*	No
European Starling	*Sturnus vulgaris*	No
Grey Warbler	*Gerygone igata*	Yes
Great Spotted Kiwi	*Apteryx haastii*	Yes
Grey Duck	*Anas superciliosa*	Yes
House Sparrow	*Passer domesticus*	No
Kea	*Nestor notabilis*	Yes
Lesser Redpoll	*Acanthis cabaret*	No
Little Shag	*Microcarbo melanoleucos*	Yes
Long-tailed Cuckoo	*Urodynamis taitensis*	Yes
Mallard	*Anas platyrhynchos*	No
Mallard x Pacific Black Duck (hybrid)	*Anas platyrhynchos x superciliosa*	No
Morepork	*Ninox novaeseelandiae*	Yes
New Zealand Bellbird	*Anthornis melanura*	Yes
New Zealand Falcon	*Falco novaeseelandiae*	Yes
New Zealand Fantail	*Rhipidura fuliginosa*	Yes
New Zealand Fernbird	*Poodytes punctatus*	Yes
New Zealand Kaka	*Nestor meridionalis*	Yes
New Zealand Pigeon	*Hemiphaga novaeseelandiae*	Yes
New Zealand Pipit	*Anthus novaeseelandiae*	Yes
Paradise Shelduck	*Tadorna variegata*	Yes
Pied Shag	*Phalacrocorax varius*	Yes
Pied Stilt	*Himantopus leucocephalus*	Yes
Pukeko	*Porphyrio melanotus*	Yes
Red-billed Gull	*Chroicocephalus novaehollandiae*	Yes
Rifleman	*Acanthisitta chloris*	Yes
Rock Pigeon	*Columba livia*	No
Sacred Kingfisher	*Todiramphus sanctus*	Yes
Shining Cuckoo	*Chrysococcyx lucidus*	Yes
Silvereye	*Zosterops lateralis*	No
Song Thrush	*Turdus philomelos*	No
South Island Oystercatcher	*Haematopus finschi*	No
South Island Robin	*Petroica australis*	Yes
Southern Black-backed Gull	*Larus dominicanus*	Yes
Spur-winged Plover	*Vanellus miles*	No
Swamp Harrier	*Circus approximans*	Yes
Tomtit	*Petroica macrocephala*	Yes
Tui	*Prosthemadera novaeseelandiae*	Yes
Variable Oystercatcher	*Haematopus unicolor*	No

Weka	*Gallirallus australis*	Yes
Welcome Swallow	*Hirundo neoxena*	No
White Heron	*Ardea alba*	No
White-faced Heron	*Egretta novaehollandiae*	Yes
White-fronted Tern	*Sterna striata*	Yes
Yellow-crowned Parakeet	*Cyanoramphus auriceps*	Yes
Yellowhammer	*Emberiza citrinella*	No

APPENDIX D
Bat Surveys in the Ngakawau ED

Thomas & Toft (1997) undertook surveys for terrestrial fauna (including bats) in the upper Waimangaroa Valley - Mt William Range area of the Denniston Plateau between November 1995 and March 1996. The study area included the upper Waimangaroa River valley, Mt William, and Deep Stream to Burnetts Face on the Denniston Plateau. Visual searches for bats were undertaken just before dusk along forest and stream edges (over 13 nights) and an ultrasonic detector (presumably a Batbox III) was used in several locations, although only during January (over 3 nights). Although no bats were seen or detected on recording equipment, the habitat was considered suitable and it was noted that more work would be required to established whether or not bats were present.

Thomas et al (1997) undertook a more targeted bat survey in March 1997 within the same survey area visited by Thomas & Toft (1997). eight acoustic recorders (Batbox IIIs) were placed in a variety of habitats where bats were considered likely to fly. The bat survey sites were located north of St Patricks Dam on St Patricks Stream (Ngakawau River catchment), in Happy Valley near the headwaters of Cypress Stream, and in the headwaters of the Waimangaroa River to the south (both in Waimangaroa River catchment). Acoustic recorder deployment locations included elevated sites above low canopy areas of forest fringe, bush edges, low scrub and open water. Visual searches were also undertaken at dusk along forest margins and stream edges on the same nights between 4-8 March (5 nights). The photograph below illustrates the types of habitats surveyed.



Cypress Stream north to Happy Valley and St Patricks Dam showing major habitat types surveyed (from Thomas et al., 1997).

Bats, most likely to be long-tailed bats, were detected at three of the eight sites on acoustic recording equipment. All bat detections were in an area known as Happy Valley, and bat activity was reported as being detected over several nights. While no specific information as to the number of passes detected or passes per night is provided, the authors considered this discovery to be "*of major significance*" and went on to state that "*further bat surveys are required to determine whether bats use the area seasonally, or whether small resident populations are present.*"

Buckingham (1998) aimed to build on the recent discovery of bats in Happy Valley (described above) by determining the species and distribution of bats within Buller Plateaux and surrounding areas. Buckingham surveyed a larger area of the Waimangaroa Valley for bats than Thomas et al., (1997), again using Batbox III detectors at 25 sites (although presumably only 12 or 13 sites with the detection frequency set to 45kHz to detect long-tailed bats), by walking transects (with a Batbox III mounted on a stick), and by visual observations at dusk. The survey ran between 11 February – 13 March 1998. Automatic detectors were relocated each night, with a maximum deployment period of 31 nights (although the author notes only 10 nights were surveyed during February). No bats were detected on either frequency (26 or 45 kHz) in a total of 413 hours of automatic monitoring (271 hours at 45 kHz), over 7 km of walk-through surveys (3 hrs total) or during lookouts at dusk. Buckingham notes that overnight temperatures on at least some survey nights were low (range 4.5-16ºC), but still considered favourable to detect bat activity.

> Buckingham concluded that "*bats may be seasonal visitors to these areas rather than residents*" and added that "*If bats are roosting in the area, roosts are likely to be in tall forest areas in the Mount William Range*" which are located to the south of the survey area. He, like Thomas et al., (1997), also concluded that "*Further bat surveys are required to determine whether bats use the area seasonally, or whether small resident populations are present.*"

Buckingham (1999) undertook a baseline survey for birds and bats in the Timberlands Inangahua Beech Working Circle (BWC2) between late September 1998 and late January 1999 (spring and summer) with the aims of comparing wildlife values between areas and offering mitigation measures to reduce the impacts of sustainable beech harvesting on fauna.

Thjis survey used acoustic recorders (Batbox III), walking transects, and dusk observations. This survey area was located outside of the Ngakawau Ecological District to the southeast, extending from the lower Buller Gorge in the north to Reefton in the south. Bats were surveyed with automatic detectors at a total of 98 sites and over a total of 1,190 survey hours. It is unclear exactly when each site was surveyed and how many nights were surveyed at each location. Low numbers of bats (presumed long-tailed bats) were recorded in the southern part of the survey area, but not north of Larry's Forest (approximately 9 km north-east of Reefton). The maximum number of passes per night was three, indicating relatively low numbers of bats in the area monitored. In total only 10 passes were recorded in 750 surveillance hours at 40 kHz and two passes in 6.5 transect hours (6 km) at 40 kHz. The distribution of long-tailed bats was described as "*patchy*", and "*locally present in apparently low numbers*". Bats were not detected in the lower Buller, Inangahua Junction areas, nor within Orikaka forest southeast of the Buller Plateaux and immediately adjacent to the boundary of the Ngakawau Ecological District.

Based on the data collected, and in particular the call rates detected, Buckingham concluded that the long-tailed bat population in BWC2 would not be nationally significant, and that even by regional standards the population is unlikely to be significant, despite more passes being detected in BWC2 than in BWC1[16] (comprising an area of lowland forest in the east Paparoa Range).

Buckingham (2002) surveyed within the proposed Cypress Mining Area in the upper Waimangaroa River valley over three nights in late February 2002 (i.e., a similar area to Thomas et al.1997). The aim was to evaluate the current population status of bats (particularly long-tailed bats which were known to be present in the area) and to compare the results with previous surveys in this area. The survey was conducted at many of the same sites as used on previous surveys, from the upper Waimangaroa River to the south to

[16] Survey sites for this bat survey could

St Patricks Dam in the north, and including the sites in Happy Valley where bats had previously been detected (Thomas et al., 1997). No bats were recorded on 40 kHz at 11 sites in a total of 241.5 hours of surveillance nor on 28 kHz at 2 sites in 30 hours of surveillance. Surveillance was replicated at most sites for 2-3 nights. Minimum temperatures during the night ranged from 10-5ºC, and temperatures at dusk were 10-12ºC.

Buckingham warned that failure to detect bats on this and most previous surveys (Thomas & Toft, 1997; Thomas et al., 1997; Buckingham, 1998) should not be interpreted as indicating an absence of bats in the area. He noted that bats can be difficult to detect when in low numbers, and that they may visit areas seasonally and thus easily be missed in one off surveys. However, he concluded that given the failure to detect bats in a relatively high number of surveillance hours and at a relatively large number of locations, it was most likely that bats were very uncommon in that locality.

Thomas & Toft (2002) undertook a terrestrial fauna survey in the Millerton Block (located between Millerton and the Stockton Mine) on the Stockton Plateau 22-24 January 2002. They noted that the area had been "*highly modified by mining*" with underground fires still burning and that the area had "*suffered severe environmental impact from past mining activities*". The primary objective of the survey was to check for the presence of bats. Ultrasonic bat detecting equipment (Batbox III) was used over two nights in likely, elevated positions, i.e. overlooking the headwaters of the Mangatini Stream in the vicinity of Southern rātā-kāmahi forest on the edge of the high terrace above Mine Creek, overlooking the tall forest downstream from old mine workings and old brick chimney stack. No evidence of either species of native bat were recorded during the survey.

Waybacks Ltd & Wildlife Surveys (2008) surveyed the general area of Millerton between 26-30 November 2007. The authors noted that long-tailed bats had previously been recorded at or near the site, making reference to Thomas et al., (1997), who detected bats approximately 8 km to the south east. Surveillance for bats involved using Batbox III detectors set up to automatically record bats. Up to six bat detectors were activated each night throughout the study area (at a total of 12 sites) in a variety of habitats including forest edge, roadside, streamside and wetland. An additional survey for bats was undertaken on the night of the 26th of November 2007, by walking through the site of the proposed Lake William retention pond. Bats were not detected during the survey which consisted of 23, 9-hour bat detector nights (a total of 207 overnight surveillance hours). In addition, no bats were recorded in a further 3.5 hours of manual surveillance (walking transects). Low overnight temperatures were experienced during the survey period (min 2-8ºC). The authors noted that bats have rarely been detected during previous surveys in and around the Stockton Plateau. They also note however that long-tailed bats may be present but missed because of their low numbers, seasonal presence or cryptic behaviour.

Wildlife Surveys (2011) surveyed the proposed Mt William North mining area and immediate vicinity in the upper Waimangaroa River valley between 6 and 9 November 2010. Bat detectors (digital recorders and Batbox III's) were deployed for three nights at 15 sites where bats were considered most likely to forage or roost (e.g., older forest, forest edges, or near streams and wetlands). This was the first bat survey to use new technology (digital bat recorders) in addition to older style automatic recorders (Batbox III's). No bats were recorded in 440 hours in a total of 44 surveillance nights, nor were bats recorded using Batbox III detectors at kiwi listening sites (sunset to approximately midnight). While the author notes that survey timing (November) was appropriate in terms of likelihood of bat activity, night-time temperatures were near the generally accepted limit for bat activity (i.e., <10ºC). Dusk temperatures of 5-10ºC were recorded, and overnight minimums were <5ºC. The authors concluded that "*Although this result should not be interpreted as indicating an absence of bats, the accumulation of survey effort in the area since 1998 suggests that bats are very scarce in the area, possibly only occasional seasonal visitors that come on foraging excursions.*"

Wildlife Surveys (2011) was first to suggest that the initial detection of (presumably) long-tailed bats in Happy Valley (Thomas et al., 1997) may in fact have been an incorrect call identification (suggesting that crickets can be similar in sound). They also suggest that since long-tailed bats have a wide foraging range (up to 19 km from their roosts) they may visit the area (i.e., Happy Valley) from either the Mokihinui Valley where long-tailed bats were known to be present, or the closer Ngakawau Valley where bats were considered possibly present.

Lloyd (2011) described the most comprehensive bat survey conducted near the Ngakawau Ecological District (approximately 5 km from the boundary and 30 km NE from St Patricks Dam on the Buller Plateaux). This work built upon previous surveys undertaken by others on behalf of Meridian since 2006 around the proposed Mokihinui Dam area (Buckingham, 2006, 2007; Mitchell Partnership, 2007a, b, 2008 – all cited in Lloyd, 2011). During these surveys, low numbers of bat passes were detected in the Mokihinui Gorge. Thirty-four detector-nights of monitoring with automatic bat detectors at 34 sites resulted in just three long-tailed bat detections. Higher numbers of bat passes were recorded upstream in the Mokihinui South Branch where there were 25 bat detections in only five detector-nights of monitoring, with long-tailed bats detected at three of the four sites monitored. The summer survey undertaken by Lloyd (2011) lasted for 84 nights, from 22 November 2010 to 14 February 11 and the autumn survey lasted 21 nights, from 29 March to 20 April 2011 (a total of 120 nights). Forty automatic detectors were used during the summer survey and 36 during the autumn survey. The numbers of detectors working on each night varied with a mean of 17.4 detectors (14.3 and 29.3 for summer and autumn respectively) achieving a total of 1,829 successful detector nights (1,185 and 644 for summer and autumn respectively). There were 174 deployments of detectors at 147 sites during the summer survey and 38 deployments at 36 sites during the autumn survey. Lloyd concluded that there were no short-tailed bats in the survey area, but that there was a “significant” resident population of long-tailed bats resident approximately 1.7 km above the Mokihinui Forks on the Mokihinui South Branch. Long-tailed bats were detected over an area of 2,376 ha in the mid-reaches of the Mokihinui catchment near the forks, but Lloyd considered that the bat population’s total home range was likely to be considerably greater than that, extending upstream in both the North and South Branch’s of the Mokihinui River and the Hemphill River. He considered the Mokihinui bat population to be both regionally and nationally significant, because it was probably the largest population in the region and one of only six large populations remaining in the South Island.

Lloyd (2019) undertook an acoustic survey of the upper Waimangaroa River catchment for bats during summer the summer of 2018 – 2019. Twenty automated recording heterodyne bat detectors were deployed along potential bat flyways in the upper Waimangaroa River catchment for 50-51 nights (between 17 February to 4 April 2019). On average the seventeen functioning detectors were each actively monitoring during suitable weather conditions on 23.8 nights, providing a total monitoring effort of 405 detector-nights. Despite ideal conditions for long-tailed bat flight activity on at least eighteen of the fifty-two nights that detectors were deployed (i.e. warm, fine, calm and outside of the full moon phase), no bats were detected.

Lloyd stated that “*It is reasonable to conclude that there were no bats in the upper Waimangaroa catchment during the survey period. It is therefore extremely unlikely that bats are resident in the catchment or visit it regularly*.” He cites additional bat surveys to support this argument, namely Buckingham’s (1999) work in the Orikaka River to the east of the Waimangaroa catchment which failed to detect bats, his own work near Mokihinui and Lake Matiri (Lloyd, 2013 & 2018) and the very low numbers of bats that had been detected in the Buller River valley at sites 13 km south and 22 km east from the upper Waimangaroa catchment recorded in the Department of Conservation bat database.

APPENDIX E

GBIF Terrestrial Invertebrate Records from the Ngakawau Ecological District

Phylum	Class	Order	Family	Species
Annelida				
Annelida				
Annelida				
Annelida				
Annelida				
Annelida				
Annelida				
Annelida				
Annelida				
Annelida				
Annelida				
Annelida	Clitellata			
Annelida				
Annelida	Clitellata			
Annelida				
Annelida	Clitellata			
Annelida	Clitellata			
Annelida				
Annelida				
Annelida				
Annelida	Clitellata			
Annelida				
Annelida				
Annelida	Clitellata			
Annelida	Clitellata			
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Malacostraca	Amphipoda		
Arthropoda	Arachnida	Araneae	Clubionidae	
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Arachnida	Araneae	Araneidae	*Eriophora pustulosa*
Arthropoda	Arachnida	Araneae	Araneidae	*Novaranea queribunda*
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*

Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Arachnida	Araneae	Pisauridae	*Dolomedes minor*
Arthropoda	Insecta	Coleoptera	Belidae	*Agathinus tridens*
Arthropoda	Insecta	Coleoptera	Carabidae	*Mecodema ducale*
Arthropoda	Insecta	Coleoptera	Carabidae	*Mecodema ducale*
Arthropoda	Insecta	Coleoptera	Carabidae	*Mecodema ducale*
Arthropoda	Insecta	Coleoptera	Cerambycidae	*Hexatricha pulverulenta*
Arthropoda	Insecta	Coleoptera	Coccinellidae	*Harmonia axyridis*
Arthropoda	Insecta	Coleoptera	Curculionidae	*Heterotyles argentatus*
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Elmidae	
Arthropoda	Insecta	Coleoptera	Hydraenidae	
Arthropoda	Insecta	Coleoptera	Hydraenidae	
Arthropoda	Insecta	Coleoptera	Hydraenidae	
Arthropoda	Insecta	Coleoptera	Hydraenidae	
Arthropoda	Insecta	Coleoptera	Ptilodactylidae	
Arthropoda	Insecta	Coleoptera	Ptilodactylidae	
Arthropoda	Insecta	Coleoptera	Scirtidae	
Arthropoda	Insecta	Coleoptera	Scirtidae	
Arthropoda	Insecta	Coleoptera	Scirtidae	
Arthropoda	Insecta	Coleoptera	Scirtidae	
Arthropoda	Insecta	Coleoptera	Scirtidae	
Arthropoda	Insecta	Coleoptera	Scirtidae	
Arthropoda	Insecta	Diptera	Anthomyiidae	
Arthropoda	Insecta	Diptera	Anthomyiidae	
Arthropoda	Insecta	Diptera	Ceratopogonidae	
Arthropoda	Insecta	Diptera	Ceratopogonidae	
Arthropoda	Insecta	Diptera	Chironomidae	
Arthropoda	Insecta	Diptera	Chironomidae	
Arthropoda	Insecta	Diptera	Chironomidae	
Arthropoda	Insecta	Diptera	Chironomidae	
Arthropoda	Insecta	Diptera	Chironomidae	
Arthropoda	Insecta	Diptera	Chironomidae	
Arthropoda	Insecta	Diptera	Chironomidae	
Arthropoda	Insecta	Diptera	Chironomidae	
Arthropoda	Insecta	Diptera	Chironomidae	

Arthropoda	Insecta	Diptera	Chironomidae
Arthropoda	Insecta	Diptera	Chironomidae
Arthropoda	Insecta	Diptera	Chironomidae

Arthropoda	Insecta	Diptera	Limoniidae	*Paralimnophila skusei*
Arthropoda	Insecta	Diptera	Limoniidae	
Arthropoda	Insecta	Diptera	Limoniidae	*Paralimnophila skusei*
Arthropoda	Insecta	Diptera	Limoniidae	
Arthropoda	Insecta	Diptera	Limoniidae	*Aphrophila neozelandica*
Arthropoda	Insecta	Diptera	Limoniidae	*Aphrophila neozelandica*
Arthropoda	Insecta	Diptera	Limoniidae	*Paralimnophila skusei*
Arthropoda	Insecta	Diptera	Limoniidae	*Paralimnophila skusei*
Arthropoda	Insecta	Diptera	Limoniidae	*Austrolimnophila argus*
Arthropoda	Insecta	Diptera	Limoniidae	
Arthropoda	Insecta	Diptera	Limoniidae	*Paralimnophila skusei*
Arthropoda	Insecta	Diptera	Limoniidae	*Paralimnophila skusei*
Arthropoda	Insecta	Diptera	Limoniidae	*Aphrophila neozelandica*
Arthropoda	Insecta	Diptera	Limoniidae	*Aphrophila neozelandica*
Arthropoda	Insecta	Diptera	Limoniidae	
Arthropoda	Insecta	Diptera	Limoniidae	*Paralimnophila skusei*
Arthropoda	Insecta	Diptera	Limoniidae	
Arthropoda	Insecta	Diptera	Limoniidae	*Paralimnophila skusei*
Arthropoda	Insecta	Diptera	Simuliidae	
Arthropoda	Insecta	Diptera	Simuliidae	
Arthropoda	Insecta	Diptera	Stratiomyidae	
Arthropoda	Insecta	Diptera	Stratiomyidae	
Arthropoda	Insecta	Diptera	Syrphidae	*Psilota decessum*
Arthropoda	Insecta	Diptera	Tachinidae	*Huttonobesseria verecunda*
Arthropoda	Insecta	Diptera	Tanyderidae	
Arthropoda	Insecta	Diptera	Tanyderidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Diptera	Tipulidae	
Arthropoda	Insecta	Hemiptera	Cicadidae	*Maoricicada cassiope*
Arthropoda	Insecta	Hemiptera	Ricaniidae	*Scolypopa australis*
Arthropoda	Insecta	Hemiptera	Notonectidae	
Arthropoda	Insecta	Hemiptera	Cicadidae	*Amphipsalta zelandica*
Arthropoda	Insecta	Hemiptera	Notonectidae	
Arthropoda	Insecta	Hymenoptera	Ichneumonidae	

Arthropoda	Insecta	Hymenoptera	Crabronidae	*Pison spinolae*
Arthropoda	Insecta	Lepidoptera	Carposinidae	*Heterocrossa eriphylla*
Arthropoda	Insecta	Lepidoptera	Carposinidae	*Heterocrossa eriphylla*
Arthropoda	Insecta	Lepidoptera	Crambidae	*Orocrambus heliotes*
Arthropoda	Insecta	Lepidoptera	Crambidae	*Diasemia grammalis*
Arthropoda	Insecta	Lepidoptera	Crambidae	*Eudonia diphtheralis*
Arthropoda	Insecta	Lepidoptera	Crambidae	*Eudonia sabulosella*
Arthropoda	Insecta	Lepidoptera	Crambidae	*Orocrambus siriellus*
Arthropoda	Insecta	Lepidoptera	Erebidae	*Nyctemera annulatum*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Declana floccosa*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Declana floccosa*
Arthropoda	Insecta	Lepidoptera	Geometridae	
Arthropoda	Insecta	Lepidoptera	Geometridae	*Epiphryne charidema*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Declana floccosa*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Epiphryne charidema*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Tatosoma tipulata*
Arthropoda	Insecta	Lepidoptera	Geometridae	
Arthropoda	Insecta	Lepidoptera	Geometridae	*Declana leptomera*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Idaea mutanda*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Tatosoma tipulata*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Adeixis griseata*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Idaea mutanda*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Ischalis fortinata*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Declana floccosa*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Elvia glaucata*
Arthropoda	Insecta	Lepidoptera	Geometridae	
Arthropoda	Insecta	Lepidoptera	Geometridae	*Chloroclystis filata*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Arctesthes avatar*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Declana leptomera*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Poecilasthena pulchraria*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Microdes quadristrigata*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Idaea mutanda*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Xanthorhoe occulta*
Arthropoda	Insecta	Lepidoptera	Geometridae	
Arthropoda	Insecta	Lepidoptera	Geometridae	*Pseudocoremia productata*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Epicyme rubropunctaria*
Arthropoda	Insecta	Lepidoptera	Geometridae	
Arthropoda	Insecta	Lepidoptera	Geometridae	*Xanthorhoe occulta*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Sestra humeraria*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Chloroclystis filata*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Arctesthes avatar*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Austrocidaria callichlora*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Idaea mutanda*
Arthropoda	Insecta	Lepidoptera	Geometridae	*Chloroclystis filata*
Arthropoda	Insecta	Lepidoptera	Noctuidae	
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Feredayia grammosa*
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Meterana vitiosa*

Arthropoda	Insecta	Lepidoptera	Noctuidae	*Physetica sequens*
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Ichneutica mutans*
Arthropoda	Insecta	Lepidoptera	Noctuidae	
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Meterana vitiosa*
Arthropoda	Insecta	Lepidoptera	Noctuidae	
Arthropoda	Insecta	Lepidoptera	Noctuidae	
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Bityla defigurata*
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Ichneutica pelanodes*
Arthropoda	Insecta	Lepidoptera	Noctuidae	
Arthropoda	Insecta	Lepidoptera	Noctuidae	
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Agrotis ipsilon*
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Meterana vitiosa*
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Meterana vitiosa*
Arthropoda	Insecta	Lepidoptera	Noctuidae	*Ichneutica caraunias*
Arthropoda	Insecta	Lepidoptera	Nymphalidae	*Dodonidia helmsii*
Arthropoda	Insecta	Lepidoptera	Oecophoridae	*Izatha huttoni*
Arthropoda	Insecta	Lepidoptera	Plutellidae	*Charixena iridoxa*
Arthropoda	Insecta	Lepidoptera	Plutellidae	*Charixena iridoxa*
Arthropoda	Insecta	Lepidoptera	Plutellidae	*Charixena iridoxa*
Arthropoda	Insecta	Lepidoptera	Psychidae	*Orophora unicolor*
Arthropoda	Insecta	Lepidoptera	Psychidae	*Orophora unicolor*
Arthropoda	Insecta	Lepidoptera	Tortricidae	*Catamacta gavisana*
Arthropoda	Insecta	Megaloptera	Corydalidae	*Archichauliodes diversus*
Arthropoda	Insecta	Megaloptera	Corydalidae	*Archichauliodes diversus*
Arthropoda	Insecta	Megaloptera	Corydalidae	*Archichauliodes diversus*
Arthropoda	Insecta	Megaloptera	Corydalidae	*Archichauliodes diversus*
Arthropoda	Insecta	Megaloptera	Corydalidae	*Archichauliodes diversus*
Arthropoda	Insecta	Megaloptera	Corydalidae	*Archichauliodes diversus*
Arthropoda	Insecta	Odonata	Petaluridae	*Uropetala carovei*
Arthropoda	Insecta	Odonata	Lestidae	*Austrolestes colensonis*
Arthropoda	Insecta	Odonata	Petaluridae	*Uropetala carovei*
Arthropoda	Insecta	Odonata	Petaluridae	*Uropetala carovei*
Arthropoda	Insecta	Odonata	Petaluridae	*Uropetala carovei*
Arthropoda	Insecta	Orthoptera	Acrididae	
Arthropoda	Insecta	Orthoptera	Acrididae	
Arthropoda	Insecta	Orthoptera	Acrididae	
Arthropoda	Insecta	Orthoptera	Acrididae	
Arthropoda	Insecta	Orthoptera	Acrididae	
Arthropoda	Insecta	Orthoptera	Anostostomatidae	*Hemideina broughi*
Arthropoda	Insecta	Orthoptera	Anostostomatidae	*Hemideina broughi*
Arthropoda	Insecta	Orthoptera	Tettigoniidae	*Conocephalus bilineatus*
Arthropoda	Insecta	Orthoptera	Acrididae	
Arthropoda	Insecta	Orthoptera	Rhaphidophoridae	*Maotoweta virescens*
Arthropoda	Insecta	Orthoptera	Anostostomatidae	*Hemiandrus maculifrons*
Arthropoda	Insecta	Orthoptera	Acrididae	
Arthropoda	Insecta	Orthoptera	Anostostomatidae	*Hemideina crassidens*
Arthropoda	Insecta	Orthoptera	Acrididae	

Arthropoda	Insecta	Phasmida	Phasmatidae	*Acanthoxyla prasina*
Arthropoda	Arachnida	Trombidiformes	Eriophyidae	
Arthropoda	Ostracoda			
Arthropoda	Arachnida			
Arthropoda	Collembola			
Arthropoda	Arachnida			
Arthropoda	Arachnida			
Arthropoda	Ostracoda			
Arthropoda	Arachnida			
Arthropoda	Collembola			
Mollusca	Gastropoda	Littorinimorpha	Tateidae	*Potamopyrgus antipodarum*
Mollusca	Gastropoda	Littorinimorpha	Tateidae	*Potamopyrgus antipodarum*
Mollusca	Gastropoda	Littorinimorpha	Tateidae	*Potamopyrgus antipodarum*
Mollusca	Gastropoda	Littorinimorpha	Tateidae	
Mollusca	Gastropoda	Littorinimorpha	Tateidae	*Potamopyrgus antipodarum*
Mollusca	Gastropoda	Stylommatophora	Rhytididae	*Powelliphanta patrickensis*
Mollusca	Gastropoda	Stylommatophora	Charopidae	*Allodiscus occidaneus*
Mollusca	Gastropoda	Stylommatophora	Rhytididae	*Powelliphanta lignaria*
Mollusca	Gastropoda	Stylommatophora	Rhytididae	*Powelliphanta patrickensis*
Mollusca	Gastropoda	Stylommatophora	Rhytididae	*Powelliphanta patrickensis*
Mollusca	Gastropoda	Stylommatophora	Punctidae	*Phrixgnathus viridulus*
Mollusca	Gastropoda	Stylommatophora	Rhytididae	*Powelliphanta patrickensis*
Mollusca	Gastropoda	Stylommatophora	Rhytididae	*Powelliphanta patrickensis*
Mollusca	Gastropoda	Stylommatophora	Charopidae	*Phacussa hypopolea*
Mollusca	Gastropoda	Stylommatophora	Rhytididae	*Powelliphanta patrickensis*
Mollusca	Gastropoda	Stylommatophora	Athoracophoridae	*Pseudaneitea gigantea*
Mollusca	Gastropoda	Stylommatophora	Limacidae	*Limax maximus*
Mollusca	Gastropoda	Stylommatophora	Rhytididae	*Powelliphanta patrickensis*
Mollusca	Gastropoda	Stylommatophora	Rhytididae	*Powelliphanta patrickensis*
Mollusca	Bivalvia		Periplomatidae	*Offadesma angasi*
Platyhelminthes				

APPENDIX F
Vegetation Classifications on the Buller Plateaux

Ground truth reference	Vegetation Type
Overmars et al. (1998)	2: Mixed beech-Southern rātā forest (red or silver beech dominant)
Stockton & Denniston Plateaux	4a: Rimu/mountain beech forest
	4c: Southern rātā-mountain beech forest
	5: Mountain beech/yellow silver pine-pink pine forest
	6. Mountain beech-silver beech forest and shrubland
	7. Leatherwood scrub
	8. Mountain beech-mānuka scrub
	9. Pink pine-*Chionochloa juncea*-mānuka tussock-shrubland
	10. Mānuka-*Dracophyllum politum*/wire rush rush shrubland
	11. [Mānuka]/wire rush-*Chionochloa juncea*-tussock-rushland with subalpine bog species
	12a. [Mānuka]/wire rush-tangle fern shrub-rushland
	12b. Mānuka/*Machaerina teretifolia*-wire rush shrub-rushland
	13. *Machaerina teretifolia-Rytidosperma gracile* rushland
	14. Red tussock-bog pine shrub-tussockland
	Mountain-silver beech/*Quintinia-Dracophyllum traversii* forest
Knightbridge et al. (2002)	Mountain beech/yellow-silver pine-pink pine/*Gahnia procera* forest
Te Kuha	Mānuka/wire rush-tanglefern shrubland
	Mānuka-*Dracophyllum politum*/wire rush shrubland
	1. Red beech forest
	2. Mixed beech Southern rātā forest
	3. Mountain beech forest
	4. Pink pine-mountain beech/yellow silver pine forest
Nichol & Overmars (2008)	
Denniston Plateau (Escarpment Mine Area)	5. [Mountain beech]/mānuka scrub
	6. Mānuka-wire rush rush-shrubland
	7. Mānuka-wire rush rushland
	8. *Machaerina teretifolia*/mānuka-wire rush rushland
Lloyd et al. (2010)	1. Rimu-hard beech forest

Stockton & Denniston Plateau	2. Rimu/mountain beech-Southern rātā forest
	3. Southern rātā-mountain beech forest
	4. Mountain beech-pāhautea forest
	5. Mixed beech forest
	6. High elevation beech forest
	7. Southern rātā-broadleaved low forest
	8. Silver beech-mountain beech forest
	9. Mānuka forest
	10. Leatherwood scrub
	11. Mānuka shrubland
	12, Boulderfield shrubland
	13. [Mānuka]/wire rush-pākihi rush-tangle fern rushland
	14. *Chionochloa flavescens* grassland
	15. *Chionochloa juncea* grassland
	16. Red tussock fen
	17. Wetland-shallow tarn complexes
	18. Herb fen
	19. Vegetation with a significant exotic component
	20. Vegetation cleared by mining, roading, pond construction etc.
	21. Millerton village
	22. Riverbed
	a1. Low mānuka shrubland with *Empodisma* and mānuka ground cover
	a2. Low mānuka shrubland with open ground
	a3. Dense low mānuka shrubland with *Empodisma* and mānuka ground cover
	b. Mānuka scrub and shrubland
Overmars & Lloyd (2012) Denniston Plateau (Escarpment Mine Area)	c. Mānuka scrub and shrubland with yellow silver pine
	d. Mixed scrub and low forest of mānuka, mountain beech, yellow silver pine and pink pine
	e. Mixed forest dominated by pink pine and mountain beech with an understorey of mountain toatoa and yellow silver pine
	f. Mountain and/or silver beech forest with Southern rātā and pink pine

APPENDIX G
Lichen species on the Buller Plateaux

Lichens (98)
Austropeltum glareosum (Threatened – Nationally Vulnerable)
Baeomyces heteromorphus
Bunodophoron microsporum
Bunodophoron scrobiculatum
Bunodophoron sp.
Calycidium cuneatum (At Risk – Naturally Uncommon)
Cladia aff. aggregata
Cladia aggregata
Cladia fuliginosa (Threatened – Nationally Vulnerable)
Cladia gorgonea
Cladia inflata (At Risk – Declining)
Cladia sullivanii
Cladonia confusa
Cladonia floerkeana
Cladonia southlandica
Cladonia tenerrima
Coccotrema cucurbitula
Coccotrema porinopsis (Data Deficient)
Crocodia rubella
Degelia gayana
Degeliella rosulata (At Risk – Naturally Uncommon)
Dibaeis arcuata
Fuscoderma amphibolum
Fuscopannaria minor (Data Deficient)
Gyalidea hyalinescens (Data Deficient)
Hypogymnia lugubris
Hypogymnia subphysodes
Knightiella splachnirima (Threatened – Nationally Vulnerable)
Lecanora demersa
Leifidium tenerum
Leiorreuma exaltatum (At Risk – Naturally Uncommon)
Lepra dactylina
Lepra gymnospora
Leptogidium contortum
Lichenomphalia umbellifera
Mazosia melanophthalma (Data Deficient)
Megalospora pauciseptata
Megalospora pupa (Data Deficient)
Menegazzia eperforata
Menegazzia pertransita
Micarea isabellina (At Risk – Naturally Uncommon)
Mycoblastus dissimulans (Data Deficient)
Neophyllis melacarpa
Nephroma australe
Ochrolechia frigida (At Risk – Naturally Uncommon)
Ochrolechia xanthostoma
Omphalina ericetorum
Pannaria allorhiza
Pannaria implexa
Pannoparmelia angustata
Parasiphula complanata
Parasiphula elixii (Data Deficient)
Parasiphula fragilis
Parasiphula jamesii? (Data Deficient)
Peltigera hymenina (Data Deficient)
Peltigera polydactylon
Pertusaria dennistonensis (Data Deficient)
Pertusaria flavoexpansa
Placopsis centrifuga (Data Deficient)
Placopsis cribellans
Placopsis dennanensis
Placopsis fuscidula
Placopsis gelida
Placopsis gelidioides (At Risk – Naturally Uncommon)
Placopsis salazina
Placopsis tararuana
Poeltiaria coromandelica

Porina sp.
Porpidia macrocarpa
Pseudocyphellaria carpoloma
Pseudocyphellaria dissimilis
Pseudocyphellaria faveolata
Pseudocyphellaria glabra
Pseudocyphellaria homoeophylla
Pseudocyphellaria lindsayi (At Risk – Naturally Uncommon)
Pseudocyphellaria pickeringii
Psoroma sp.
Pulchrocladia retipora
Pycnothelia caliginosa (Threatened – Nationally Endangered)
Rhizocarpon geographicum
Siphula decumbens
Siphula dissoluta
Siphula gracilis
Siphula ramalinoides
Siphula rubra [?]
Stereocaulon caespitosum
Stereocaulon colensoi
Stereocaulon ramulosum
Stereocaulon vesuvianum
Sticta filix
Tremolecia atrata
Usnea torulosa
Xanthocarpia ochracea (Data Deficient)
Xanthoparmelia australasica
Xanthoparmelia isidiotegeta (Data Deficient)
Xanthoparmelia philippsiana (Data Deficient)
Xanthopsoroma contextum
Yarrumia coronata

APPENDIX B

Buller Plateaux Vegetation Mapping (Ecological Solutions Limited 2026b)

ecoLogical Solutions

Environmental Consultants







January 2026

Buller Plateaux Vegetation Mapping

Submitted to:

Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by:	[redacted] Ecologist	
	[redacted] Ecologist	
Reviewed by:	[redacted] Terrestrial Ecology Team Leader	

Status: Final v3 **Issued:** 27 January 2026

Recommended Citation: [redacted] Buller Plateaux Vegetation Mapping. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. January 2026. Ecological Solutions Limited, Kāeo. 76 pp + appendices.

Ecological solutions

tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 4/195 main highway,
ellerslie, Auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

nelson office
58 Factory Road
Brightwater
Nelson 7022
027-371-6887

www.ecologicalsolutions.co.nz

Table of Contents

Executive Summary **1**
1.0 Introduction **2**
1.1 Background 2
1.2 Scope of Report 3
1.3 Limitations 3
2.0 Ecological Setting **4**
2.1 Ngakawau Ecological District 4
2.2 Brunner Coal Measures 8
2.2.1 Coal Measures Geology 8
2.2.2 Coal Measures Vegetation 8
2.2.3 Buller Plateaux 10
3.0 Methods **11**
3.1 Overview 11
3.2 Vegetation Surveys 12
3.3 Data Management 13
3.3.1 Introduction 13
3.3.2 Combining Data Sets 13
3.3.3 Ordination 16
3.3.4 Principal Species 17
3.3.5 Investigating the Influence of Plot Descriptors on Vegetation Type 18
3.3.6 Principal Components Analysis 19
3.3.7 Wetland Determination 19
3.4 Drone Photography 20
3.4.1 Introduction 20
3.4.2 Drone platforms, survey and flight planning and drone operations 20
3.4.3 Image capture and storage 20
3.5 Geospatial analysis 20
3.5.1 Image processing 20
3.5.2 Classification 21
3.5.3 Additional processing 21
4.0 Results **21**
4.1.1 NMDS Ordination 21
4.1.2 Individual Vegetation Group Descriptions 25
4.1.3 Relationship between Plot Descriptors and Vegetation Type 38
4.1.4 Principal Components Analysis 39

4.1.5 Comparing Descriptors Amongst Vegetation Groups 40
4.1.6 Categoric Environmental Variables 41
4.1.7 Percentage Ground Cover 45
4.1.8 Principal Species 46
4.1.9 Vegetation Patterns Among Groups 49
4.1.10 Wetland Determination 50
4.2 Drone Survey 52
4.2.1 Images Collected 52
4.2.2 Mosaic of Orthomaps 52
4.2.3 Classification 55
4.2.4 Extent of vegetation groups 61
5.0 References 63

Index to Tables

Table 1: Height intervals used to define vegetation tiers. 13
Table 2: Results from ANOSIM, PERMANOVA and PERMADISP tests for groupings from the NMDS ordination diagram and the 13 classification methods with k=13. 23
Table 3: Group classification confidence of the five 2025 vegetation plots. 24
Table 4: Mean percentage cover per plot for principal species in each of the thirteen vegetation types (A–N, described in text). 26
Table 5: Comparison between vegetation types identified in this survey and previous surveys. 37
Table 6: Correlation values (D^2) between the ordination and numeric variables describing vegetation plots at the Buller Plateaux. 38
Table 7: Mean and 95% confidence intervals *(CI95%)* for environmental variables by vegetation type for the 13 ordination groups. 40
Table 8: Proportion of plots in the 13 ordination groups according to location, physiography and drainage. 42
Table 9: Mean percentage ground cover values with 95% confidence intervals *(CI95%)* for the five ground cover types in vegetation plots belonging to the 13 ordination groups. 45
Table 10: Principal species identified from 152 RECCE plots at the Buller Plateaux. 47
Table 11: Comparison of the plot group assignments in NMDS ordinations obtained using the full data set (of 256 species) and the 35 Principal Species. 48
Table 12: Number of plant species per plot recorded in plots assigned to the 13 ordination groups. 49
Table 13: Percentage cover for plots assigned to the 13 ordination groups. Values for each group are mean total cover for plots in a group and the mean of cover scores for each the five height tiers for plots in that group. 50
Table 14: Natural inland wetland status of vegetation groups. 52

Table 15: Survey dates, location and drones used. 52
Table 16: Section designation and extent of the overall orthomap. 53
Table 17: Number of training samples generated for classification. 57
Table 18: Accuracy and Kappa values of the mosaics for each section. 60
Table 19: Extent of vegetation groups at the Buller Plateaux*. 61

Index to Figures

Figure 1: The Buller Plateaux in relation to the Ngakawau Ecological District. 5
Figure 2: Location of Brunner coal measures geology in relation to the Buller Plateaux. 9
Figure 3: Summary of vegetation mapping methods for the Buller Plateaux. 11
Figure 4: Plot locations at the Denniston Plateau, Mt William and surrounds. 14
Figure 5: Plot locations at the Stockton Plateau and surrounds. 15
Figure 6: Mean cover score per plot and percentage of plots where they occurred for the 256 species recorded at 147 plots. Red symbols are the 35 principal species defined in text. 18
Figure 7: Ordination diagram from Non–metric Multidimensional Scaling (NMDS) showing the first two dimensions. 22
Figure 8: Ordination diagram from NMDS showing the first two dimensions, with 13 clusters of plots identified by colour and the letters A to N (excluding I). 24
Figure 9: Canonical Analysis of Principal Coordinates highlighting group J (red circles) in relation to Groups A-H and K, L, M and N (grey circles). The new plots are represented as black triangles. 25
Figure 10: Mixed beech-podocarp-broadleaf forest showing dominant red beech on the western slopes of Mt William. 27
Figure 11: Southern rātā-mountain beech-podocarp forest near the Waimangaroa Gorge, showing dominant podocarps with emergent Southern rātā. 28
Figure 12: Low stature silver beech-mountain beech forest near the summit of Mt William. 29
Figure 13: Mānuka-mountain beech-podocarp shrubland near Deep Stream, Stockton Plateau. 29
Figure 14: Mānuka/Gahnia-wire rush shrubland at the western Denniston Plateau. 30
Figure 15: Weedy shrubland with gorse and heath rush near Cedar Creek Road. 31
Figure 16: Mānuka-tussock-wire rush shrubland at the Denniston Plateau. 31
Figure 17: Mānuka-flax/wire rush shrubland on the Denniston plateau. 32
Figure 18: Typical low pākihi vegetation in the Deep Stream catchment, Stockton Plateau. 33
Figure 19: Tanglefern shrubland variant of low pākihi north of Stockton Mine. 33
Figure 20: Weedy low pākihi on the Stockton Plateau. 34
Figure 21: Exotic grassland with common heath rush, gorse and toetoe near Sullivan Mine, Denniston Plateau. 34

Figure 22: Tussock-flax shrubland with high flax component near the summit of Mt William. 35
Figure 23: Red tussock fen sub-type of tussock-flax shrubland in a valley near the Stockton plateau. 35
Figure 24: Leatherwood shrubland near Mt Frederick, Stockton Plateau. 36
Figure 25: Ordination diagram from NMDS overlayed by contours for a) average canopy top-height (m) and b) percentage canopy cover. The 13 clusters of plots are distinguished by colours. 38
Figure 26: PCA bi-plot showing the variable relationships on the first two principal components. 39
Figure 27: Box-and-whisker plots showing the distribution among ordination groups for: a) altitude (m asl), b) slope (º) and c) soil depth (mm). 41
Figure 28: Location of RECCE plots by vegetation type on the Denniston Plateau. 43
Figure 29: Location of RECCE plots by vegetation Group on the Stockton Plateau. 44
Figure 30: Ordination diagram showing the first two dimensions from a NMDS ordination using only the 35 principal species. 46
Figure 31: Sections of the merged mosaic of orthomaps. 54
Figure 32: Vegetation plot locations in relation to drone survey areas. 56
Figure 33: Training samples generated from the segments and based on survey plots and drone imagery. 58
Figure 34: Randomly stratified accuracy assessment points. 59
Figure 35: Vegetation within the Mapped Area. 62

Appendices

Appendix A – Plant Species List
Appendix B – RECCE Plot Vegetation Groups

Executive Summary

This report discriminates and maps the unique vegetation and habitats of the Buller Plateaux into 13 distinct vegetation groups and three land cover types.

Vegetation across the plateaux has been previously mapped by Wildland Consultants Limited (2010), who identified 19 vegetation types and four naturally uncommon ecosystems using field-based mapping across 10,000ha. This survey aimed to build on the work done by Wildland Consultants to generate reliable, ground-truthed spatial information on the vegetation and land cover types of the Buller Plateaux.

Vegetation data was derived from 152 RECCE plots carried out between 2008 and 2025, which sampled each of the 19 vegetation types from the Wildland Consultants Limited (2010) survey. Capturing and processing of high-resolution drone photographs was undertaken between 2019 and 2024.

A non-metric multi-dimensional scaling (NMDS) ordination of plot data resulted in the identification of 13 separate vegetation groups, which included three forest types, eight shrubland types and four low vegetation types. The 13 groups were distinguished by vegetation structure, with significant differences in canopy height and canopy cover observed between groups. Descriptions of each group were derived using species abundance (mean cover per plot) and occurrence (proportion of plots) for each of the species and height tiers. The number of plots per group ranged from two (exotic grassland) to 45 (mānuka-tussock-wire rush shrubland).

Geospatial machine-learning algorithms made it possible to map these 13 vegetation groups and three other land cover types (bare rock, cleared vegetation, water) across c.10,129 ha of the Buller Plateaux ('Mapped Area') at a finer scale than previously attempted. Segments of similar spectral features were produced from the orthomaps of high-resolution drone imagery and training samples generated using both plot location and respective vegetation group, and local knowledge. Training samples, which made up c. 4% of the segments, were used in the machine-learning algorithms (SVM and RF classifiers) to extrapolate vegetation and land cover groups across the rest of the Mapped Area. Manual editing ensured greater accuracy of the resulting polygon layers.

The most common vegetation groups were Southern rātā-mountain beech-podocarp forest (2485.6ha), low pākihi (2,083.3ha) and mānuka-mountain beech-podocarp shrubland (1467.8ha). Non-vegetated land cover made up about 12.6% of the Mapped Area, including bare rock (which includes the naturally uncommon ecosystem sandstone erosion pavement) which contributed to 8.7% of the Mapped Area. Much of the Buller Plateaux exhibits wetland hydrology and soil features and it was of interest to determine which vegetation groups qualified as 'natural inland wetlands' under the NPS-FM (2020). Seven shrubland and low vegetation groups were identified as 'natural inland wetlands', often dominated by mānuka, wire rush and tussock species.

Generating accurate spatial data on vegetation groups and land cover types across the Buller Plateaux and surrounds allows for more comprehensive, robust assessments of ecological effects and will be a valuable resource for planning and management of the Buller Plateaux.

1.0 Introduction

1.1 Background

Bathurst Resources Limited ('BRL') is New Zealand's largest coal producing company and is a New Zealand registered, ASX-listed, resource company with the majority of its shareholders being overseas investors. All BRL's mining operations are located within New Zealand, being distributed across the West Coast, Southland and Waikato regions. BRL operations provide thermal coal to domestic dairy and food processing industries, and for electricity generation, as well as providing coking coal for local steel making. BRL also exports high quality metallurgical coal to international steel makers.

BRL is a 65% joint venture owner (with Talley's Group Limited) of BT Mining. BT Mining currently operates the existing Stockton Mine near Westport. Some coal resources at the Stockton Mine have approximately 5–7 years remaining. To enable ongoing continuity of mining and supply of their premium coking coal product from Stockton, BRL has been undertaking exploration in areas of known coal resource across the Stockton and Denniston plateaux (collectively 'The Buller Plateaux'). This exploration work has identified several areas of suitable coal quality to enable ongoing supply to existing customers. Ongoing mining in the area would significantly extend the life and profitability of the existing mines on the Buller Plateaux and provide financial and job security for the Buller District.

The Buller Plateaux is located within the Ngakawau Ecological District. A large number of ecological surveys have been undertaken across parts of the Buller Plateaux by Solid Energy and others since at least the early 1990s which have been summarised by Ecological Solutions Limited (2025a). The Buller Plateaux is the only known area of Brunner coal measures geology which covers a large contiguous area (thousands of hectares) and where gently undulating terrain, relatively high altitude, high annual rainfall (4,000–6,400mm), poorly drained and infertile soils, and high westerly wind exposure have combined to create a distinctive coal measures vegetation. The Buller Plateaux is a low fertility environment with often shallow soils where plant growth is stunted, plants grow slowly and the food supply for animals is constrained. Vegetation forms an intricate mosaic with a high degree of natural edge which forms ecotones between different vegetation communities. This, combined with the extent and diversity of more fertile habitats surrounding the Buller Plateaux, results in a high plant species richness and a correspondingly high richness of fauna (Ecological Solutions Limited 2025a).

Newell (1990) classified vegetation communities of a coastal hillslope in the Ngakawau Ecological District based on presence/absence of 138 plant species. She identified six forest communities on tertiary Brunner coal measure parent material and 17 communities from a comparative area overlying upper cambrian Greenland greywacke. Community distribution was not affected by differences in underlying parent material. She concluded that forest community distribution related to elevational gradients, landform type, slope and aspect with vegetation compositional changes occurring gradually. Knightbridge (2002) at Te Kuha and Overmars (2012) at Escarpment Mining Area applied similar techniques to plot data resulting in classification into four and eight separate vegetation classes respectively at those locations.

Wildland Consultants Limited (2010) mapped the vegetation on the Buller Plateaux and surrounding areas using aerial photography and 'local knowledge' and identified 19 vegetation groups and four naturally uncommon ecosystems (tarns, boulderfields of acidic rock, seepages and sandstone erosion pavement). A fifth naturally uncommon ecosystem, pākihi, is also present.

This is the first attempt to map the vegetation of the entire Buller Plateaux and surrounding areas using plot-based descriptions and multidimensional vegetation classification methods.

1.2 Scope of Report

Wildland Consultants Limited (2010) described and mapped 19 broad vegetation types and four naturally uncommon ecosystems across more than 10,000ha of the Buller Plateaux and surrounds. The survey was done using field mapping from aerial photographs and subsequent desktop mapping. Wildland Consultants Limited (2010) recognised that mapping uncertainties existed for areas that were not ground-truthed, and suggested further information on subcanopy, understorey and ground cover composition could provide justification for changes to vegetation groups.

We have used high resolution drone photographs collected between 2021 and 2024 and a plot-based survey combined with multivariate analysis to discriminate, describe and map the vegetation groups across the Buller Plateaux in high resolution. The purpose of this survey is to reliably map vegetation groups across the Buller Plateaux in greater detail than previously, sufficient to inform an ecological impact assessment. Plot based surveys were carried out in all of the 19 vegetation groups identified by Wildland Consultants Limited for use in training an algorithm classification tool and an ordination/multivariate analysis was carried out to discriminate vegetation groups as discussed in more detail below.

This report includes the work of Dr Brian Lloyd (Lloyd's Ecological Consulting) and Dr Glenn Aguilar (Unitec Institute of Technology) both of whom have contributed to previous vegetation survey work across the Buller Plateaux. Analyses of data collected from 152 modified RECCE plots across the Buller Plateau to distinguish vegetation groups was undertaken by Dr Brian Lloyd. Plot data collected 2008–2012 was collected by Fred Overmars, Richard Nichol and Sonia Roxburgh. Geospatial analyses were undertaken by Dr Glenn Aguilar which involved capturing and processing high resolution drone images of the Buller Plateaux, and applying vegetation groups to segments produced on the resulting orthomaps. Morgan Newburry (MBC Environmental) also contributed drone imagery for analysis.

The purpose of this report is to generate reliable, ground-truthed spatial information on the vegetation of the Buller Plateaux and build on the work done by Wildland Consultants Limited (2010). Generating accurate spatial data on vegetation groups across the Buller Plateaux allows for more comprehensive, robust assessments of ecological effects and will be a valuable resource for planning and management of the Buller Plateaux.

1.3 Limitations

Mapping a large area of an environment that contains fine-scale vegetation mosaics with indistinct boundaries using the methods described in this report presents some challenges.

Firstly, polygons were determined using a spatial analyst tool in ArcGIS, which grouped pixels with similar spectral and spatial characteristics into distinct segments. Several iterations of the segmentation process were needed to produce an acceptable result. Variation in drone imagery (i.e., lighting, shadows, resolution) appeared to have affected segment size and shape. The rest of the mapping exercise relied on the segmentation output. Segments did not always distinguish different vegetation and land cover groups, and there were areas of overlap where multiple groups existed within a segment. During additional processing, once a draft map had been produced, manual edits had to be made to segment shapes to increase accuracy, although time and practicality limited the extent to which manual edits could be made. Assigning training segments relied on both assignment of plots to vegetation groups as well as local knowledge. Vegetation group descriptions and individual plot descriptions aided in assigning training segments. However, not all of the plots within an assigned vegetation group were consistent with the overall group characteristics, so assignment of training segments at these plot locations was based on local knowledge and individual plot descriptions.

The small sample size of plots relative to the size of the Mapped Area likely contributed to inaccuracies in vegetation or land cover type assigned to segments. For example, five of the vegetation groups were based on between two and four plots, so assigning training samples to these groups was limited by the small number of plots and relied heavily on local knowledge. The machine-learning algorithms produced inconsistencies in distinguishing bare rock versus cleared vegetation, which can appear similar, even to the human eye. Again, manual edits to these land cover groups were required.

Processing large files, including high-resolution drone imagery and shapefiles of segments requires high storage and processing power. There were limitations in minimum segment size and the amount of polygon vertices for practical use in GIS software, which required a simplification tool to be applied to the segments. This resulted in a shapefile that was practical to use but reduced accuracy at a small scale.

The large scale of the mapping exercise and data limitations meant small watercourses were often not detected during the segmentation process. The 'water' cover class typically included water infrastructure and visible open water within rivers.

2.0 Ecological Setting

2.1 Ngakawau Ecological District

The Ngakawau Ecological District ('ED') covers approximately 48,750ha, as shown in Figure 1, and is located in the North Westland Ecological Region (McEwen 1987). The ED is characterised by elevated coal plateaux in the southwest and west trending coastal hills and low mountains up to 1,400m asl in the north and southeast (McEwen 1987, F. Overmars pers. comm. 2011). The district includes large areas of Eocene (40 – 50 million years old) quartz sandstone, grit and conglomerate with Brunner coal seams forming dissected plateaux with highly distinctive vegetation. The district experiences mild temperatures and high rainfall (2,800–6,000mm per annum) and most of the district remains in indigenous vegetation (McEwen 1987).

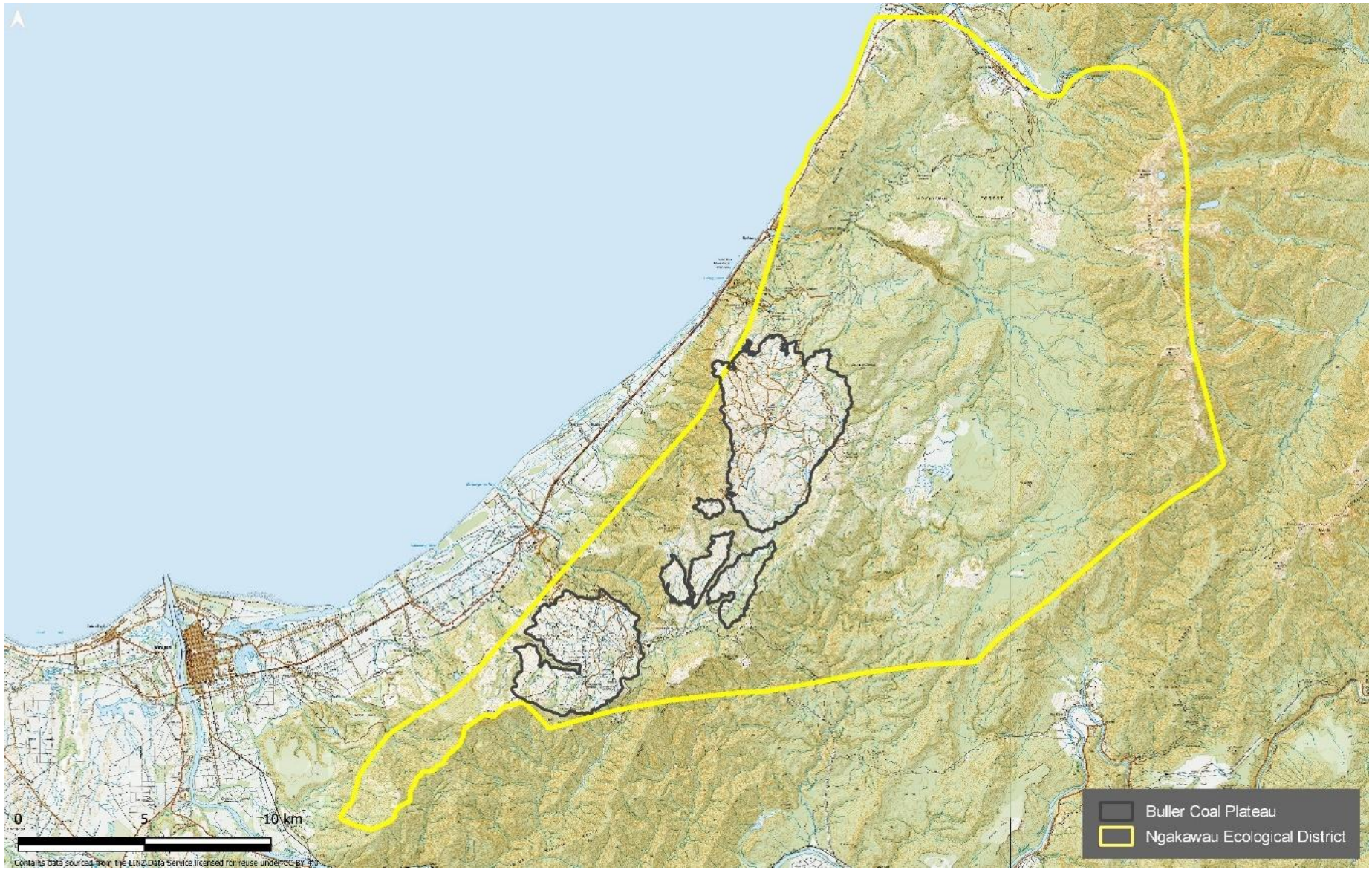


Figure 1: The Buller Plateaux in relation to the Ngakawau Ecological District.

The district includes endemic species such as *Chionochloa juncea*[1] (North Westland snow tussock, coal measures tussock) and the Ngakawau Gorge daisy (*Celmisia morganii*) (McEwen 1987, Overmars et al. 1998). The Ngakawau Gorge daisy is "virtually confined" to the Ngakawau Gorge (McEwen 1987, Gosden 2023). The streamside tree daisy (*Olearia cheesemanii*) is also present in the district, along with *Sticherus tener*, *S. urceolatus* and *Metrosideros parkinsonii*. Both species of *Sticherus* (umbrella fern) and *M. parkinsonii* (Parkinson's rātā) have disjunct (discontinuous) distributions which include the Ngakawau Ecological District. Weeds are largely confined to disturbed areas on the Buller Plateaux, including active and retired mining areas, roads and tracks. The most common weed species are gorse (*Ulex europeaus*) and heath rush (*Juncus squarrosus*). Additional exotic weed species have been identified and are present in isolated areas, normally as a result of previous disturbance or human occupation.

The bryophyte flora of the Ngakawau ED is unusual in that it includes a high diversity of species, including a large number of 'threatened' and 'at risk' species, as well as a number of unusual records of species either found at very few other locations elsewhere in New Zealand, or otherwise known from overseas. Between 1997 and 2020, bryophyte surveys in the Ngakawau ED identified approximately 123 moss species, 345 liverwort species, and five hornwort species (Ecological Solutions Limited 2025a). In addition, several undescribed liverwort species, including those from the genus *Riccardia*, have been recorded in pākihi habitats across the Buller Plateaux (D. Glenny pers. comm.). A recent addition to the liverwort flora is *Riccardia dimorpha*, described in 2024 with the type location of the Stockton Plateau (Glenny 2024).

Lichens have seldom been separately surveyed at Stockton and Denniston, but open sandstone pavement and quartzite sands are known to provide important habitat for *Austropeltum glareosum* ('Threatened – nationally vulnerable') and *Pycnothelia caliginosa* ('Threatened – nationally endangered'). Despite the lack of extensive survey, approximately 98 species of lichens are known from the Buller Plateaux (Ecological Solutions Limited 2025a). Of the species recorded to date, four are considered 'Threatened', eight 'At Risk', and fourteen 'Data Deficient' (Ecological Solutions Limited 2025a).

At least four species of lizard are known to occur in the Ngakawau Ecological District including West Coast green gecko (*Naultinus tuberculatus*), forest gecko (*Mokopirirakau granulatus*), Newman's speckled skink (*Oligosoma newmani*) and Northern grass skink (*O. polychroma*) (Department of Conservation Herpetofauna Database). Of those species West Coast green gecko is considered to be 'Threatened - nationally vulnerable' and forest gecko, and Newman's speckled skink are considered to be 'At Risk – declining'. Northern grass skink are considered 'Not Threatened' (Hitchmough et al. 2021).

Pākihi shrubland provides habitat for South Island fernbird (*Bowdleria punctata punctata*), which are also locally common throughout parts of the Tiger and Blackburn pākihi and at Te Kuha (R. Buckingham pers. comm. 2013, G Bramley pers. obs.). Tall forest vegetation on fertile sites within the ED provides habitat for other threatened bird species such as kākā (*Nestor meridionalis meridionalis*), great spotted kiwi (*Apteryx maxima*) and New Zealand falcon (*Falco novaeseelandiae*). Kea (*Nestor notabilis*) are also known from the district (McEwen 1987, Ecological Solutions Limited 2025a).

Bats (presumed to be long-tailed bats) were recorded at Happy Valley in the upper Waimangaroa Valley in March 1997, however more recent surveys have failed to detect bats on the Buller Plateaux (Ecological Solutions Limited 2025a). The closest recent bat records suggest a resident population of long-tailed bats in the Mōkihinui River valley to the

[1] Botanical names used here are as used by the New Zealand Plant Conservation Network (www.nzpcn.org.nz).

north-east of (outside) the Ngakawau ED.

The threatened land snails *Powelliphanta patrickensis*, *P. augusta* and sub-species of *P. lignaria* are also endemic to the Ngakawau ED with *P. patrickensis* and *P. augusta* endemic to the Buller Plateaux (Walker 2003, Walker et al. 2008, 2024).

The invertebrate community of the Buller Plateaux is predominantly indigenous and includes cosmopolitan species, Westland endemics and species adapted to wet, alpine environments (Ecological Solutions Limited 2025a). Previous terrestrial invertebrate surveys have often collected 'new' species, i.e., those that have not been encountered in the area before, as well as, occasionally, undescribed species which are new to science. This is likely due to the high invertebrate richness which is characteristic of the Buller Plateaux and associated with the diverse vegetation mosaic which occurs there and consequently the high diversity of habitats it provides. Furthermore, coal measures vegetation has a number of features in common with higher altitude vegetation, and as such supports an invertebrate fauna that also includes elements of higher altitude invertebrate communities. For example, alpine grasshoppers, the screaming cicada (*Maoricicada cassiope*), the stick insect *Mimarchus tarsatus*, the snow tussock wainscot (*Ichneutica ceraunias*) and Harris's tussock butterfly (*Argyrophenga harrisi*) have all been collected from the Buller Plateaux and are typical of wet, alpine environments where they occur elsewhere (Ecological Solutions Limited 2025a). Despite relatively extensive terrestrial invertebrate surveys on the Buller Plateaux, only seven species of conservation concern have been recorded there, including the two species of *Powelliphanta* snail mentioned above. Other invertebrate species of conservation concern recorded include the Avatar moth (*Arctesthes avatar*), the flatworm *Spathula neara*, the caddis fly *Kokira miharo*, the hydrophliid beetle *Rygmodus alienus* and the forest ringlet butterfly (*Dodonidia helmsii*) (Ecological Solutions Limited 2025a).

The lack of 'Threatened' and 'At Risk' species identified may be due, at least in part, to the limited ecological knowledge with respect to the invertebrate species detected, particularly the undescribed species.

Surveys throughout the Buller Plateaux over a number of years have demonstrated that mice (*Mus musculus*), rats (primarily *Rattus rattus*), possums (*Trichosurus vulpecula*) and stoats (*Mustela erminea*) are present in most habitats at varying densities depending on a number of factors including habitat, seasonal influences, recent pest control operations and mast seeding events (Ecological Solutions Limited 2025a, Alliance Ecology 2025). Goats (*Capra hircus*) are known to occur over some areas of the Buller Plateaux but are more common in the surrounding forested areas, particularly to the east (including Cascade Mine). Deer (primarily red deer, *Cervus elaphus*), hares (*Lepus europaeus*) and cats (*Felis catus*) have not been recorded over or near the Denniston Plateau in recent times. However, these species are thought to be present in the general area and hares are present within the Stockton mine site on the Stockton Plateau (Ecological Solutions Limited 2025a).

Overall, pest animals are typically more common in forested habitats within the Buller Plateaux and the surrounding forested slopes. These forests are warmer and more fertile and, therefore, provide better habitat for fauna, including introduced mammals.

Approximately 94% of the 5,272ha Buller Plateaux receives ecosystem management funded by Bathurst Resources as part of the Denniston Permanent Protection Area ('DPPA', 718 ha); Denniston Biodiversity Enhancement Area ('DBEA' 1,742ha); Snail Enhancement Area ('SEA' 893ha) or Wider Habitat Enhancement Area ('WHEA' 1,588ha). These management areas extend beyond the plateaux to adjoining habitats. Together the DPPA and the WHEA comprise 12,700ha which covers c. 26% of the Ngakawau Ecological District. The WHEA surrounding Stockton Plateau primarily involves pest control to protect great spotted kiwi and *Powelliphanta* snails. The DBEA involves weed, predator and pest

control and monitoring within 4,500ha within and around the Denniston Plateau. The wider Buller Plateaux and surrounds have also been subject to regular aerial 1080 operations in an effort to reduce the incidence of bovine tuberculosis in possums (most recently control operations have occurred in 2005, 2009, 2015, 2019 and 2023) (Ecological Solutions Limited 2025a). These operations will also have temporarily reduced populations of other resident mammals (particularly rodents and mustelids), but monitoring suggests mammal numbers regularly exceed biodiversity protection thresholds (Alliance Ecology 2025, Ecological Solutions Limited 2025a)

2.2 Brunner Coal Measures

2.2.1 Coal Measures Geology

The term “coal measures” refers to geological sediments laid down in a depositional environment in which coal can form (Overmars et al. 1998). Coal measures may, or may not, contain coal.

Brunner coal measures occupies an area of 26,585ha on the northern West Coast of the South Island between Golden Bay and Ross and extending as far east as the Gordon Range (north of St Arnaud). The largest concentration of Brunner Coal Measures occurs on the Buller Plateaux, where the acidic geology combines with poor drainage in a cool, wet, and windy environment to create distinctive vegetation communities and exposed gently sloping rock pavements (sandstone pavement). Brunner coal measures cover around 3,013ha at Stockton Plateau and 1,648ha at Denniston Plateau, where the most extensive vegetation communities on the exposed gently sloping rock pavements are dominated by prostrate shrub and tussock communities. Forests and shrublands comprising species adapted to infertile environments develop in more sheltered locations, or those with deeper soils, such as hill slopes and deeply incised gorges.

The approximate extent of Brunner coal measures on the Stockton and Denniston Plateaux is shown in Figure 2.

2.2.2 Coal Measures Vegetation

The vascular flora of the coal measures includes locally endemic species such as coal measures tussock (*Chionochloa juncea*) and the alpine daisy *Celmisia dubia*, as well as ‘Threatened’ and ‘At Risk’ species and species with localised distributions within New Zealand.

Two species of Australian umbrella fern (*Sticherus urceolatus* and *S. tener*) have unusual occurrences on the Buller Plateaux associated with Brunner coal measures vegetation. Both are regarded as ‘At Risk – naturally uncommon (de Lange et al. 2024). The eyebright (*Euphrasia wettsteiniana*), which has a conservation ranking of ‘At Risk – declining’ occurs in herbfields located on coal measures.



Figure 2: Location of Brunner coal measures geology in relation to the Buller Plateaux.

Thirty-one 'Threatened' or 'At Risk' plant species have been recorded from the Buller Plateaux, including the orchid *Calochilus paludosus* ('Threatened – nationally vulnerable'), coal measures tussock, *Dracophyllum densum* and red mistletoe (*Peraxilla tetrapetala* (all 'At Risk - declining') as well as *Carex carsei*, *Schizacme helmsii* and *Carex dallii* (all 'At Risk - naturally uncommon') (de Lange et al. 2024, Ecological Solutions Limited 2025a).

At least eight plant species found on the Buller Plateaux have localised distributions within New Zealand including *Actinotus novae-zelandiae*, *Astelia subulata*, *Diploblechnum fraseri*, *Celmisia dallii*, *Celmisia dubia*, *Celmisia similis*, *Metrosideros parkinsonii* and *Pseudowintera traversii* (Williams & Courtney 1998; Overmars et al. 1998). Some of these species also have disjunct (disconnected) distributions, including Parkinson's rātā and *D. fraseri*. The small shrub *Dracophyllum pubescens* is also endemic to the northern West Coast of the South Island with a patchy distribution including high altitude sites on the Buller Plateaux.

2.2.3 Buller Plateaux

The Buller Plateaux covers a large contiguous area (over 6,400ha) where gently undulating terrain, relatively high altitude, high annual rainfall (4,000–6,400mm), poorly drained and infertile soils, and high westerly wind exposure have combined to create a distinctive coal measures vegetation. Templeton and McMorran (2020) considered that the current shape of the Buller Plateaux is a function of the tectonic forces which have uplifted a north-south elongated block of the crust and erosion processes that have removed the younger part of the sedimentary sequence exposing the relatively smooth and flat surface of the weathering resistant Brunner coal measures. The Waimangaroa and Ngakawau River systems, being large, have sufficient gradient and flow to erode through the Brunner coal measures into the basement rock, which has dissected the Buller Plateaux forming the now separated Denniston and Stockton Plateaux. The extent of the Buller Plateaux and its component parts is shown in Figure 1.

A wide range of fauna species occur on the Buller Plateaux. Because of its location, the plateau is well connected to surrounding habitats which are more fertile and productive (e.g., Orikaka forests) from which species visit the plateaux and contribute to the diversity of fauna species observed, although fauna densities (particularly for birds) are often low or moderate compared to surrounding habitats.

More than 50 flora and fauna surveys have been undertaken in various parts of the Ngakawau ED including the Upper Waimangaroa and at Stockton and Denniston, usually in preparation for a development proposal, which may or may not have proceeded. These studies have identified at least 585 species of terrestrial plant, 56 species of bird (including 28 native species), 458 species of bryophyte (105 mosses, 4 hornworts, 349 liverworts), four species of lizards, more than 300 species of terrestrial invertebrates and 186 taxa of aquatic invertebrates (Ecological Solutions Limited 2025a). There are also at least five naturally uncommon ecosystems present within the Ngakawau Ecological District, all of which occur on the Buller Plateaux including seepages and flushes, boulder fields of acidic rock, sandstone erosion pavement, tarns and pākihi. Wildland Consultants Limited (2010) mapped four of these naturally uncommon ecosystems on the Buller Plateaux, including seepages and flushes (c. 1.1ha), boulderfields of acidic rock (c. 20ha), sandstone erosion pavement (c. 1,474ha) and tarns (c. 1.9ha).

3.0 Methods

3.1 Overview

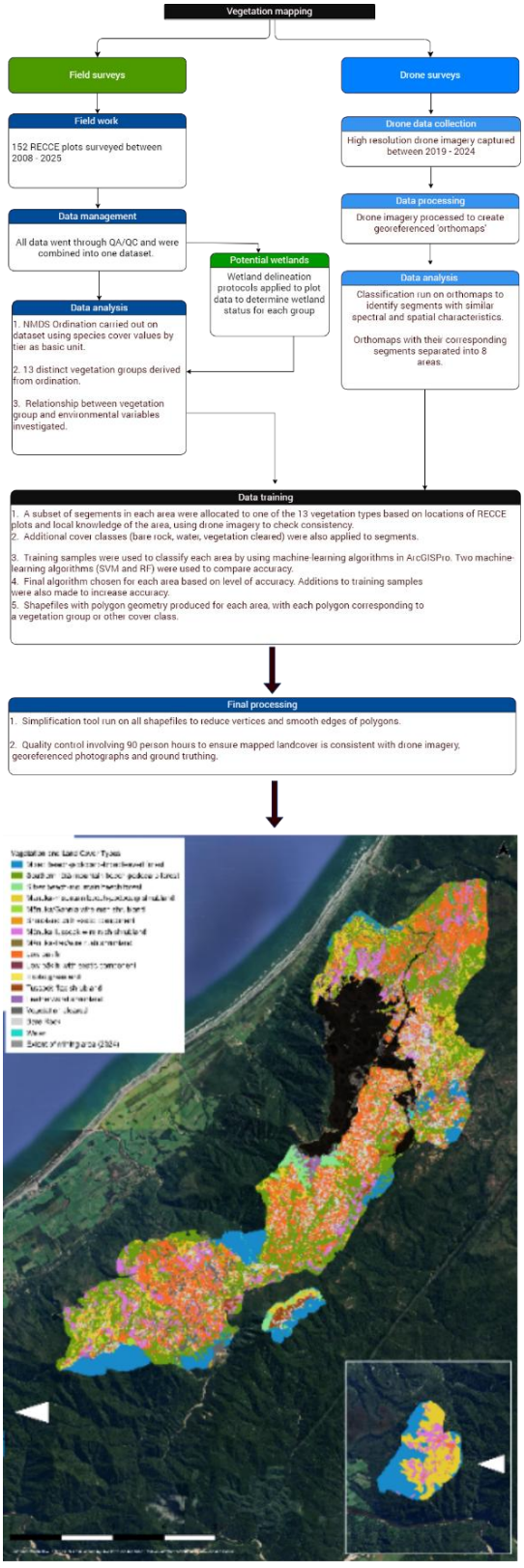


Figure 3: Summary of vegetation mapping methods for the Buller Plateaux.

3.2 Vegetation Surveys

Fifty-nine plots completed between 22 January 2024 and 22 February 2024, and five plots completed on 7 July 2025 were combined with existing data from 88 similar plots collected in previous surveys (Nichol & Overmars, 2008; Lloyd, 2012; Overmars & Lloyd, 2012; Ecological Solutions Limited 2025a). This resulted in a total of 152 plots.

Vegetation types surveyed included tussockland, shrubland, tall forest, low-stature forest, herbfield, rushland and non-remediated areas. These non-remediated areas were disturbed and abandoned prior to mine rehabilitation becoming common practice. Plots were undertaken in each of the vegetation groups mapped by Wildland Consultants Limited (2010). The vegetation group recorded was generally consistent with the Wildland Consultants Limited map, except for rimu-hard beech forest which was not found during this survey, even in areas mapped as that class.

Although data from all the surveys were collected using the standard RECCE method at the time of survey (Hurst & Allen, 2007; Hurst, Allen & Fergus, 2022), there were slight differences in the methods used across the four surveys, particularly in relation to the height tiers, cover classes and plot sizes used. During the 2025 survey and surveys prior to 2024, the six standard height tiers for predominantly woody vegetation were used, whereas during the 2024 surveys, the standard height tiers for non-woody vegetation were used (Hurst, Allen & Fergus, 2022). Non-woody, or 'grassland' plots were designed to be used for predominantly non-woody vegetation, and use the same number of height tiers as woody vegetation plots but with lower heights and intervals (Hurst, Allen & Fergus 2022).

During the 2025 survey and surveys prior to 2024, the six cover-classes in the standard RECCE method (Hurst & Allen, 2007) were used to describe percentage canopy cover (i.e., <1%, 1–5%, 6–25%, 26–50%, 51–75% and 76–100%). During the 2024 surveys, the cover was estimated directly in the field and assigned to one of these classes later for analysis.

Nichol and Overmars (2008) used 5 x 5m, 10 x 10m and 20 x 20m plots for grassland, shrubland and forest vegetation respectively. During the 2011–12 and 2012 surveys all plots were 10 x 10m regardless of vegetation group (Lloyd (2012), Overmars and Lloyd (2012)). During the 2024 and 2025 surveys all plots were 10 x 10m, but each plot was divided into four 5 x 5m quadrats, with information from each quadrat recorded separately. Data sheets for grassland plots (rather than forest or shrubland plots) were used for data collection due to the widespread and locally dominant presence of herbaceous vegetation throughout the survey area.

For each quadrat in the 2024 surveys, vascular plant species were recorded along with their cover and height classes as described above. The physiography, slope angle, aspect and soil depth (using a 75cm soil probe) from each quadrat was recorded. The percentage cover of vegetation, non-vascular (i.e., bryophytes), litter, bare ground and rock in the ground layer was also recorded. Average top height (m) and the percentage canopy cover for each species present was also estimated for each quadrat. Any herbivory or other features of note, such as invertebrates or birds encountered within the plot or nearby, was also noted. Atkinson's (1985) structural class method was used to assign descriptive names to the vegetation communities.

Across the 152 plots, 287 vascular plant taxa were present, with 256 identified to species level. Over 90% of taxa were native, and five species were of conservation concern (de Lange et al. 2024). A list of plant species recorded is provided in Appendix A. Appendix B provides a description of each of the vegetation types identified for each plot.

3.3 Data Management

3.3.1 Introduction

Data from 152 plots at the locations shown in Figure 4 and Figure 5 surveyed within vegetation on the Buller Plateaux between 2008 and 2025 were used including:

- 2008: Escarpment Mine Project area and Trent Stream area (*n* = 15 plots);
- 2011–2012: An area extending east from Conglomerate Stream to Burnett's Face, but excluding the Escarpment Mine Project area (*n* = 50 plots);
- 2012: Denniston and Stockton Plateaux (*n* = 23 plots);
- 2024: Denniston and Stockton Plateaux (*n* = 59 plots); and
- 2025: Stockton North, north of the current mining area (n = 5 plots).

3.3.2 Combining Data Sets

Data from four surveys (2008 – 2024) were combined for analyses. The 2025 plots were undertaken in response to uncertainties in vegetation type during mapping in the Stockton North area, which lacked any survey plots. Data from these five plots were analysed and assigned to the ordination vegetation groups as described in Section 3.3.3.

Species names from earlier surveys were updated to the names adopted in the New Zealand Plant Conservation Network website[2]. The 2024 survey data were grouped so that cover-class and tier height definitions were consistent with those used in surveys prior to 2024 and those used in the 2025 survey as shown in Table 1. Information from the 5 x 5m quadrats used during the 2024 surveys was merged to provide information describing each 10 x 10m plot.

Table 1: Height intervals used to define vegetation tiers.

Pre–2024 and 2025 Surveys		2024 Survey	
Tier	**Height Interval (m)**	**Tier**	**Height Interval (m)**
-	-	7	0.1
6	<0.3	6	0.1–0.3
5	0.3–2	5	0.3–1
-	-	4	1–2
4	2–5	3	2–5
3	5–12	2	5–12
2	-	1	12–25
Epiphyte			

The percentage vegetation cover recorded during the 2024 surveys was converted to one of the six cover-classes used in the permanent forest plot RECCE method. The cover classes from all surveys were converted to mid-range values for subsequent analysis, i.e., <1% became 0.5%, 1–5% became 3%, 6–25% became 15.5%, 26–50% became 38%, 51–75% became 63% and 76–100% became 88%.

[2] www.nzpcn.org.nz

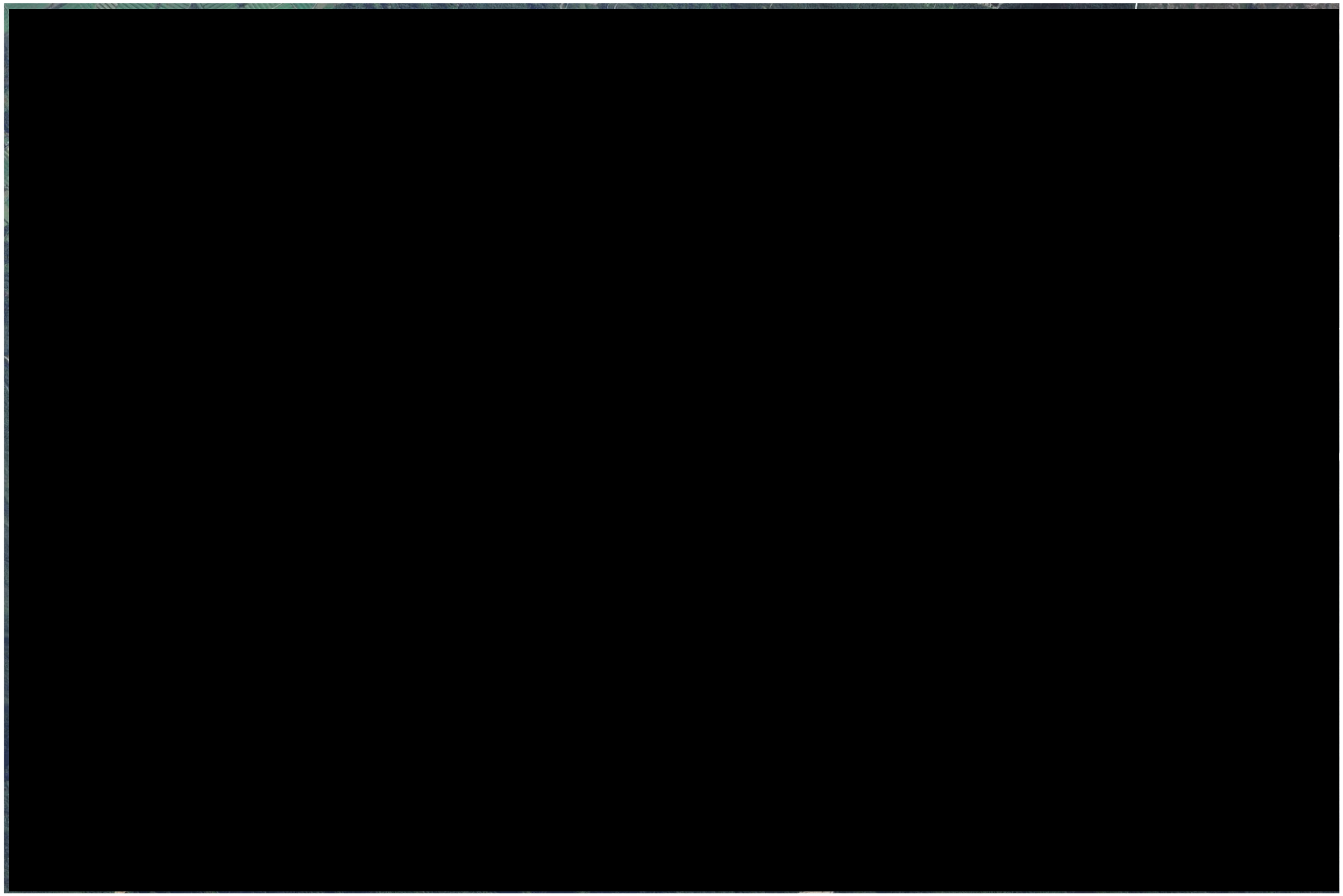


Figure 4: Plot locations at the Denniston Plateau, Mt William and surrounds.

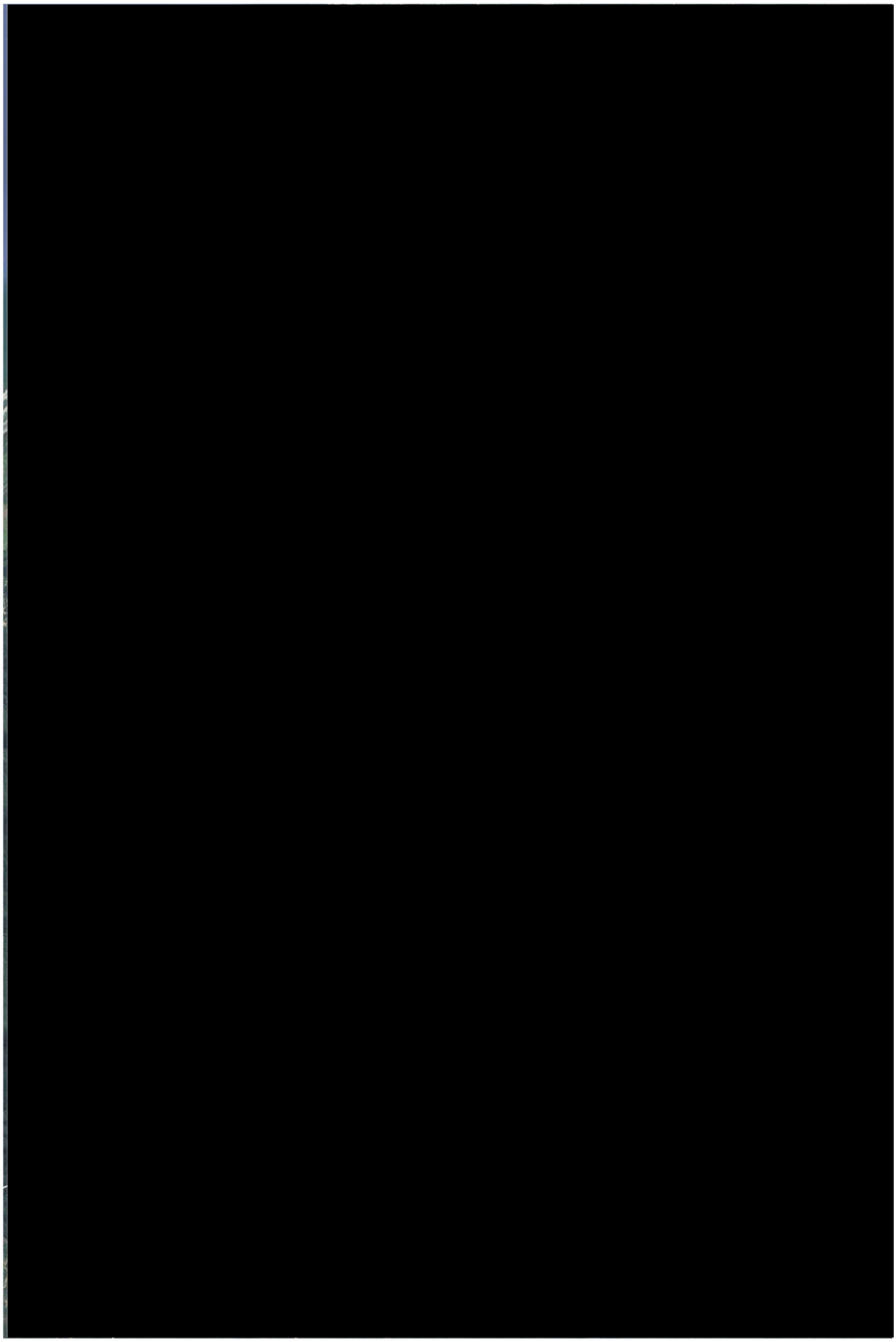


Figure 5: Plot locations at the Stockton Plateau and surrounds.

The four lowest height tiers in the 2024 survey data were collapsed into two tiers. Tiers <0.1m and 0.1–0.3m were combined to form tier <0.3m, and tiers 0.3–1m and 1–2m were combined to form tier 0.3–2m. Cover-class values for the new tiers were calculated as the average of the cover-class mid-range values for the original tiers. The Epiphyte tier was removed because there were very few epiphytes recorded in any of the surveys.

To convert information from the 5 x 5m quadrats in the 2024 surveys to 10 x 10m plots, the average mid-range value of the cover-classes in each plot's four quadrats was used as the cover for the plot.

During the four surveys, slightly different methods were used to score the variables physiography, drainage and cultural impacts (i.e., evidence of human interference). To combine data from the four surveys, physiography variables were standardized to one of 'Face', 'Gully', 'Ridge' or 'Terrace' and drainage variables were standardised to one of 'Good', 'Moderate' or 'Poor'. The cultural scores were reduced to one of either 'No recent human interference' or 'Modified'. To overcome the 360° to 0° discontinuity in the 'Aspect' data, a new categoric variable 'Cardinal' was created with the continuous aspect values converted to one of the eight cardinal points of the compass (N, NE, W etc.) plus 'Flat'. Both square-root and logarithmic transformations were applied to the vegetation cover data, and analyses were run with and without these transformations.

3.3.3 Ordination

Others (Leathwick, 1987, Duncan, Norton, & Woolmore, 1990, Norton & Leathwick, 1990) have analysed data derived from RECCE plots using a single importance value for each species in a plot to reflect its relative biomass in the plot. However, using a single importance value for each species ignores information on the vegetation's three-dimensional structure.

Structural information is especially relevant for analysing vegetation data from the Buller Plateaux, where structure is an important feature distinguishing different vegetation groups (Lloyd and Overmars 2008). For this analysis, species cover values by tier (i.e., individual cover values for each species in each tier) were retained and used as the basic unit of the analyses.

Overmars & Lloyd (2012) demonstrated that ordination using non-metric multi-dimensional scaling (NMDS) (Kruskal 1964, Minchin 1987) was the most effective method for distinguishing different vegetation groups using data from RECCE plots on the Buller Plateaux. NMDS ordinations were implemented for this study using the *R*-functions 'nmds' and 'metaMDS' in the *R*-libraries 'labdsv' (Roberts, 2011) and 'vegan' (Oksanen et al., 2011) respectively. Distance matrices for ordination analyses were produced using the Bray-Curtis method.

For NMDS ordinations with the *R*-functions 'nmds' in 'labdsv', distance matrices were estimated using the *R*-function 'vegdis' in library 'vegan'. The function 'ordcomp' (*R*-library 'labdsv') was used to plot the distribution of pair-wise distances of all points in an ordination against the distances in the distance matrix the ordination was calculated from and provide an estimate of the correlation between the two.

NMDS ordinations were conducted using species cover values with and without height tiers. Thirteen numerical hierarchical classification methods were used to classify plot data, including 11 agglomerative hierarchical clustering methods and two divisive hierarchical clustering methods.

The two divisive hierarchical clustering methods were DIANA (Divisive Analysis Clustering) and TWINSPAN (Two-Way Indicator Species Analysis). Analyses with DIANA were undertaken using the R-function 'diana' in the R-library cluster. Analyses with TWINSPAN were undertaken using the R-function 'twinspan' in the R-library twinspan.

Three tests were used to determine whether there were statistically significant differences between vegetation groups identified using ordinations and numeric classification methods:

- Analysis of similarity (ANOSIM) (Clarke & Green, 1988);
- Permutational multivariate analysis of variance (PERMANOVA) (Anderson, 2017; McArdle & Anderson, 2001); and
- PERMDISP (Anderson, 2006; Anderson, Ellingsen, & McArdle, 2006).

ANOSIM tests were performed using the R-function 'anosim' (R-library vegan) with 999 permutations. PERMANOVA tests were performed using the R-function 'adonis2' (R-library vegan) with 999 permutations. A Bray-Curtis dissimilarity matrix was used for both tests.

Analyses of multivariate homogeneity of groups dispersions (beta dispersal) were undertaken using the R-function betadisper (R-library 'vegan'), which implements the PERMDISP procedure (Anderson, 2006; Anderson et al., 2006). ANOVA tests were used to determine whether there were significant differences in dispersion among groups in each of the groupings. Pairwise comparisons of group mean dispersions were obtained using the R-function TukeyHSD (R-library stats).

Canonical Analysis of Principal Coordinates (CAP) (Anderson and Willis 2023) was used to predict group membership of the five additional plots surveyed in 2025. The original data was analysed in CAP based on square root transformed percent cover data, which was them converted to a similarity matrix using the Bray-Curtis distance measure.

The classification function of CAP was then used to classify the five new plots based on the existing vegetation groupings. The number of PCO axes used for the classification was 5 based on the scree-plot, this number (m) accounted for 78.9% of the variation in the data cloud.

Similarity Percentages (SIMPER) was used to identify species characterising group J and the new plots. SIMPER analysis was performed on community data with group as the factor. The cut-off for cumulative percent contribution to the community pattern was the 90% level of Bray-Curtis similarity.

3.3.4 Principal Species

A total of 256 species were found in the 152 RECCE plots. Many of the species occurred in only a few plots, or in only small amounts (i.e., low cover scores), as shown in Figure 6. Consequently, these less frequent species are considered unlikely to affect the ordination results. Principal species were defined as either species that were found in more than two plots (i.e. >1.6% of the plots) with mean cover scores >10% where they occurred, or as species that were found in ≥30 plots (i.e. >20%) regardless of the mean cover scores as shown in Figure 6.

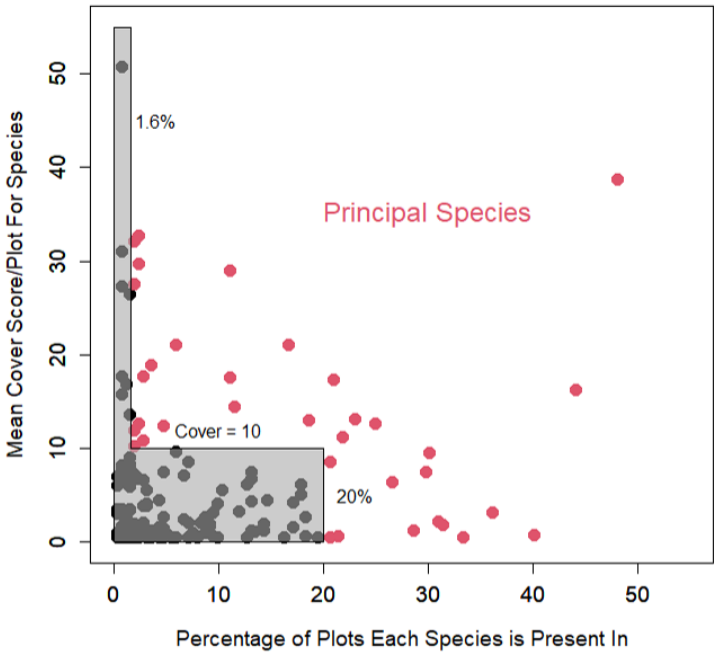


Figure 6: **Mean cover score per plot and percentage of plots where they occurred for the 256 species recorded at 147 plots. Red symbols are the 35 principal species defined in text.**

3.3.5 Investigating the Influence of Plot Descriptors on Vegetation Type

The relationships between vegetation classes identified from the ordination and numeric environmental variables describing the plots (altitude, slope, percentage ground cover) were investigated using the R-functions 'surf' and 'ordisurf' (R-libraries 'labdsv' and 'vegan'). The two functions fit smooth surfaces for the environmental variable to the ordination and plot the results on the ordination diagram using a Generalized Additive Model ('GAM') with thinplate splines to find fitted values in a regular grid for the model fit (Wood 2003). Goodness of fit was assessed by comparing correlations between calculated dissimilarities and fitted values.

Variation in the distributions of categoric values among the vegetation groups from the NMDS ordination were visualised using box-and-whisker plots (Tukey 1977). The box-and-whisker plots were drawn with the width of boxes in the plots proportional to the square-root of the numbers of plots in the groups and notches in the side of the boxes calculated as ± (1.58 x Interquartile Range / $\sqrt{n}$). Non-overlapping notches are evidence that median values for the groups are significantly different. Differences between environmental values for plots in the different vegetation groups were also tested using generalised linear models (GLMs) (Faraway, 2006; Gelman & Hill, 2007). Generalised linear models with normal (i.e. Gaussian) error distributions were used to compare the distributions of numeric variables describing the plots including altitude, slope, soil depth and average canopy-top-height. Logistic regression implemented using GLMs with binomial error distributions was used to compare percentage ground covers and percentage canopy cover in the plots. Variation in the distributions of categoric environmental values among the vegetation groups from the NMDS ordination were examined by tabulation and tested using contingency tests. Chi-squared tests were used to compare differences in the distribution of plots among values of each of the following categoric variables: location (Stockton or Denniston), drainage, physiography and aspect with the distributions of all plots among values of each of the categoric variables.

3.3.6 Principal Components Analysis

The relationship between vegetation groups and explanatory variables was examined using a Principal Components Analysis ('PCA'). PCA reduces a large set of variables into a small set that retains most information from the original data set. In this case, the variables altitude, aspect, bedrock, drainage, physiography and slope were reduced to five principal components (PC1 to PC5).

Prior to performing the PCA, the data were normalised to ensure scale independence. PCA analyses were conducted using R Version 3.6.0 (R Core Team, 2024).

Drainage in each plot was assigned a value of 1 (poorly drained), 2 (moderately drained) or 3 (well drained) from the field sheets. These values were averaged within each vegetation type creating a continuous variable for analysis using PCA. Aspect values were converted to cartesian coordinates by transforming each compass direction (θ, 0° - 360°) into sine and cosine components as follows:

- $x = \cos(\theta)$.
- $y = \sin(\theta)$.

This approach preserved the circular structure of the data whilst avoiding the discontinuity at 0°/360° and created linear data as assumed by the PCA. The results cannot be interpreted in isolation, so to provide an interpretable output, the arc tangent ratio (atan^2) of each pair of values was calculated (Mahan 1991). This provides a single value in degrees to assist in interpreting the data output.

The principal components were used as axes in an ordination to graphically represent sites in ordinal space. Principal component scores explain the percentage of variation of the variables contributed by each axis and linear coefficients define the contribution of each variable to each axis. Vectors plotted on the PCA ordination superimpose environmental gradients.

3.3.7 Wetland Determination

The wetland delineation protocols associated with the National Policy Statement for Freshwater (2020) (the NPS-FM) were applied to data from each RECCE plot to determine whether they met the definition of 'natural inland wetland'. Vegetation groups were said to meet this definition if all the plots within the group passed the vegetation tests.

Discretion was needed to determine wetland status for groups where not all plots passed vegetation tests. Hydrology, soil and environmental conditions unique to the Buller Plateaux were considered when assigning wetland status for those groups.

The dominance test involved using the 50/20 rule as described in Clarkson (2013) to determine the dominant species for each plot. Any species that occurred in more than one tier were assessed separately for each occurrence. If more than 50% of the dominants from all of the tiers had a wetland indicator rating of obligate ('OBL'), facultative-wetland ('FACW') or facultative ('FAC'), the dominance test threshold was met. Any species without a wetland indicator rating were considered to be upland ('UPL'). A prevalence test was also completed for each plot. If the prevalence test score was ≤3.00 for the plot, the prevalence index threshold was met.

If a plot passed both of these tests, it would meet the definition of a natural inland wetland set out in the NPS-FM. If only one of the tests was met, then that plot was considered likely to be a wetland, but if neither test was met then that plot would not be considered a natural inland wetland for the purposes of the NPS-FM.

Because plots were surveyed in the field following the RECCE method rather than the NPS-FM wetland delineation protocols, wetland soil or hydrological features could not always be

confirmed for each plot. However, plots that were recorded as having 'poor drainage'[3] were assumed to meet the criteria for wetland hydrology (Ministry for the Environment 2021). This helped to confirm wetland status of some plots which had inconclusive results from the vegetation tests. Additionally, soil depth was used to determine evidence of a shallow aquitard (i.e., semi-permeable–impermeable layer confirmed within 60 centimetres of the soil surface), and physiography and slope angle was used to determine geomorphic position as a secondary indicator.

3.4 Drone Photography

3.4.1 Introduction

A series of drone survey flights were conducted across the Buller Plateaux between 2019 and 2024. High resolution imagery and products resulting from the imagery processing allow the visualisation of features of the landscape, provide data for geospatial analysis and serve as a reference for future planning and monitoring efforts.

3.4.2 Drone platforms, survey and flight planning and drone operations

Several drones were utilized for this survey including the DJI Phantom 4 Advanced, DJI Phantom 4 Pro, Mavic Mini, DJI Mavic 3, DJI Mavic 3 Pro and DJI Matrice 300RTK. Survey planning involved generating maps of the drone surveys with ArcGIS Pro to identify suitable launch sites, area coverage, surrounding obstacles, regulatory regimes and identify logistic requirements such as the number of batteries required, number of flights to be flown and time required for the survey session.

Flight planning apps for iPad or iPhone including Field Agent by Sentera, SiteScan LE by ArcGIS and DroneDeploy were used for the surveys. These apps set the drone flight height, overlaps, area to be flown, speed and required drone safety settings. For the DJI Matrice 300RTK the DJI Pilot installed in the controller was used for flight planning. For the Phantom Advanced and Pro, DJI Go 4 was used to check to calibrate the drones prior to flights. Flights also followed regulations associated with part 101 of NZ Civil Aviation together with permits from agencies as required.

Drone flights required the highest possible launch site to provide coverage over the area and avoid obstacles on launch and landing. Line of sight between the drone and controller was required to maintain the link between the controller and the drone since the survey was interrupted when the connection was lost.

3.4.3 Image capture and storage

Cameras on board the drones ranged from 12MP to 40MP resolutions with image capture settings set to overlap images at 70% or better for increased orthomapping accuracy. Image data stored in each of the drones' SD card were uploaded to either a hard drive or online storage for processing.

3.5 Geospatial analysis

3.5.1 Image processing

Drone2Map orthomapping software by ArcGIS was used to process the images collected and produce two dimensional orthomaps and three-dimensional Digital Surface Model

[3] 'Poor drainage' is applicable to an area if 'water stands for extended periods', as defined in 'The Recce method for describing New Zealand vegetation – expanded manual' (Hurst et al. 2022).

('DSM'), Digital Terrain Model ('DTM') and point clouds. An online service, webODM was used in the latter surveys because online processing proved more convenient, and in most cases faster, than local workstation processing. While Drone2Map provided a significant number of tools and integrated seamlessly with ArcGIS Pro, the services provided by webODM resulted in faster processing and a similar variety of products for further analysis.

When orthomaps were completed from each flight set, these were organised in ArcGIS Pro and mosaicked to provide a wider area coverage, determine the boundary and identify the individual footprints of the source images. Radiometry adjustment via the 'Build Boundary' tool in ArcGIS was used to remove commonly occurring black and white edges around the boundaries and footprints of each mosaic. Since the elements of the mosaic were from different flights, light conditions varied and colour balancing was applied using the 'Colour Balance Mosaic Dataset' tool. Mosaics were then exported as TIF rasters for classification and further processing.

3.5.2 Classification

Each image was classified using an object- or feature- based approach. The object-based step used the 'Segment Mean Shift' tool which identifies segments with similar spectral and spatial characteristics in the imagery. Varying the spatial and spectral characteristics resulted in different segment sizes and shapes, so an iterative process was needed to reflect what were obviously distinct classes in the imagery.

Training samples were created by assigning a subset of segments a vegetation group derived from the ordination. Segments used in training were those that were located around or near a vegetation plot, or were known to be of a particular vegetation type based on the field surveys. The aim was to get training sample segments of each of the vegetation types and each of the other cover classes (bare rock, cleared vegetation and water) to improve the accuracy and reliability of the classification output.

3.5.3 Additional processing

The classification process resulted in complex segments with high numbers of vertices which resulted in very large data file sizes deemed unnecessary and impractical for vegetation mapping at this scale. A simplification tool was run on the shapefiles, which reduced the data file size and produced smoother segments with fewer vertices. Vegetation classification of individual segments was checked and corrected manually for particular areas (e.g., within proposed project areas). The active mining areas at Stockton Mine, including Cypress Mining Area, were excluded from the vegetation map due to the presence of rehabilitated areas, some of which were incorrectly classified as undisturbed vegetation types.

The accuracy of mapped vegetation was visually reviewed (and edited) via desktop assessment (approx.140 person hours) using local knowledge contributed by four members of staff whom collectively have at least 782 hours field experience on the Buller Coal Plateaux and surrounds, in association with this Project.

4.0 Results

4.1.1 NMDS Ordination

NMDS ordinations were undertaken using 147 plots: 15 from 2008, 50 from 2011–2012, 23 from 2012 and 59 from 2024.

Neither the square-root transformation nor the logarithmic transformation of cover values

improved the spread of plots in the NMDS ordination diagrams, regardless of whether height tiers were included or not. Using height tiers in the ordination resulted in more slightly dispersed plots and more evident clustering compared to the ordination without height tiers.

Figure 6 shows the first two dimensions of a NMDS ordination undertaken using the *R*-function 'nmds' in the *R*-library 'labdsv' with a Bray-Curtis distance matrix, 50 random starts and the number of dimensions $k = 6$. The k value was selected after plotting stress values for ordinations with k values ranging from two to eight.

Vegetation plots were distributed throughout the ordination plot, without discrete well-defined clusters as shown in Figure 7. The absence of well-defined clusters is perhaps not surprising since vegetation groups on the plateaux occur on a continuum, without clearly defined boundaries. The numerical methods described in Section 3.3.3 did not support the groupings identified by the NMDS ordination. When located on the NMDS ordination, vegetation plots were scattered and not clustered.

There were significant differences for all groupings derived from the NMDS ordination tested using ANOSIM, PERMANOVA ($p < 0.001$) and PERMDISP ($p \leq 0.05$). These results indicated that vegetation plots within groupings from the NMDS ordination were more similar than plots within groupings from any of the numeric classification methods. The test statistics for ANOSIM, PERMANOVA and PERMDISP are set out in Table 2.

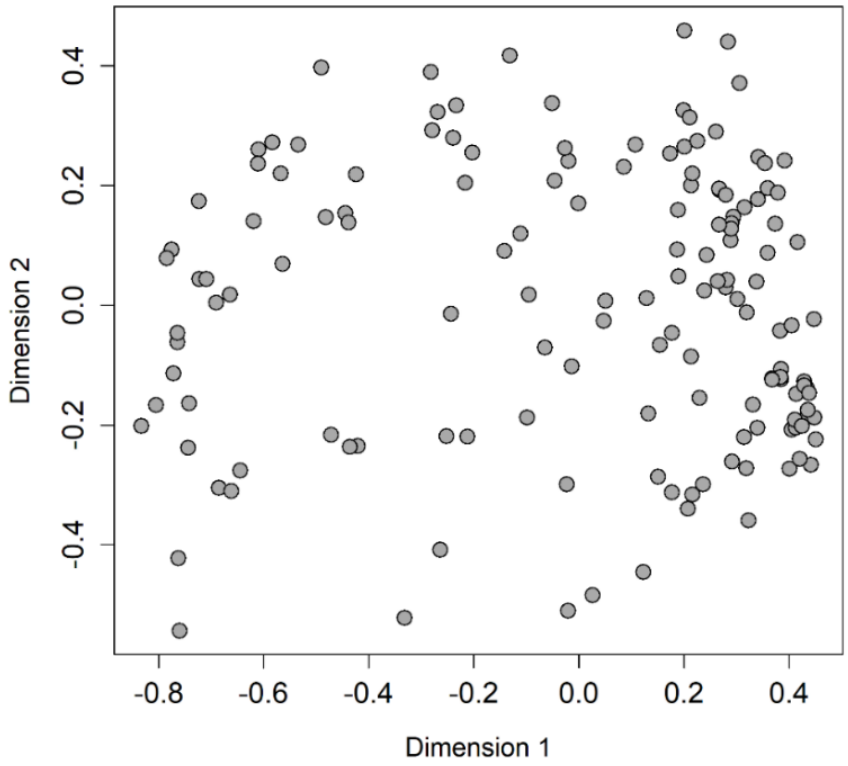


Figure 7: Ordination diagram from Non–metric Multidimensional Scaling (NMDS) showing the first two dimensions.

Table 2: Results from ANOSIM, PERMANOVA and PERMADISP tests for groupings from the NMDS ordination diagram and the 13 classification methods with k=13.

Grouping		ANOSIM		PERMANOVA		PERMDISP
		R-statistic	Rank	*F*-statistic	Rank	n Significant
NMDS Ordination						
	Original	0.766	13	20.75	1	6
	Revised*	0.811	10	20.01	2	45
Agglomerative Methods						
hclust:	Average	0.860	1	11.17	5	23
	Sqrt Average	0.815	7	10.29	9	22
	Complete	0.832	5	12.00	3	29
	Sqrt Complete	0.832	6	12.00	4	29
	Ward 1	0.766	14	5.63	13	18
	Ward 2	0.774	11	5.15	14	18
agnes:	Average	0.860	2	11.17	6	23
	Sqrt Average	0.815	8	10.29	10	22
	Flexible	0.860	3	11.17	7	23
	Sqrt Flexible	0.815	9	10.29	11	22
	Ward	0.774	12	5.15	15	1
Divisive Methods						
	DIANNA	0.841	4	9.89	12	18
	TWINSPAN	0.659	15	11.12	8	1

*~ Contains 17 groups whereas there are 13 groups in all other groupings

Although there were no well-defined clusters identified using numerical methods, some clustering was evident to the eye as shown in Figure 7. Because clustering is necessary to define the vegetation types required for mapping, clusters of plots in the ordination diagrams were delineated visually (Legendre & Legendre, 2012). Thirteen clusters were used to provide the basis for vegetation group descriptions. The clusters, or vegetation types, are labelled “A” to “N” (“I” was not used) in a clockwise direction starting in the bottom left corner of the ordination plot in Figure 8. The stress level of this ordination was 0.084.

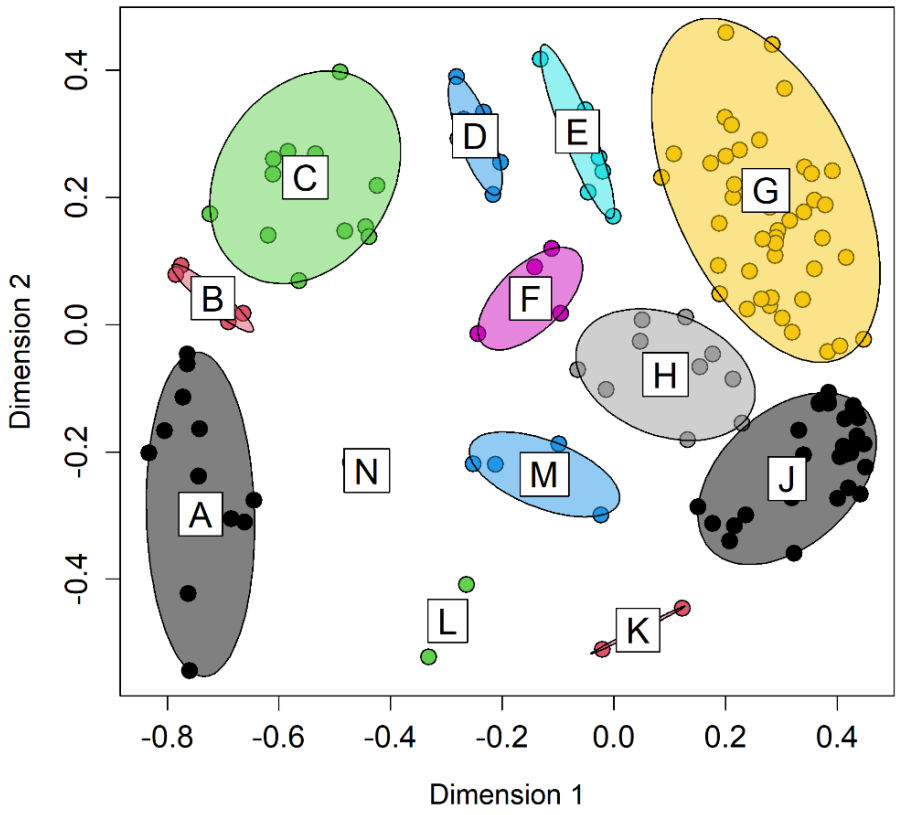


Figure 8: Ordination diagram from NMDS showing the first two dimensions, with 13 clusters of plots identified by colour and the letters A to N (excluding I).

CAP predicted with varying confidence that all five of the 2025 plots belonged to group J. Plots 3, and 5 were predicted with high confidence (81% and 100%) while there was moderate confidence in the classification of plots 1 and 2 into group J (67%) (Table 3).

Group J was characterised by *Leptospermum scoparium* and *Empodisma minus* with a cumulative contribution of 51.1% to the total similarity within the group. The new plots were characterised by *Epacris pauciflora, Leptospermum scoparium* and *Empodisma minus* with a cumulative contribution of the within group similarity of 30.6%. *Gleichenia dicarpa* had a moderate influence on the similarity amongst the new plots (18.07%), but had less influence amongst plots in group J. Overall, there was no difference between the groups (R = 0.01; P = 0.33) so between group assessments using SIMPER were not undertaken.

Table 3: Group classification confidence of the five 2025 vegetation plots.

Plot	Group prediction	Confidence	PC-1	PC-2
Plot 1	Group J	67%	0.2251	0.4078
Plot 2	Group J	67%	0.2115	0.3012
Plot 3	Group J	100%	0.3468	0.0941
Plot 4	Group J	100%	0.3135	0.1348
Plot 5	Group J	81%	0.3655	0.1891

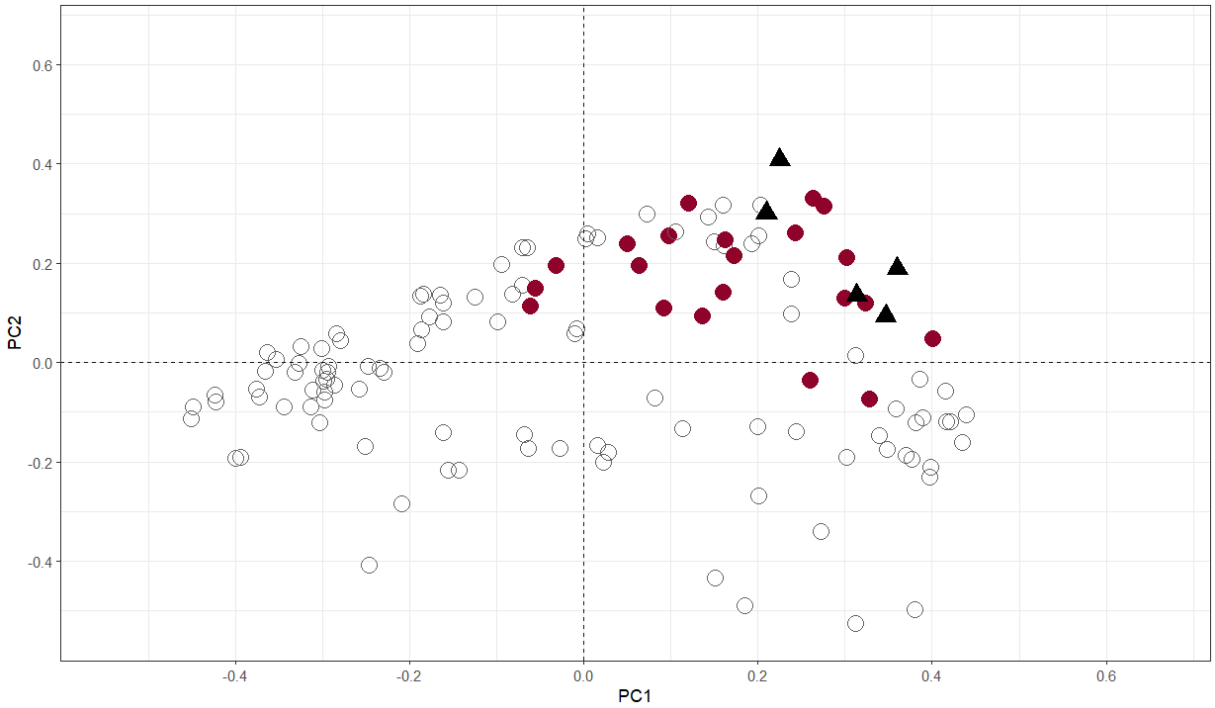


Figure 9: Canonical Analysis of Principal Coordinates highlighting group J (red circles) in relation to Groups A-H and K, L, M and N (grey circles). The new plots are represented as black triangles.

4.1.2 Individual Vegetation Group Descriptions

4.1.2.1 Introduction

Descriptions of each vegetation type were derived using species abundance (mean cover/plot) (shown in Table 4) and occurrence (proportion of plots) for each of the species and tiers grouped by the ordination groups. The descriptions for each vegetation type are provided below.

Table 4: Mean percentage cover per plot for principal species in each of the thirteen vegetation types (A–N, described in text).

Species	A	B	C	D	E	F	G	H	J	K	L	M	N
Archeria traversii	39.5	23.9	11.9	7.3				0.5					0.5
Carpha alpina				0.5	0.5	0.5	2.9	4.3	1.8	0.5		0.5	0.5
Celmisia dubia	4.8	0.5		0.5	0.5	0.5	0.6	0.8	0.7	0.5	0.5	1.8	1.8
Chionochloa juncea				0.5	1.0		9.3	11.4	8.0	0.5			
Chionochloa rubra							6.0	12.3	35.0	27.3	1.0	17.7	1.0
Dacrydium cupressinum	77.5	27.5	1.0				1.0						
Dracophyllum palustre									7.7	31.0			
Dracophyllum rosmarinifolium		0.5	21.5	4.3	1.0	0.5	4.8	3.5	2.4			2.2	0.5
Drosera spatulata				0.5	0.5	0.5	0.6	0.5	0.5	0.5		0.5	
Empodisma minus		0.5	0.5	3.8	28.8	87.5	17.5	20.9	45.5	10.5	0.5	5.5	0.5
Fuscospora cliffortioides	27.6	46.6	31.4	31.8	4.8	12.0	1.5	5.2	1.0				
Fuscospora fusca	55.0				1.0	6.5							
Gahnia procera	3.5	8.9	26.5	24.6	20.2	6.0	4.2	12.5	1.0			0.5	6.0
Gleichenia dicarpa				0.5	9.4	18.5	7.6	22.0	48.4			0.5	
Halocarpus biformis	20.5	17.6	30.8	16.3	17.5	31.0	3.9	10.5	3.5			1.0	23.5
Holcus lanatus		0.5				18.5			0.5		0.5		31.0
Juncus squarrosus		1.0				3.0	3.0		20.5	20.5	26.8	1.0	
Lateristachys diffusa			0.5	0.5	4.9	0.5	2.1	2.7	2.0			1.8	
Lepidothamnus intermedius	7.8	4.0	55.7	37.6	16.7	41.5	13.5	3.9	1.4				3.0
Leptecophylla junipera	1.0	1.5	2.8	1.4	2.0	1.3	1.1	1.5	0.5	0.5		1.1	
Leptospermum scoparium		7.0	16.3	56.5	81.5	33.2	70.9	17.2	20.1	1.0		2.3	
Libocedrus bidwillii	4.5	7.0	30.8		1.0								
Lophozonia menziesii	69.6	14.2	35.3	0.5	1.0	0.5	1.0		6.5			0.5	19.0
Macrolearia colensoi	4.0							31.0				4.8	77.3
Metrosideros umbellata	48.0	27.4	26.1	7.2	4.0	4.5	1.6	2.3	1.0	23.5	0.5	0.5	
Oreobolus strictus				0.5		0.5	0.6	0.5	0.8	0.5		1.3	
Pentachondra pumila		0.5		0.5	0.5		0.5	0.5	0.5	0.5		1.8	0.5
Phormium cookianum	4.8	2.7	7.6	8.1	14.0	14.3	5.0	31.2	1.6	1.8	1.0	30.2	12.3
Phyllocladus alpinus	23.7	29.8	33.6	4.4	5.0	6.1	2.8	3.5				0.5	0.5
Podocarpus laetus	72.3	2.0	1.8		1.0		0.5						
Pseudopanax colensoi var. ternata	28.7	19.3	3.0	1.0	0.5		0.5					0.5	1.0
Pterophylla racemosa	53.8	32.8	24.1	3.1	1.0	16.2	1.6	2.3		0.5	0.5	0.5	
Quintinia serrata	47.3	35.8	17.6	6.1	1.0	1.0	0.5					0.5	
Ulex europaeus		1.0	34.0			34.0			6.0			1.0	31.0

4.1.2.2 Group A: Mixed beech-podocarp-broadleaf forest

This group is characterised by tall (mean height 12.4m; range 3.4–30m), dense, old growth forest, dominated by large forest trees such as red beech (*Fuscospora fusca*), silver beech (*Lophozonia menziesii*), Hall's totara (*Podocarpus laetus*) and southern rātā (*Metrosideros umbellata*), with rimu (*Dacrydium cupressinum*) and red beech dominating the emergent layer. This forest group typically occurred in sheltered gullies on the lower elevation flanks of the plateaux, or on more fertile colluvial material such as the lower slopes of Mt William. An example of mixed beech-podocarp-broadleaved forest is shown in Figure 10.

The emergent tier was characterised by relatively few species (average 1.3) and a moderate mean cover score (average 25%), whereas the canopy was more diverse (5.8 species on average) and had a higher mean cover score (85%). Other common species in the canopy and sub-canopy included kāmahi (*Pterophylla racemosa*), Quintinia (*Quintinia serrata*), dracophyllum (*D. elegantissimum, D. traversii*), coprosma (*C. dumosa, C. foetidissma*), pseudopanax (*P. colensoi var. ternata, P. linearis*) and mountain horopito (*Pseudowintera colorātā*). Parkinson's rātā (*Metrosideros parkinsonii*) occurred in this vegetation group and was locally common in places. Ground cover was mainly dominated by ferns (small kiokio (*Parablechnum procerum*), crown fern (*Lomaria discolor*), *Hymenophyllum* species) and bush rice grass (*Microlaena avenacea*).



Figure 10: Mixed beech-podocarp-broadleaf forest showing dominant red beech on the western slopes of Mt William.

4.1.2.3 Group B: Southern rātā-mountain beech-podocarp forest

This medium height forest (average height 7.5m; range 3.0–11.2m) was commonly associated with gullies dissecting the plateaux, with topography providing a refuge from exposed conditions. This diverse forest group had a sparse emergent tier (mean cover score 7.7%) and a dense canopy layer (mean cover score 77%). This vegetation group had the highest species richness (109 species) and highest mean number of species per plot (39.5) of the 13 vegetation groups as shown in Table 12. An example of Southern rātā-mountain beech-podocarp forest is shown in Figure 11.

Southern rātā was often present as a sparse emergent as well as occupying the canopy in varying proportions. The canopy primarily comprised southern rātā, mountain beech (*Fuscospora cliffortioides*), the podocarps pink pine (*Halocarpus bidwillii*) and yellow-silver pine (*Lepidothamnus intermedius*) and occasionally silver beech. Pahautea (*Libocedrus bidwillii*) formed a sparse but conspicuous component of the canopy in sheltered areas, typically near waterways. The understorey was diverse and included species such as broadleaf (*Griselinia littoralis*), weeping mapou (*Myrsine divaricata*), mountain toatoa (*Phyllocladus alpinus*), pseudopanax (*P. colensoi var. ternata, P. linearis*) and various coprosma and dracophyllum species. Rōhutu (*Neomyrtus pedunculata*) was locally common within this vegetation group. Ground cover was diverse, containing gahnia (*Gahnia procera*), ferns (small kiokio, kiokio (*Parablechnum novaezelandiae*), *Hymenophyllum* species), astelias (*A. nervosa*, *A. linearis*) and tree/shrub seedlings. Orchids (*Aporostylis bifolia*, *Pterostylis* spp., *Caladenia* spp.) were also present in the ground layer.



Figure 11: Southern rātā-mountain beech-podocarp forest near the Waimangaroa Gorge, showing dominant podocarps with emergent Southern rātā.

4.1.2.4 Group C: Silver beech-mountain beech forest

Medium height forest (5.4m; range 4.1 – 6.8 m), but typically short in stature, found on high elevation sites such as the upper slopes of Mt Frederick and Mt William and in gullies across the Denniston and southern Stockton plateaux.

At high elevation sites, stunted silver and mountain beech and *Dracophyllum elegantissimum* dominated the canopy, with occasional southern rātā. *Archeria traversii*, mountain toatoa and *Pseudopanax linearis* were dominant in the subcanopy. Non-vascular vegetation was a feature of the ground layer, along with *Astelia nervosa*, coprosma species (*C. colensoi, C. foetidissma*, *C. pseudocuneata*), *Luzuriaga parviflora* (lantern berry) and mountain flax (*Phormium cookianum*).

Species composition at lower elevation sites across the Denniston Plateau was similar to that of group B, with canopy species dominated by mountain beech, silver beech, pink pine, yellow-silver pine and Southern rātā, however the vegetation in group C was shorter on average than group B.

The ‘At Risk – Naturally Uncommon’ *Pseudowintera traversii* is largely confined to this vegetation group. An example of silver beech-mountain beech forest is shown in Figure 12.



Figure 12: Low stature silver beech-mountain beech forest near the summit of Mt William.

4.1.2.5 Group D: Mānuka-mountain beech-podocarp shrubland

This group is a medium stature (mean height 3.9m; range 2.2–6.0m) shrubland or forest with a sparse upper canopy (mean cover score of 5.8%). The canopy (Tier 4) had a moderately high mean cover score (70%) and was dominated by mānuka (*Leptospermum scoparium* agg.) and mountain beech, with yellow-silver pine and pink pine in varying proportions. Southern rātā and mountain toatoa were occasional. The ground tier had a moderate mean cover score (53%), and comprised primarily gahnia, yellow-silver pine and mānuka seedlings and saplings, with some wire rush (*Empodisma minus*). Prickly mingimingi (*Leptecophylla juniperina*), *Coprosma* species, mountain flax and weeping mapou were also present in the ground layer. This vegetation group was widespread across the Buller Plateaux, and often formed part of the ecotone between taller forest on more well-drained slopes and stunted shrubland and pākihi communities either at elevation or in more poorly drained areas. An example of mānuka-mountain beech-podocarp shrubland is shown in Figure 13.



Figure 13: Mānuka-mountain beech-podocarp shrubland near Deep Stream, Stockton Plateau.

4.1.2.6 Group E: Mānuka/Gahnia-wire rush shrubland

This medium stature (mean height 2.8m; range 2.25–4.0m) shrubland had a moderately dense mānuka canopy, and the ground cover was dominated by wire rush and *Gahnia procera*. The top tier, Tier 4, had a moderate cover (44.1%) and was dominated by mānuka and to a lesser extent mountain beech, yellow-silver pine and mountain toatoa. The lower vegetation layers, Tier 5 and 6, had moderately high mean cover scores (75% and 77% respectively) and were dominated by mānuka, podocarps, *Gahnia procera* and wire rush. *Dracophyllum* species, prickly mingimingi and mountain flax were also present in the ground layer. All six plots in this group were located on Denniston Plateau. An example of mānuka/Gahnia-wire rush shrubland is shown in Figure 14.



Figure 14: Mānuka/Gahnia-wire rush shrubland at the western Denniston Plateau.

4.1.2.7 Group F: Weedy shrubland

This mixed species shrubland was of medium stature (mean height 2.01m; range 0.65–4.0m) with sparse cover in the canopy and emergent layers (Tiers 3 and 4) but dense lower tiers. The mean cover score for the ground tier exceeded 100%. Mānuka, kāmahi and pink pine were present in most plots, with occasional occurrences of mountain beech and Southern rātā. Seven exotic species were present in one or more plots in this group: gorse (*Ulex europaeus*), rushes including soft rush (*Juncus effusus*), heath rush (*J. squarrosus*) and tailed seeded rush (*J. canadensis*), and grasses including Yorkshire fog (*Holcus lanatus*), browntop (*Agrostis capillaris*) and sweet vernal (*Anthoxanthum odoratum*). All plots in this group were within or near the Denniston Plateau, but similar vegetation occurred at Stockton Plateau around roads and other disturbed areas. Three of the plots were known to have been directly disturbed in the past. An example of weedy shrubland is shown in Figure 15.



Figure 15: Weedy shrubland with gorse and heath rush near Cedar Creek Road.

4.1.2.8 Group G: Mānuka-tussock-wire rush shrubland

A low to moderate stature (mean height 0.83 m; range 0.10–4.0 m) mānuka shrubland with low to moderate mean cover scores throughout. The canopy (Tier 4), was sparse and dominated by mānuka, while mean cover scores for the lowest two tiers were moderate (51% and 63% respectively). *Dracophyllum* species (particularly *D. rosmarinifolium*), *Gahnia* spp. and tangle fern (*Gleichenia* spp.) were often present in the lower tiers. Ground cover was primarily mānuka and wire rush, with coal measures tussock (*Chionochloa juncea*) and small amounts of carpet grass (*Chionochloa australis*). A range of small herbs occupied the ground layer, most notably the mountain daisy *Celmisia dubia* and sundews (*Drosera* spp.). This vegetation group was widespread across the Buller Plateaux. It is representative of West Coast pākihi and coal measures vegetation. An example of mānuka-tussock-wire rush shrubland is shown in Figure 16.



Figure 16: Mānuka-tussock-wire rush shrubland at the Denniston Plateau.

4.1.2.9 Group H: Mānuka-flax/wire rush shrubland

This vegetation group is similar in structure to Mānuka-tussock-wire rush shrubland (Group G), but with mountain flax as a conspicuous sub-dominant species. This low stature vegetation (mean height 0.73m; range 0.2–1.63m) had a canopy dominated by mānuka and mountain flax, and ground cover dominated by mānuka and wire rush. Tussock species (*Chionochloa* spp.), *Dracophyllum* species and podocarps formed a minor component of the upper tiers. This vegetation group was typical of historically burnt areas and is found throughout the Buller Plateaux. An example of mānuka-flax/wire rush shrubland is shown in Figure 17.



Figure 17: Mānuka-flax/wire rush shrubland on the Denniston plateau.

4.1.2.10 Group J: Low pākihi

This is a stunted, pākihi-type vegetation (mean height 0.30m; range 0.07–1.0m) that was typically found on flat areas amongst sandstone erosion pavement. It is dominated by stunted mānuka and wire rush, with some red tussock (*Chionochloa rubra*), coal measures tussock and carpet grass. The upper tiers (Tiers 4 and 5) were sparse while the ground tier (Tier 6) had a moderate mean cover score (73%). *Carpha alpina*, cushion plant (*Donatia novaezelandiae*), tangle fern and sundews were commonly found in the ground layer. Exotic soft rush and heath rush were found in two plots. This vegetation group had two variants, one where pākihi rush (*Machaerina teretifolia*), square sedge (*Lepidosperma australe*) and *Rytidosperma* spp. were dominant over *Chionochloa* spp in poorly drained, flat areas and another where tangle fern was dominant beneath sparse shrubs of tāmingi (*Epacris pauciflora*), *Gahnia rigida*, mountain flax and mānuka. The second variant was mostly located on the lower elevation gentle slopes north of Stockton Mine. Examples of low pākihi are shown in Figure 18 and Figure 19.



Figure 18: Typical low pākihi vegetation in the Deep Stream catchment, Stockton Plateau.



Figure 19: Tanglefern shrubland variant of low pākihi north of Stockton Mine.

4.1.2.11 Group K: Weedy low pākihi

This vegetation group is similar to low pākihi (Group J), being low stature pākihi vegetation (mean height 0.50m; range 0.09–0.78m) dominated by wire rush, red tussock and exotic heath rush. Other Juncus species, including *J. edgariae* and *J. bulbosus* were present. Small trees and shrubs, including southern rātā, *Ozothamnus vauvilliersii* and low-growing *Dracophyllum densum* were also present. The top tier (Tier 5) had a low mean cover score, while the ground tier (Tier 6) had a moderate mean cover score (66%). This vegetation group was typically found around disturbed areas such as road and track edges. An example of weedy low pākihi is shown in Figure 20



Figure 20: Weedy low pākihi on the Stockton Plateau.

4.1.2.12 Group L: Exotic grassland

This vegetation group was of very low stature (mean height 0.31m; range 0.18–0.45m) and dominated by heath rush, along with exotic grasses such as browntop and Yorkshire fog. Exotic herbs such as catsear (*Hypochaeris radicata*) were also present, along with small amounts of native grasses and low-growing shrubs present. The top tier (Tier 5) was very sparse with a mean cover score of 2.5%, while the ground tier had a low to moderate mean cover score (43%). The two plots in this group were both located on the Stockton Plateau, but this vegetation group also occurs on the Denniston Plateau at disturbed areas. An example of exotic grassland is shown in Figure 21.



Figure 21: Exotic grassland with common heath rush, gorse and toetoe near Sullivan Mine, Denniston Plateau.

4.1.2.13 Group M: Tussock-flax shrubland

This low stature vegetation (mean height 0.93m; range 0.48–1.7m) was dominated by tussock species (red tussock and/or snow tussock (*Chionochloa flavescens*)) along with mountain flax and wire rush. A range of shrubs were present such as *Dracophyllum* species and mountain tauhinu (*Ozothamnus vauvilliersii*), but not mānuka. Exotic species were present near disturbed areas, including heath rush and catsear. This is a broad group which had three distinct sub-types represented in plots. These include red tussock fens found in valleys, toe slopes and river terraces, tussock-flaxland found in historically burnt areas and on the Mt William summit, and *Chionochloa flavescens* grassland, found on an exposed ridge near Mt Frederick. The latter is a result of dispersal of *Chionochloa flavescens* from plantings at Stockton Mine. Examples of tussock-flax shrubland are shown in Figure 22 and Figure 23.



Figure 22: Tussock-flax shrubland with high flax component near the summit of Mt William.



Figure 23: Red tussock fen sub-type of tussock-flax shrubland in a valley near the Stockton plateau.

4.1.2.14 Group N: Leatherwood shrubland

This visually distinctive low stature (mean height 1m; range 0.8m to 1.2m) shrubland is dominated by leatherwood (*Macrolearia colensoi, Brachyglottis buchananii*), and other woody species such as silver beech, in the canopy. This vegetation group occurred on high elevation, exposed slopes including Mt Frederick and Mt Rochfort. There was a wide variety of species in the three plots in the group. The top tier (Tier 5) was sparse, with a mean cover score of 4%, while the ground cover was very dense with a mean cover score >100%. Gorse, Yorkshire fog and browntop were present in one plot. *Astelia*, *Dracophyllum*, *Celmisia*, *Chionochloa* tussocks and *Coprosma* species were typical of leatherwood shrubland. An example of leatherwood shrubland is shown in Figure 24.



Figure 24: Leatherwood shrubland near Mt Frederick, Stockton Plateau.

The vegetation types identified here are compared to previous vegetation types identified in the area in Table 5.

Table 5: Comparison between vegetation types identified in this survey and previous surveys.

This study	Singers and Rodgers 2014	Mitchell Partnerships (2013)	Wildland Consultants Limited (2010)	Knightbridge (2002)	Overmars et al. 1998	McKelvey 1984	Newell (1990)
Buller Plateaux and surrounds	*New Zealand*	*Te Kuha*	*Buller Plateaux and surrounds*	*Te Kuha*	*Ngakawau Ecological Districtt*	*South Island*	*Buller Plateaux and surrounds*
Mixed beech-podocarp-broadleaf forest	CLF10: Red beech-silver beech forest	Rimu-red beech-silver beech forest Rimu/hard beech forest	Rimu/southern rātā-mountain beech forest Mixed beech forest	Hard beech-red beech/kāmahi forest Hard beech-silver beech/kāmahi forest	Unit 2: mixed beech-southern rātā forest Unit 4a: rimu/mountain beech forest	Rimu-general hardwoods-beeches Class I: NI3 - NI5	
Southern rātā-mountain beech-podocarp forest	CDF7: Mountain beech, silver beech, montane podocarp forest		Southern rātā-mountain beech forest	Mountain beech-silver beech-quintinia forest Mountain beech/pink pine-yellow silver pine forest	Unit 4c: southern rātā-mountain beech forest Unit 5: mountain beech/yellow silver pine-pine pine forest	Rimu-general hardwoods-beeches Class I: NI9 and SI6	3. Mountain beech/Gahnia forest 4. Silver beech/kāmahi-toro-Quintinia forest 1. Pink pine-yellow silver pine/Gahnia forest
Silver beech-mountain beech forest	CLF12: Silver beech-mountain beech forest		High elevation beech forest Silver-mountain beech forest		Unit 6: mountain beech-silver beech forest and shrubland	Beeches Class K: SK2	2. Mountain beech/Astelia forest
Mānuka-mountain beech-podocarp shrubland	MF18: Yellow silver pine, mānuka forest VS4: mānuka scrub	Yellow-silver pine-manuka scrub Mountain beech/yellow silver pine-pink pine forest	Mānuka shrubland Mānuka forest		Unit 5: mountain beech/yellow silver pine-pine pine forest Unit 8: [mountain beech]/mānuka scrub	Rimu-general hardwoods-beeches Class I: SI7 Beeches Class K: SK7	
Mānuka/Gahnia-wire rush shrubland	WL4: Mānuka, lesser wire rush, tangle fern scrub/fernland/restiad rushland [Pakihi] WL12: Mānuka, tanglefern scrub/fernland		Mānuka shrubland		Unit 12: [mānuka]/wire rush-tanglefern shrub-rushland		
Weedy shrubland			Vegetation with significant exotic component				
Mānuka-tussock-wire rush shrubland	WL4: Mānuka, lesser wire rush, tangle fern scrub/fernland/restiad rushland [Pakihi]	Mānuka shrubland	Mānuka shrubland [Mānuka]/wire rush-pakihi rush-tangle fern rushland	Mānuka/wire rush - tangle fern shrubland	Unit 8: [mountain beech]/mānuka scrub Unit 9: pink pine-Chionochloa juncea-mānuka tussock-shrubland Unit 10: mānuka-Dracophyllum politum[1]/wire rush rush-shrubland Unit 11: [mānuka]/wire rush-Chionochloa juncea tussock-rushland		
Mānuka-flax/wire rush shrubland	WL4: Mānuka, lesser wire rush, tangle fern scrub/fernland/restiad rushland [Pakihi]		Mānuka shrubland		Unit 12: [mānuka]/wire rush-tanglefern shrub-rushland		
Low pākihi	WL4: Mānuka, lesser wire rush, tangle fern scrub/fernland/restiad rushland [Pakihi]	Mānuka-dracophyllum rockland	Chionochloa juncea grassland [Manuka]/wire rush-pakihi rush-tangle fern rushland	Mānuka/C. juncea-C. australis-wire rush shrub-tussockland Baumea-bracken/tanglefern rushland	Unit 11: [mānuka]/wire rush-Chionochloa juncea tussock-rushland Unit 12: [mānuka]/wire rush-tanglefern shrub-rushland		
Weedy low pākihi			Vegetation with a significant exotic component				
Exotic grassland			Vegetation with a significant exotic component				
Tussock-flax shrubland	TI6: Red tussock tussockland		Red tussock fen Chionochloa flavascens grassland		Unit 14: red tussock-bog pine shrub-tussockland		
Leatherwood shrubland	CDF6: Olearia, Pseudopanax, Dracophyllum scrub [Sub-alpine scrub]		Leatherwood scrub		Unit 7: Leatherwood scrub		

4.1.3 Relationship between Plot Descriptors and Vegetation Type

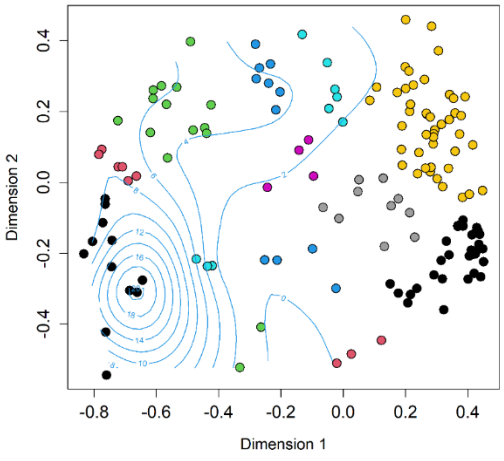
The correlation between the ordination axes and the two variables describing the vegetation structure in the plots (average top-height and percentage canopy cover), were relatively high at 0.84 and 0.72 respectively as shown in Table 6, indicating that the environmental values captured by the axes were good predictors of vegetation structure. Figure 25 shows contours for average top-height and percentage canopy cover overlaying the NMDS ordination illustrating the relationship between vegetation structure and the ordination clusters.

Use of the 'surf' function to investigate associations between the ordination values and numeric environmental variables describing the plots (i.e., altitude, slope and soil depth) produced correlation values between 0.15 and 0.34 as shown in Table 6, indicating a poor association between vegetation type and the individual environmental variables measured. The correlations between the ordination values and the percentage of vegetation cover, litter cover, bare ground and rock in the plots were also low, ranging between 0.10 and 0.27 as shown in Table 6.

Table 6: Correlation values (D^2) between the ordination and numeric variables describing vegetation plots at the Buller Plateaux.

Variable Type	Variable	D^2
Environmental		
	Altitude (m. a.s.l)	0.343
	Slope (º)	0.205
	Soil Depth (mm)	0.145
% Plot Cover		
	Vegetation	0.270
	Litter	0.268
	Bare Ground	0.098
	Rock	0.200
	Vegetation	0.270
Vegetation Structure		
	Average Top Height (m)	0.841
	% Canopy Cover	0.719

a)



b)

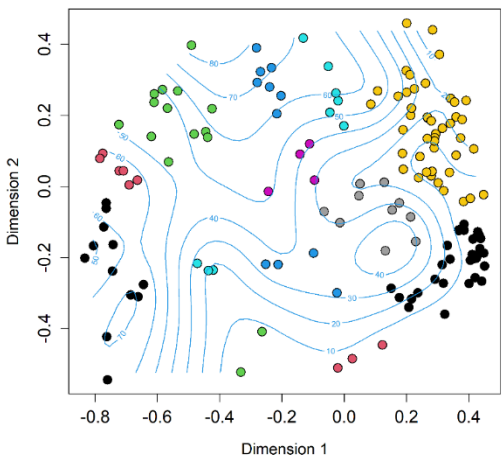


Figure 25: Ordination diagram from NMDS overlayed by contours for a) average canopy top-height (m) and b) percentage canopy cover. The 13 clusters of plots are distinguished by colours.

4.1.4 Principal Components Analysis

The first two principal components explained 54.3% of the total variance in the data. PC1 accounted for 34.8% of the variance, while PC2 explained an additional 19.4% (Figure 24). PC1 combined variables related to altitude and slope, and was positively correlated with with both. PC2 reflects the aspect, bedrock cover and a negative relationship with physiography. Aspect was positively correlated with vegetation group whilst bedrock cover was negatively correlated.

Figure 26 shows the relationships between variables based on the direction and length of the arrows. Variables pointing in similar directions are positively correlated, while those pointing in opposite directions are negatively correlated. The length of the arrows indicates how well the variables are represented in these two dimensions. The scatter of points shows how the vegetation groups are distributed in the reduced dimensional space, with their positions relative to the variable arrows indicating their characteristics with respect to these variables.

The PCA loadings for sine and cosine of aspect on PC1 (0.28, -0.008) as atan2 is 91.6° indicating this axis captures north-south facing associations with vegetation type. Loadings on PC2 (0.37, -0.73) as atan2 is 153.1° capturing northwest facing vegetation types.

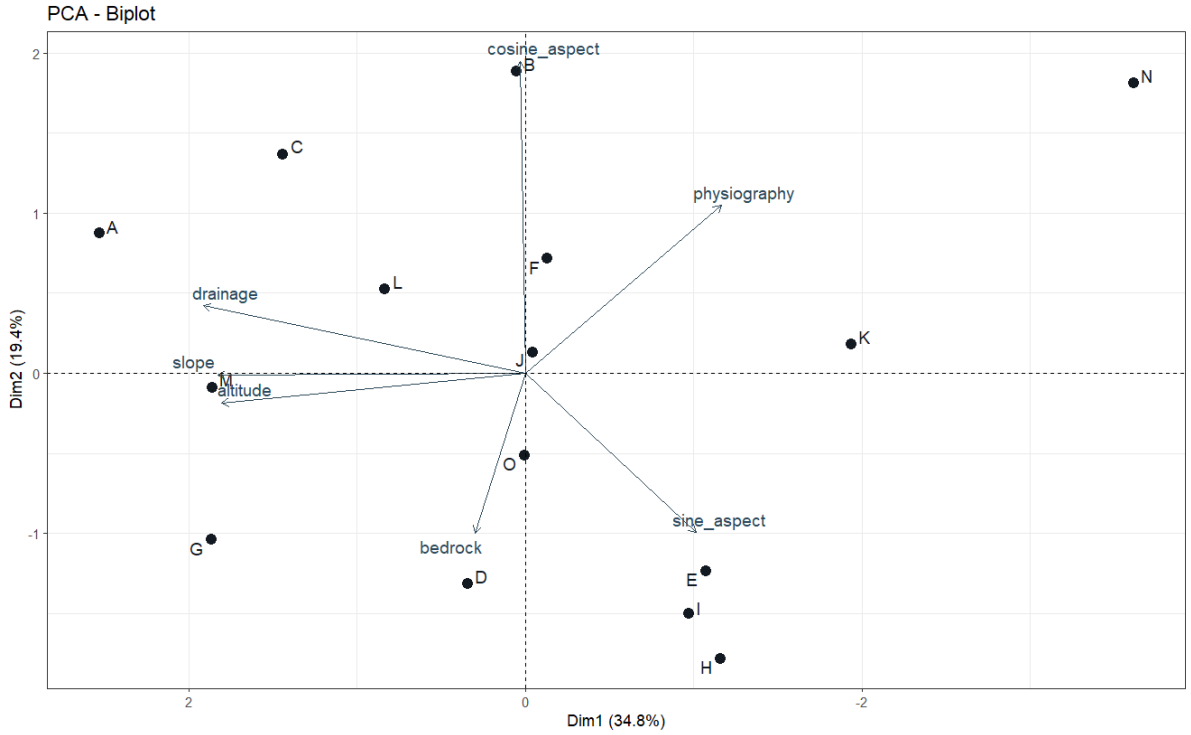


Figure 26: PCA bi-plot showing the variable relationships on the first two principal components.

Altitude, drainage and slope are strongly influential in the first principal component, indicating that changes in elevation relate to slope and drainage characteristics. Aspect and bedrock on the second component indicate that geological factors and orientation significantly influence the vegetation groups, which may have implications for vegetation or hydrology in these regions. The importance of physiography across multiple components (i.e. PC1 - PC4) suggests that physiography affects the other variables measured.

4.1.5 Comparing Descriptors Amongst Vegetation Groups

4.1.5.1 Numeric Environmental Variables

In GLMs comparing the three numeric environmental variables between plots assigned to the 13 ordination groups, there were significant differences in values for altitude (p <0.001), slope (p <0.01), and soil depth (p <0.1) as shown in Table 7. In a box-and-whisker plot of altitude for each of the groups shown in Figure 25 (a) the median altitude for plots assigned to the mixed beech-podocarp-broadleaf forest (Group A), weedy low pākihi (Group K), exotic grassland (Group L), tussock-flax shrubland (Group M) and leatherwood shrubland (Group N) vegetation types were all ≥ 800m asl, whereas the median altitude of the other eight groups were below 800m asl. Box-and-whisker plots also revealed differences in the distribution of slopes and soil depths amongst the groups, but there was no obvious pattern to the differences evident in Figure 27. Soil depth in the two plots assigned to the exotic grassland (L) group was close to 0mm. Average top height (p <0.001) and percentage canopy cover (p <0.01) were significantly different between groups.

Table 7: Mean and 95% confidence intervals *(CI95%)* for environmental variables by vegetation type for the 13 ordination groups.

Group	Plots (n)	Altitude (m asl)		Slope (°)		Soil (mm)		Average Top Height (m)		Canopy Cover (%)	
Mixed beech-podocarp-broadleaf forest (A)	12	792	*(739–846)*	17	*(10–24)*	409	*(278–539)*	12.4	*(11.0–13.8)*	64	*(35–85)*
Southern rātā-mountain beech-podocarp forest (B)	6	700	*(625–776)*	5	*(0–14)*	572	*(377–769)*	7.5	*(5.5–9.6)*	61	*(24–89)*
Silver-mountain beech forest (C)	13	725	*(674–776)*	19	*(12–25)*	421	*(283–560)*	5.4	*(4.1–6.8)*	54	*(28–78)*
Mānuka-mountain beech-podocarp shrubland (D)	7	772	*(702–842)*	21	*(12–29)*	446	*(169–723)*	3.9	*(2.0–5.8)*	68	*(30–91)*
Mānuka/Gahnia-wire rush shrubland (E)	6	713	*(638–788)*	10	*(1–19)*	444	*(167–721)*	2.8	*(0.8–4.9)*	55	*(20–86)*
Weedy shrubland (F)	4	618	*(526–710)*	9	*(0–20)*	639	*(413–865)*	2.0	*(0–4.5)*	43	*(9–84)*
Mānuka-tussock-wire rush shrubland (G)	45	707	*(680–734)*	15	*(12–19)*	331	*(239–424)*	0.8	*(0.1–1.6)*	22	*(11–38)*
Mānuka-mountain flax/wire rush shrubland (H)	10	762	*(704–820)*	19	*(12–26)*	350	*(211–488)*	0.7	*(0–2.3)*	30	*(9–64)*
Low pākihi (J)	37	652	*(661–726)*	6	*(3–11)*	257	*(162–352)*	0.3	*(0–1.1)*	17	*(2–25)*
Weedy low pākihi (K)	3	745	*(639–851)*	8	*(0–21)*	314	*(88–540)*	0.5	*(0–3.3)*	6	*(0–88)*
Exotic grassland (L)	2	858	*(728–988)*	12	*(0–27)*	75	*(0–352)*	0.3	*(0–3.8)*	2	*(0–100)*
Tussock-flax shrubland (M)	4	948	*(856–1,039)*	25	*(14–36)*	320	*(94–546)*	0.9	*(0–3.4)*	38	*(8–82)*
Leatherwood shrubland (N)	3	887	*(781–993)*	14	*(1–27)*	358	*(132–585)*	1.7	*(0–5.2)*	12	*(0–91)*

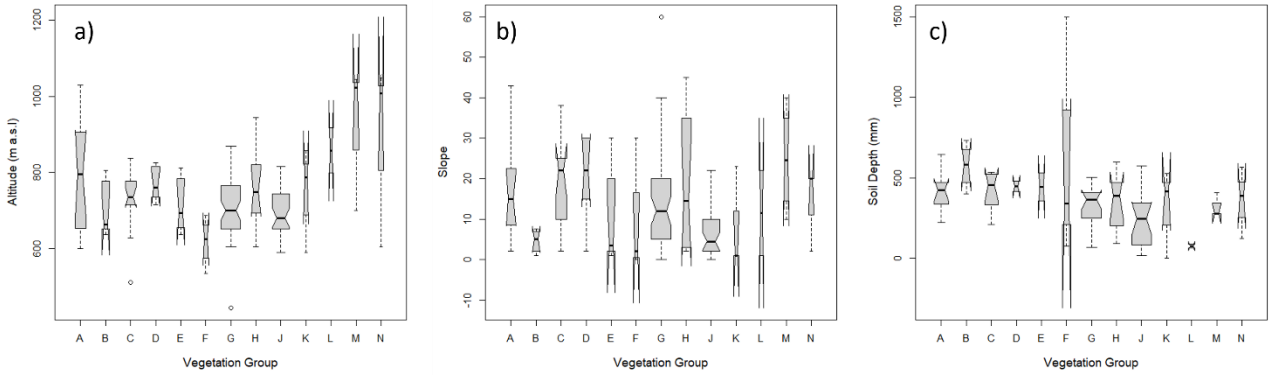


Figure 27: Box-and-whisker plots showing the distribution among ordination groups for: a) altitude (m asl), b) slope (º) and c) soil depth (mm).

4.1.6 Categoric Environmental Variables

Plots were approximately evenly spread across the drainage, physiography and aspect classes as shown in Table 8. Chi-squared tests also confirmed that plots from all 13 groups were not significantly different between the two plateaux as shown in Table 8. Eleven of the vegetation types were sampled across both plateaux, as shown in Figure 28 and Figure 29. The mānuka/Gahnia-wire rush shrubland (E) vegetation group was only sampled at Denniston and the exotic grassland (L) vegetation group was only sampled at Stockton.

Table 8: Proportion of plots in the 13 ordination groups according to location, physiography and drainage.

Factor:	Plots (n)	Plateau		Physiography				Drainage		
Categories:		Den.	Stock.	Face	Gully	Ridge	Terrace	Poor	Mod.	Good
Number of plots	152	119	33	94	18	28	12	36	48	66
Group										
Mixed beech-podocarp-broadleaf forest (A)	12	83%	17%	58%	25%	17%	-	-	8%	92%
Southern rātā-mountain beech-podocarp forest (B)	6	83%	17%	67%	33%	-	-	-	50%	50%
Silver-mountain beech forest (C)	13	62%	38%	69%	15%	8%	8%	-	-	100%
Mānuka-mountain beech-podocarp shrubland (D)	7	71%	29%	71%	14%	14%	-	-	71%	29%
Mānuka/Gahnia-wire rush shrubland (E)	6	100%	0%	67%	-	33%	-	17%	83%	
Weedy shrubland (F)	4	75%	25%	50%	25%	-	25%	50%	-	50%
Mānuka-tussock-wire rush shrubland (G)	45	93%	7%	69%	9%	20%	2%	27%	42%	31%
Mānuka-mountain flax/wire rush shrubland (H)	10	60%	40%	90%	-	10%	-	20%	40%	40%
Low pākihi (J)	37	78%	22%	41%	11%	24%	24%	42%	28%	31%
Weedy low pākihi (K)	3	33%	67%	33%	33%	33%	--	100%	-	-
Exotic grassland (L)	2	0%	100%	50%	-	50%	-	50%	-	50%
Tussock-flax shrubland (M)	4	75%	25%	100%	-	-	-	-	25%	75%
Leatherwood shrubland (N)	3	33%	67%	67%	-	33%	-	33%	-	67%
All		**81%**	**19%**	**64%**	**12%**	**19%**	**5%**	**24%**	**31%**	**45%**

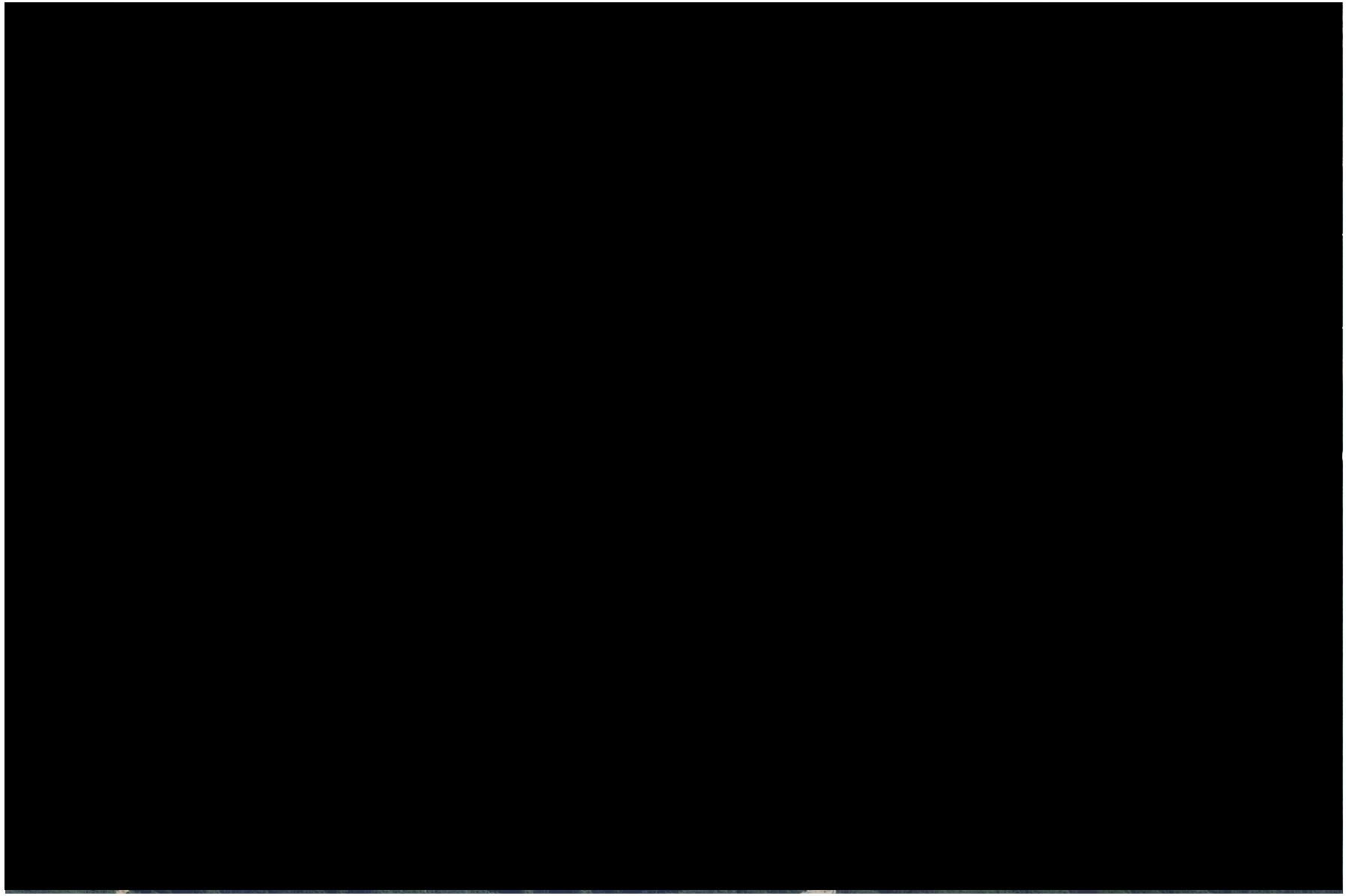


Figure 28: Location of RECCE plots by vegetation type on the Denniston Plateau.

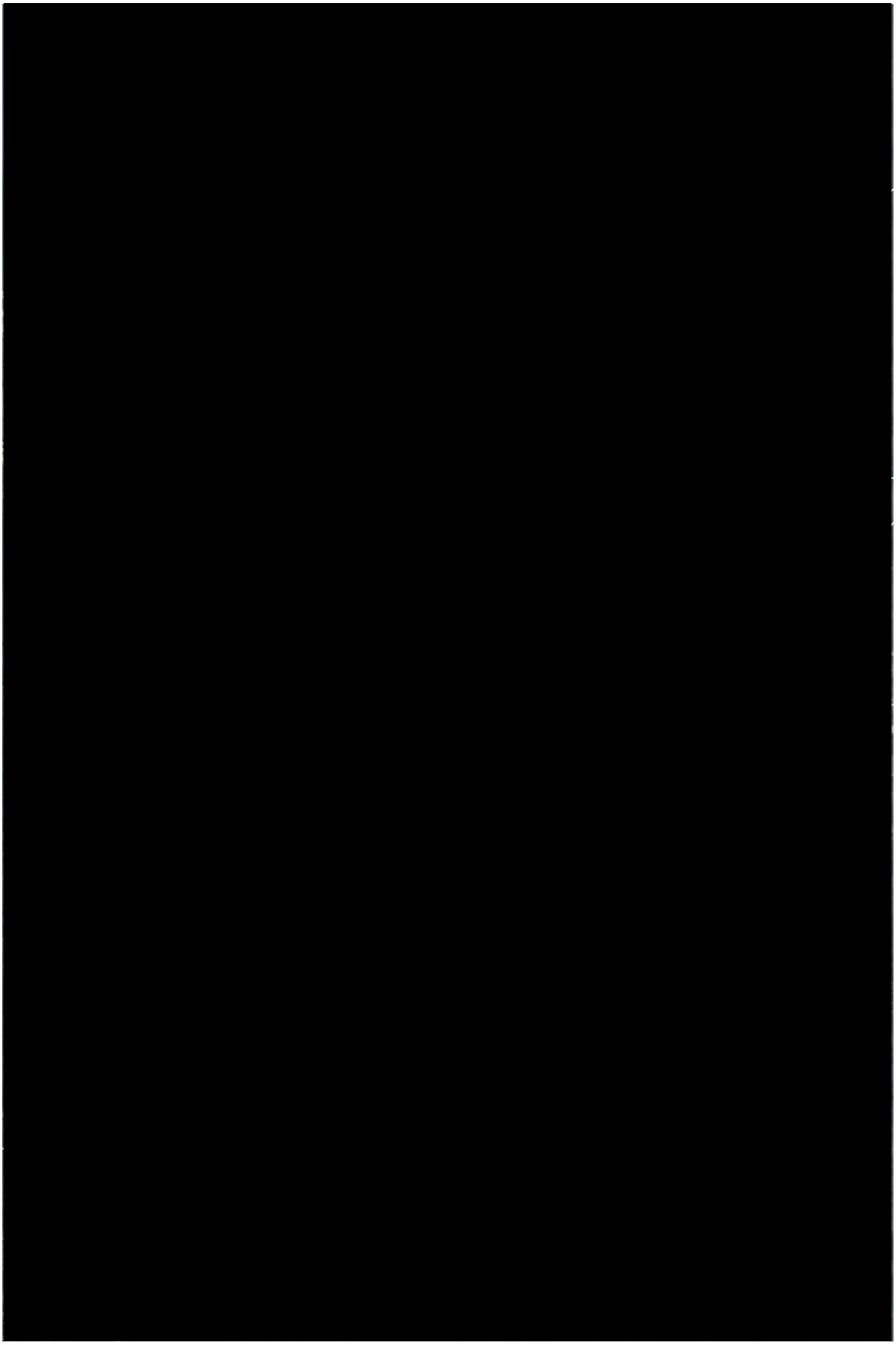


Figure 29: Location of RECCE plots by vegetation Group on the Stockton Plateau.

4.1.7 Percentage Ground Cover

Logistic regressions confirmed that there were no significant differences in the percentage cover of vascular vegetation, non-vascular vegetation, litter and rock amongst the 13 ordination groups as shown in Table 9 (p>0.1).

Table 9: Mean percentage ground cover values with 95% confidence intervals *(CI95%)* for the five ground cover types in vegetation plots belonging to the 13 ordination groups.

Group	Plots (n)	Mean Percentage Ground Cover (95% Confidence Interval)									
		Vegetation		Non-Vascular		Litter		Bare Soil		Rock	
Mixed beech-podocarp-broadleaf forest (A)	12	45	*(21–72)*	38	*(16–66)*	18	*(5–49)*	0.0	*(0–100)*	0	*(0–100)*
Southern rātā-mountain beech-podocarp forest (B)	6	48	*(16–82)*	23	*(4–67)*	24	*(5–67)*	0.5	*(0–100)*	3	*(0–75)*
Silver-mountain beech forest (C)	13	53	*(28–77)*	27	*(10–56)*	18	*(5–47)*	0.4	*(0–97)*	3	*(0–41)*
Mānuka-mountain beech-podocarp shrubland (D)	7	69	*(31–91)*	21	*(4–62)*	12	*(1–57)*	0.6	*(0–99)*	1	*(0–93)*
Mānuka/Gahnia-wire rush shrubland (E)	6	80	*(35–97)*	11	*(1–62)*	9	*(1–62)*	1.0	*(0–97)*	0	*(0–100)*
Weedy shrubland (F)	4	72	*(23–96)*	13	*(1–73)*	13	*(1–73)*	3.6	*(0–88)*	1	*(0–100)*
Mānuka-tussock-wire rush shrubland (G)	45	76	*(61–86)*	5	*(2–17)*	6	*(2–18)*	2.9	*(1–15)*	12	*(5–25)*
Mānuka-mountain flax/wire rush shrubland (H)	10	65	*(33–87)*	6	*(0–47)*	11	*(2–47)*	0.8	*(0–89)*	20	*(5–54)*
Low pākihi (J)	32	69	*(48–80)*	10	*(2–22)*	9	*(0–19)*	5.6	*(1–20)*	19	*(11–39)*
Weedy low pākihi (K)	3	52	*(10–91)*	6	*(0–88)*	4	*(0–93)*	0.7	*(0–100)*	36	*(5–86)*
Exotic grassland (L)	2	50	*(6–94)*	32	*(2–90)*	5	*(0–97)*	2.9	*(0–99)*	10	*(0–92)*
Tussock-flax shrubland (M)	4	63	*(18–93)*	12	*(1–74)*	20	*(2–74)*	0.7	*(0–100)*	4	*(0–85)*
Leatherwood shrubland (N)	3	81	*(19–99)*	3	*(0–97)*	16	*(1–81)*	0.0	*(0–100)*	0	*(0–100)*

When comparing the ground cover of the 13 groups, the most obvious feature was the variation in the percentage of rock cover amongst the groups. There was little or no rock present in the ground layer of the forest and shrubland groups A to F and group N. By contrast, rock was a significant component of the ground cover in groups G to M. The highest average percentage of rock cover was present in the weedy low pākihi (K) group (36%). These differences were not statistically significant.

4.1.8 Principal Species

Using the principal species definition set out in Section 3.3.4, the original dataset containing 256 species was reduced to a dataset containing 35 principal species as set out in Table 10. These species were used for a new NMDS ordination as shown in Figure 30. This closely resembled the ordination obtained using all 256 species (Figure **7**). Comparison of the plot assignments for the two ordinations revealed that 131 (89.2%) of the 147 plots remained in the same ordination group using either method as shown in Table 11. Where plots were reassigned to different groups in the second ordination, the groups were typically close together on the ordination axes.

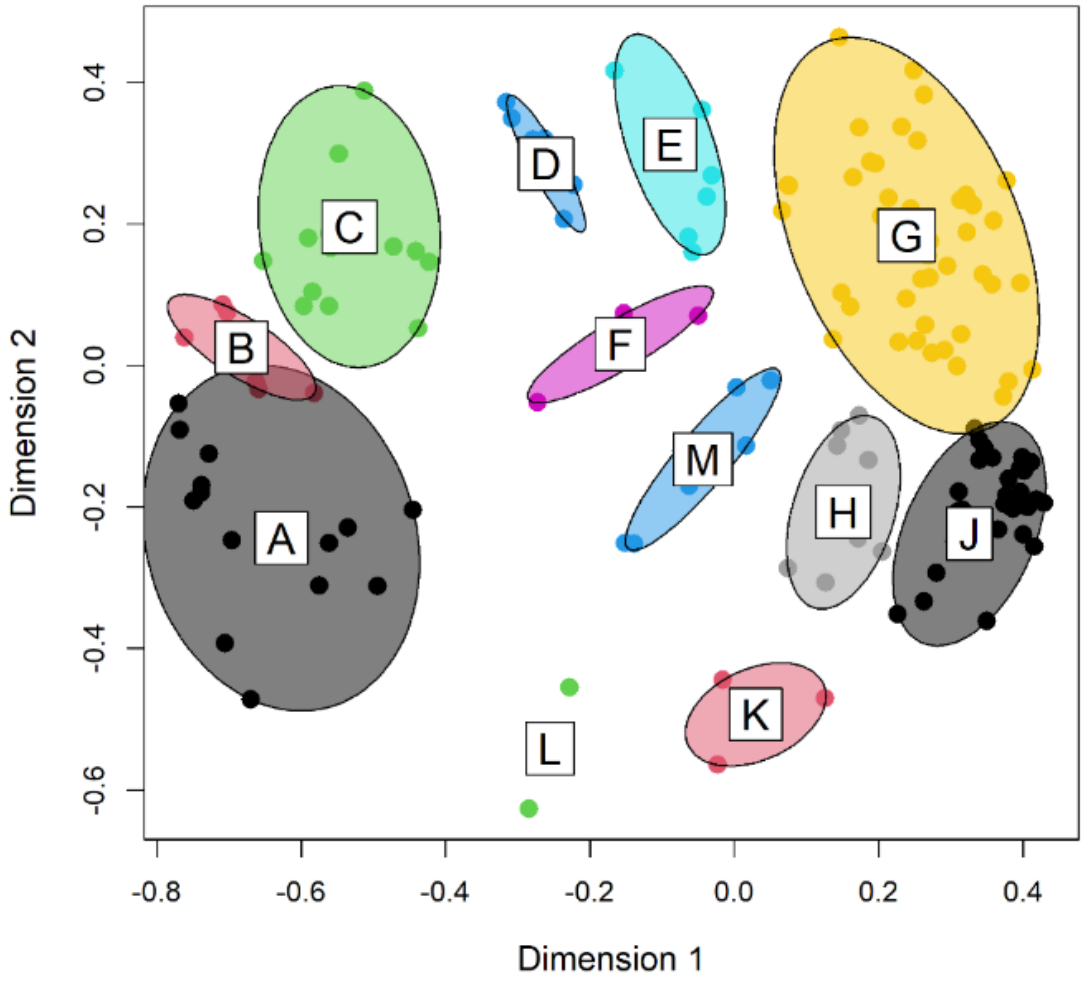


Figure 30: Ordination diagram showing the first two dimensions from a NMDS ordination using only the 35 principal species.

Table 10: Principal species identified from 152 RECCE plots at the Buller Plateaux.

Stature	Common Name	Scientific Name	Percentage of Plots	Mean Cover Score
Trees:				
	Rimu	*Dacrydium cupressinum*	2.0	27.6
	Mountain beech	*Fuscospora cliffortioides*	16.7	21.0
	Red beech	*Fuscospora fusca*	2.4	29.8
	Pink pine	*Halocarpus biformis*	21.8	11.2
	Yellow–silver pine	*Lepidothamnus intermedius*	21.0	17.3
	Mountain cedar	*Libocedrus bidwillii*	2.8	10.9
	Silver beech	*Lophozonia menziesii*	11.1	29.0
	Southern rātā	*Metrosideros umbellata*	23.0	13.1
	Mountain celery pine	*Phyllocladus alpinus*	20.6	8.6
	Hall's totara	*Podocarpus cunninghamii*	2.0	32.1
	Kāmahi	*Pterophylla racemosa*	18.7	13.0
	Quintinia	*Quintinia serrata*	11.5	14.4
Shrubs:				
	Archeria	*Archeria traversii*	11.1	17.5
	Mānuka	*Leptospermum scoparium*	48.0	38.7
	Leatherwood	*Macrolearia colensoi*	2.4	32.7
	Pseudopanax	*Pseudopanax colensoi var. ternata*	2.8	17.6
	Gorse*	*Ulex europaeus**	3.6	18.9
	Inaka	*Dracophyllum rosmarinifolium*	36.1	3.1
	Prickly mingimingi	*Leptecophylla juniperina*	28.6	1.3
Tussocks and other monocots:				
	Coal measures tussock	*Chionochloa juncea*	29.8	7.5
	Red tussock	*Chionochloa rubra*	6.0	21.0
	Tussock	*Chionochloa sp*	2.4	12.7
	Gahnia	*Gahnia procera*	25.0	12.7
	Yorkshire fog*	*Holcus lanatus**	2.0	10.2
	Heath rush*	*Juncus squarrosus**	4.8	12.5
	Mountain flax	*Phormium cookianum*	30.2	9.5
Ground cover:				
	Carpha	*Carpha alpina*	31.3	1.9
	Mountain daisy	*Celmisia dubia*	40.1	0.8
	Swamp neinei	*Dracophyllum palustre*	2.0	11.9
	Sundew	*Drosera spatulata*	33.3	0.5
	Wire rush	*Empodisma minus*	44.0	16.2
	Umbrella fern	*Gleichenia dicarpa*	26.6	6.4
	Lycopodium	*Lateristachys diffusa*	31.0	2.2
	Comb sedge	*Oreobolus strictus*	21.4	0.7
	Dwarf heath	*Pentachondra pumila*	20.6	0.5

Note: *Exotic species. 'Mean cover score' is the average percentage cover for that species in plots where it occurred.

Table 11: Comparison of the plot group assignments in NMDS ordinations obtained using the full data set (of 256 species) and the 35 Principal Species.

All Species Groups:	Principal Species Groups: A	B	C	D	E	F	G	H	J	K	L	M	Total
Mixed beech-podocarp-broadleaf forest (A)	12												12
Southern rātā-mountain beech-podocarp forest (B)		5	1										6
Silver-mountain beech forest (C)		1	12										13
Mānuka-mountain beech-podocarp shrubland (D)				7									7
Mānuka/Gahnia -wire rush shrubland (E)					5		1						6
Weedy shrubland (F)					1	3							4
Mānuka-tussock-wire rush shrubland (G)							45						45
Mānuka-mountain flax/wire rush shrubland (H)							1	5				4	10
Low pākihi (J)								3	29				32
Weedy low pākihi (K)										3			3
Exotic grassland (L)											2		2
Tussock-flax shrubland (M)								1				3	4
Leatherwood shrubland (N)	2					1							3
Total	14	6	13	7	6	4	47	4	29	3	2	7	147

Note: Numbers in red are the number of plots assigned to different groups in the two ordinations.

4.1.9 Vegetation Patterns Among Groups

There were distinct patterns in species richness, density and height of vegetation and ground cover composition amongst the 13 ordination groups. The mean number of species per plot was highest in the southern rātā-mountain beech-podocarp forest (B) group with 39.5 species, with the lowest (16.0) in the low pākihi (J) group as shown in Table 12. The mean total vegetation cover scores, which provide a measure of overall vegetation density in each vegetation type, also varied, with 345% in the mixed beech-podocarp-broadleaf forest (A) group and 45% in the exotic grassland (L) group as shown Table 13. Average canopy top heights were highest in the mixed beech-podocarp-broadleaf forest (A) group (12.4m) and lowest in the low pākihi (J), weedy low pākihi (K) and exotic grassland (L) groups (0.3 – 0.5m). Percentage canopy cover scores varied between c. 60% for groups A to E (mixed beech-podocarp-broadleaf forest; southern rātā-mountain beech-podocarp forest; silver-mountain beech forest; mānuka-mountain beech-podocarp shrubland; mānuka/Gahnia-wire rush shrubland) and c. 2% for the exotic grassland (L) group.

Table 12: Number of plant species per plot recorded in plots assigned to the 13 ordination groups.

Group	Plots (n)	Species		Tier:	Mean Species per Tier				
		Group Total	Per Plot		2	3	4	5	6
Mixed beech-podocarp-broadleaf forest (A)	12	94	29.1		1.3	5.8	11.8	21.1	27.8
Southern rātā-mountain beech-podocarp forest (B)	6	109	39.5		1.2	5.5	12.0	26.8	37.3
Silver-mountain beech forest (C)	13	94	30.5			3.2	10.2	21.7	29.2
Mānuka-mountain beech-podocarp shrubland (D)	7	77	32.6			0.9	5.4	15.1	31.4
Mānuka/Gahnia-wire rush shrubland (E)	6	62	24.7				3.2	15.3	24.0
Weedy shrubland (F)	4	64	22.5			1.0	3.5	11.8	21.3
Mānuka-tussock-wire rush shrubland (G)	45	104	19.1				0.4	6.0	18.9
Mānuka-mountain flax/wire rush shrubland (H)	10	82	22.7				0.1	8.0	22.6
Low pākihi (J)	37	99	16.0				1.0	4.1	16.9
Weedy low pākihi (K)	3	46	20.7					4.3	20.7
Exotic grassland (L)	2	33	20.5					2.5	20.5
Tussock-flax shrubland (M)	4	74	32.0					7.8	31.8
Leatherwood shrubland (N)	3	81	33.7				1.3	14.7	33.7

Note: Values for each group are the total number of species recorded, the mean number of species per plot, and the mean number of species in the five height tiers in each group.

Table 13: Percentage cover for plots assigned to the 13 ordination groups. Values for each group are mean total cover for plots in a group and the mean of cover scores for each the five height tiers for plots in that group.

Group	Plots (n)	Mean/ Plot Cover Score	Tier	Mean Cover Score Per Tier				
				2	3	4	5	6
Mixed beech-podocarp-broadleaf forest (A)	12	345		25	85	94	71	70
Southern rātā-mountain beech-podocarp forest (B)	6	272		8	60	66	74	65
Silver-mountain beech forest (C)	13	231			39	67	65	60
Mānuka-mountain beech-podocarp shrubland (D)	7	189			6	70	60	53
Mānuka/Gahnia-wire rush shrubland (E)	6	197				44	75	77
Weedy shrubland (F)	4	202			5	17	73	107
Mānuka-tussock-wire rush shrubland (G)	45	118				4	51	63
Mānuka-mountain flax/wire rush shrubland (H)	10	118				0	37	82
Low pākihi (J)	37	110				3	30	84
Weedy low pākihi (K)	3	86					20	66
Exotic grassland (L)	2	45					3	43
Tussock-flax shrubland (M)	4	97					20	78
Leatherwood shrubland (N)	3	212				2	89	121

Low pākihi (Groups J and K) and exotic pasture (Group L) had the lowest species richness, lowest cover scores, lowest average canopy top heights and lowest percentage canopy cover, while Groups G to L had the highest proportions of rock present as ground cover.

Exotic plant species were present in 44 plots (30%) within groups F, J, K, L and N.

4.1.10 Wetland Determination

Plot data was analysed using the standard methods of wetland delineation including the vegetation tool (Clarkson 2013) and hydrology tool (Ministry for the Environment 2021). Many of the plots didn't conclusively pass the vegetation tests, so hydrological indicators and professional judgement were used to determine whether they met the definition of 'natural inland wetland'. A summary of wetland status of vegetation groups is present in Table 14.

Plots from mixed beech-podocarp-broadleaf forest (A), silver beech-mountain beech forest (C) and leatherwood shrubland (N) groups failed both the dominance and prevalence vegetation tool tests, indicating that these vegetation groups do not meet the definition of a natural inland wetland as defined by the NPS-FM. The majority of plots (17 out of 19) from Southern rātā-mountain beech-podocarp forest (B) failed both tests, with two plots failing one test, so this group is also unlikely to be a natural inland wetland vegetation type.

Plots from tussock-flax shrubland (M) failed both vegetation tool tests. However, this group had a small sample size (n = 3) as well as highly variable species composition and associated environmental variables. The red tussock fen sub-type of this group exhibited wetland features, often occurring in valleys, along watercourses, terraces and fans on peaty substrate. Seepages are known to occur within red tussock fen vegetation. In contrast, on previously burnt areas that did not have determinate wetland hydrology or soil, red tussock

and mountain flax can dominate the vegetation along with regenerating trees and shrubs as part of vegetation recovery.

The majority of plots (27 of 37, 73%) from the low pākihi (J) vegetation group passed both the dominance and prevalence tests or passed one test and had a primary hydrological indicator. A further eight of the 37 plots (22%) passed only one of the vegetation tests and did not have a primary hydrological indicator to confirm wetland status. Given that the majority of plots passed both vegetation tests, and plots were typically located in geomorphic positions compatible with wetland conditions (i.e., on river flats, terraces, and among gently sloping sandstone pavement), this vegetation group can be considered a natural inland wetland type.

For mānuka-tussock-wire rush shrubland (G), 35 of 45 plots (78%) passed both vegetation tests or passed one test and had a primary hydrological indicator. Seven plots (16%) passed only one test and did not have a primary hydrological indicator to confirm wetland status. For plots that had soil depth measured (n=18), all were considered to have a shallow aquitard[4], which is a secondary hydrological indicator, with soil depths ranging from 263 – 423 mm. Based on the vegetation and hydrological results, this group is considered a natural inland wetland.

Eight out of 10 plots (80%) from group H (mānuka-flax/wire rush shrubland) passed at least one of the vegetation tests which confirmed their status as natural inland wetland, and all plots with soil depth measured (n = 8) had a shallow aquitard.

Mānuka-mountain beech-podocarp shrubland (D), mānuka/Gahnia-wire rush shrubland (E), weedy shrubland (F), weedy low pākihi (K) and exotic grassland (L) vegetation groups were not able to be assigned wetland status from the vegetation and hydrology wetland tools. This was because the plots only passed one of the vegetation tool tests, having insufficient soil and hydrology data to supplement the vegetation tests, and/or plots within each group yielding a range of wetland results. Therefore, professional judgement was used to assign wetland status of these plots.

Much of the Buller Plateaux exhibits hydrological and soil features compatible with those of wetlands, as evidenced by soil saturation, surface water, stunted plants, a shallow aquitard (i.e., sandstone basement rock) and peaty or gley soils. The high rainfall contributes to these wetland features. Several plants that are a common and widespread feature of the vegetation on the plateau have Facultative (e.g., mānuka, mountain beech, yellow-silver pine), Facultative-Upland (e.g., *Gahnia procera*, mountain flax) or Obligate Upland (e.g., *Dracophyllum rosmarinifolium*, Southern rātā, silver beech) wetland status, even though these plants survive in waterlogged conditions there. Most plots within vegetation groups D, E and K only narrowly failed the prevalence test because the dominant species were facultative, facultative-upland or upland. Results for groups F and L remain inconclusive because of the small sample sizes and the variety within the plots. These vegetation types would need to have their wetland status determined on a more site-specific basis.

[4] A shallow aquitard is a semi-permeable–impermeable layer is confirmed within 60 centimetres of the soil surface, as defined in the Wetland delineation hydrology tool for Aotearoa New Zealand (MfE, 2021).

Table 14: Natural inland wetland status of vegetation groups.

Natural inland wetland	Not considered natural inland wetland	Inconclusive
Mānuka-mountain beech-podocarp shrubland (D)	Mixed beech-podocarp-broadleaf forest (A)	Weedy shrubland (F)
Mānuka/Gahnia-wire rush shrubland (E)	Southern rātā-mountain beech-podocarp forest (B)	Exotic grassland (L)
Mānuka-tussock-wire rush shrubland (G)	Silver-mountain beech forest (C)	
Mānuka-mountain flax/wire rush shrubland (H)	Leatherwood shrubland (N)	
Low pākihi (J)		
Weedy low pākihi (K)		
Tussock-flax shrubland (M)		

4.2 Drone Survey

4.2.1 Images Collected

A total of 45,690 images were collected between July 2019 and February 2024 as shown in Table 15. Images ranged in size from 7MB to 20MB depending on the sensor attached to the drone. Resolutions ranged from 2mm to 5mm depending on the drone and height of survey.

Table 15: Survey dates, location and drones used.

Date of Survey	Location	Number of Images	Drones
Jul-19	Denniston Escarpment	290	DJI Phantom 4 Advanced
Nov-19	Denniston	1,536	DJI Phantom 4 Advanced
Apr-21	Denniston Stockton	4,409	DJI Phantom 4 Advanced, DJI Mavic Mini
Jul-22	Denniston	1,314	DJI Phantom 4 Pro
Aug-22	Denniston	2,945	DJI Mavic 3
Oct-22	Denniston Stockton	11,260	DJI Matrice 300RTK
Oct 23-Feb 24	Denniston Stockton	23,936	DJI Mavic3 Pro
	Total	**45,690**	

4.2.2 Mosaic of Orthomaps

The total area covered by imagery is 11,438.375ha as shown in Figure 31 and the entire resulting exported raster of the mosaic of orthomaps was organised into eight sections. The largest section was South Stockon (2,050.695ha) and the smallest Northeast Stockton (593.711ha) as shown in Table 16.

Table 16: Section designation and extent of the overall orthomap.

Area No	Name	Area (ha)
1	North Stockton	1,375.262
2	Northeast Stockton	593.711
3	Northwest Stockton	1,664.740
4	East Stockton	1,749.099
5	South Stockton	2,050.695
6	Northeast Denniston	1,879.921
7	Northwest Denniston	1,288.295
8	Te Kuha	836.652
	Total	**11,438.375**

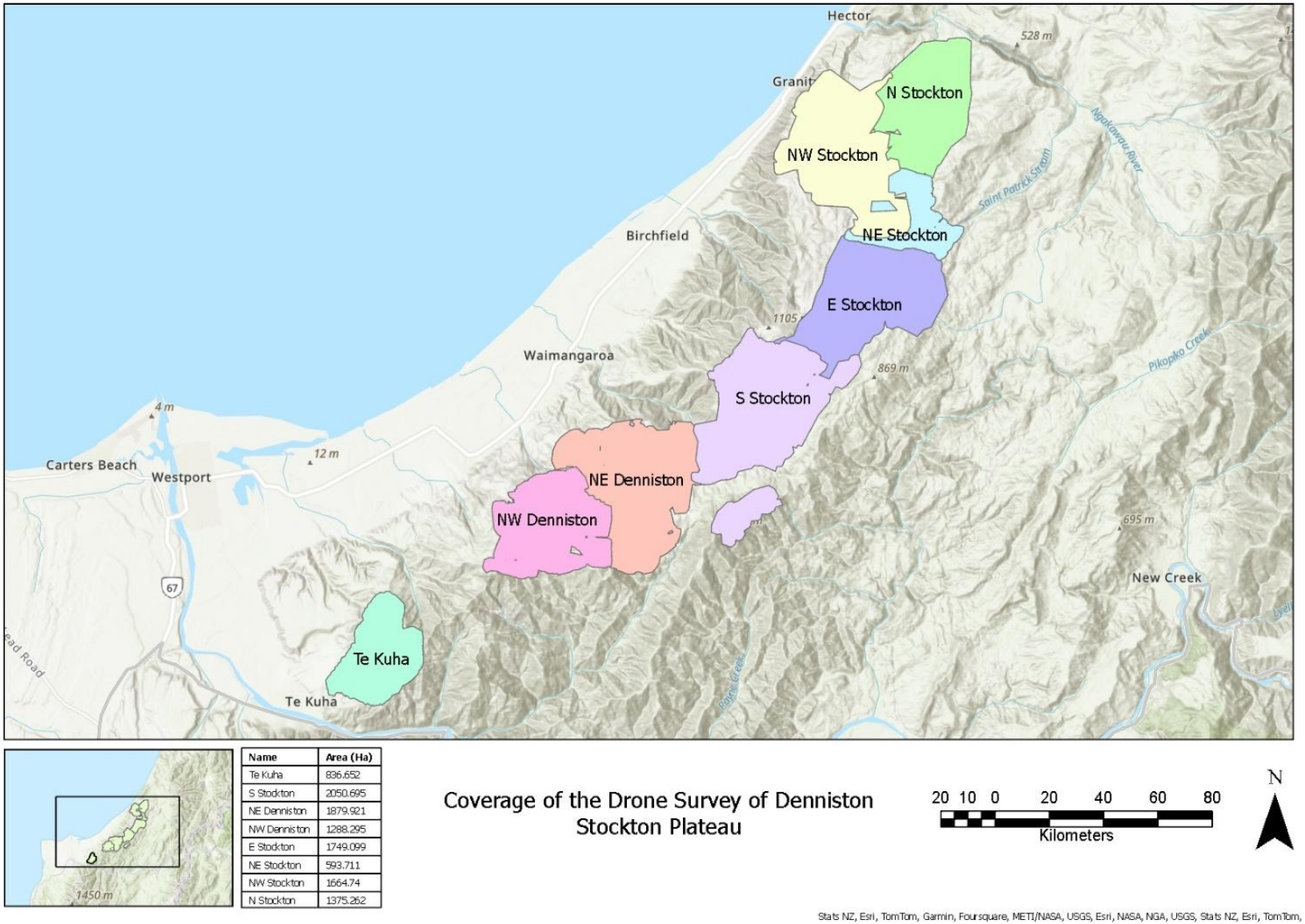


Figure 31: Sections of the merged mosaic of orthomaps.

4.2.3 Classification

4.2.3.1 Training Sources: Survey Plots

Data from the vegetation plots combined with the 13 vegetation groups derived from the ordination served as the basis for the vegetation categories used in the training of the segments generated.

Cleared vegetation, water and bare rock were added as land cover categories used in the training sample generation to account for non-vegetated land cover types. Cleared vegetation was typically present as roads, tracks or any other areas that had been cleared. Bare rock was defined as sandstone pavement, talus, boulders or any other exposed natural rock. Water was often associated with historic mining infrastructure (ponds and the like).

The process of allocating vegetation groups to training samples (based on plot locations) from the orthomaps identified some discrepancies between individual plot descriptions and the vegetation group assigned to them by the ordination. This was likely due to the low accuracy resolution (typically ± c. 3m) for the handheld GPS units. Therefore, training samples were allocated to a vegetation group using plot-specific data and local knowledge of the surrounding area.

Two forest groups derived from the ordination (B and C) were representative of Southern rātā-mountain beech-podocarp forest. Plots from these groups were similar in species composition, sharing 11 out of 15 species in the canopy tier, but differed significantly in canopy top height. Since canopy height cannot be determined from aerial imagery, plots from these groups were combined during mapping and mapped as group B 'Southern rātā-mountain beech-podocarp forest.' High-elevation silver beech-mountain beech forest has been recorded in other surveys on the Buller Plateaux and in the South Island (Table 5). This forest was structurally and ecologically different to the other vegetation groups derived from the ordination, and could be discriminated from the aerial imagery. Three plots in group A were used as a reference for mapping silver beech-mountain beech forest, which was mapped as group C. These three plots represented stunted silver beech-mountain beech forest at high elevations, not typical of tall mixed beech-podocarp forest represented by the rest of the plots in group A.

The plot-based survey included the majority of the Denniston sections and smaller parts of East Stockton and South Stockton. There were no survey plots located in North-West Stockton, North-East Stockton or Te Kuha. Some survey plots were also outside of the drone mapping coverage, particularly in the Stockton mining areas to the west of East Stockton as shown in Figure 32.

4.2.3.2 Segmentation

Several iterations of the segmentation step were necessary to produce visually acceptable results that corresponded to the shapes of the different types of vegetation or land cover present. The spectral detail, spatial detail and the minimum size of each segment determined the final shape of the resulting segmentation used in the generation of training samples.



Figure 32: Vegetation plot locations in relation to drone survey areas.

4.2.3.3 Training samples

The process of generating training samples involved using the Training Sample Manager of the Classification Tools in ArcGIS Pro. Classification involved assigning classes to selected segments at the survey sites while checking the imagery for consistency with the plot classification ascribed. Training was also facilitated using local knowledge from those that undertook the vegetation surveys. The training samples generated are shown in Figure 33 and the number of training samples for each section is summarised in Table 17.

Table 17: Number of training samples generated for classification.

Site	Segments	Training Samples	%
NW Denniston	43,867	1,217	2.77%
NE Denniston	66,616	6,181	9.28%
S Stockton	35,902	1,157	3.22%
E Stockton	36,151	862	2.38%
NW Stockton	20,450	1,657	8.10%
NE Stockton	35,732	952	2.66%
N Stockton	95,935	2,484	2.59%
Te Kuha	91,156	1,950	2.14%
Total	**425,809**	**16,460**	**3.87%**

4.2.3.4 Classification using SVM and RF

Each section was classified using both the SVM and RF classifiers resulting in a total of 16 classified rasters. Accuracy assessment points (Figure 34) were generated for each classified image using stratified random sampling for the final ground truthing and generation of the confusion matrix to determined overall accuracy and the kappa statistic. This was necessary to select which classified raster was to be converted into polygons for the final classification map.

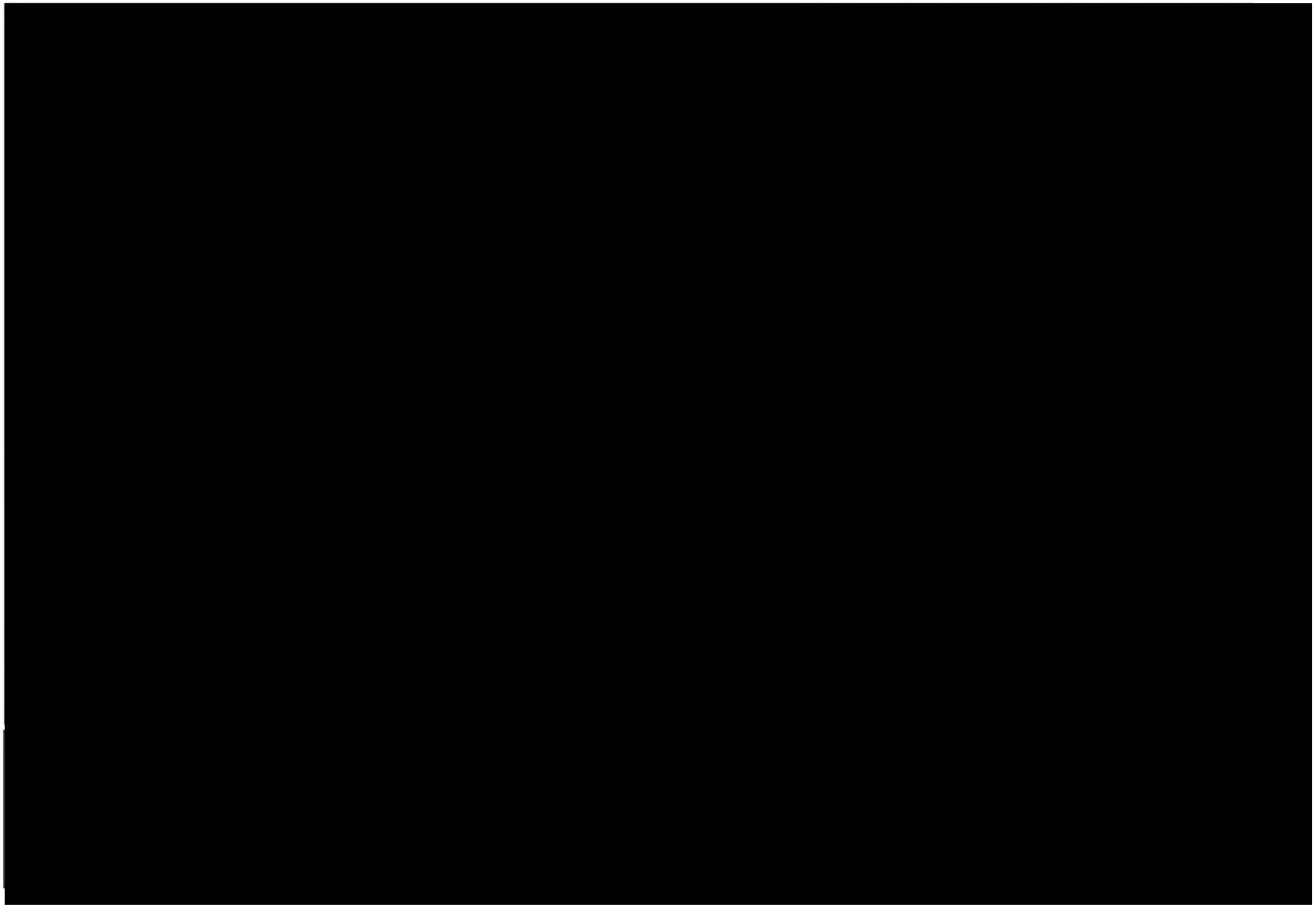


Figure 33: Training samples generated from the segments and based on survey plots and drone imagery.

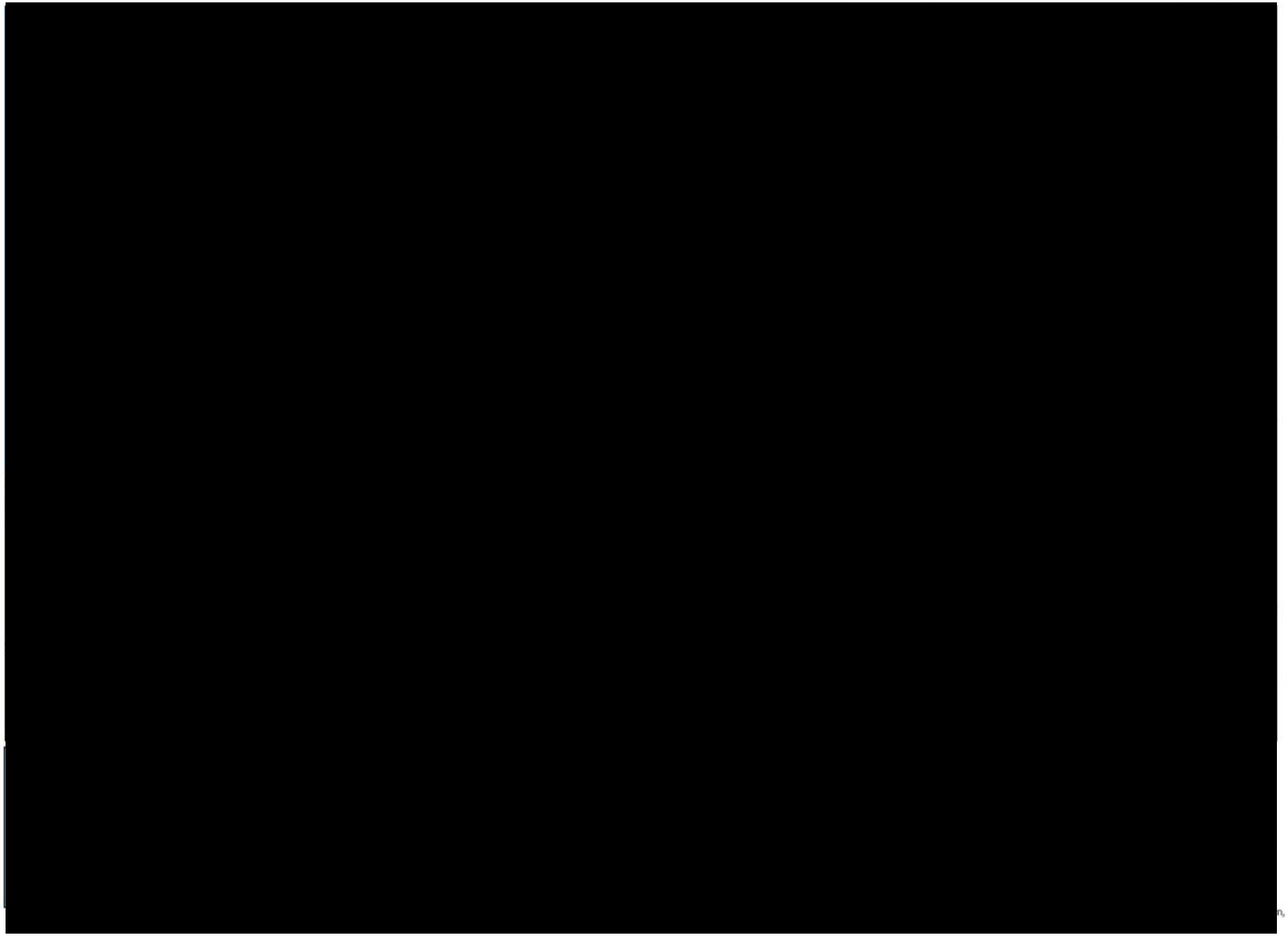


Figure 34: Randomly stratified accuracy assessment points.

4.2.3.5 Accuracy assessment results

Measurements of classification accuracy using a confusion matrix for each different section showed RF to have better results than SVM in five out of the eight sections (Table 18). The range of values for kappa ranged from 0.703 to 0.798, which rates within the (0.61–0.80) range of substantial agreement for Cohen's kappa values (McHugh 2012).

Table 18: Accuracy and Kappa values of the mosaics for each section.

Site	RF			SVM		
	Accuracy	Kappa	Assessment Pts	Accuracy	Kappa	Assessment Pts
NW Denniston	0.845	0.797	233	0.731	0.646	227
NE Denniston	0.765	0.730	506	0.800	0.764	496
S Stockton	0.811	0.777	413	0.768	0.728	410
E Stockton	0.763	0.719	401	0.737	0.674	380
NW Stockton	0.727	0.680	454	0.748	0.703	465
NE Stockton	0.830	0.798	436	0.793	0.742	406
N Stockton	0.756	0.691	401	0.779	0.733	448
Te Kuha	0.863	0.724	386	0.853	0.722	382

Note: kappa values in red denote a favourable result and signify whether RF or SVM was used at each site.

4.2.3.6 Classification of vegetation polygons across Buller Plateaux

Results of the classification of each section when converted from rasters to polygons and after additional processing are shown in Figure 35. Vegetation that overlapped Stockton Mine (including Cypress Mine) was removed.

Because there were no vegetation plots surveyed at Te Kuha for this report, we were less confident about assigning vegetation groups there compared to the rest of the Mapped Area. Vegetation mapping surveys have been conducted at Te Kuha in the past, with detailed maps containing vegetation groups similar to those found on the rest of the plateaux (Mitchell Partnerships 2013, Knightbridge 2002, Mitchell Partnerships and Landcare Research 2001). Comparing the classified polygons to past survey maps identified discrepancies in both polygon geometry and type of vegetation. To increase the level of confidence in assigning vegetation groups to a level consistent with that of the rest of the Mapped Area, we used Mitchell Partnerships (2013) to map the vegetation at Te Kuha.

Georeferencing in QGIS was used to create polygons that matched those in Mitchell Partnerships (2013). Vegetation groups used in Mitchell Partnerships (2013) were amended to those used in this report (see Table 5). The groups 'rimu-red beech-silver beech forest' and 'rimu/hard beech forest' in Mitchell Partnerships (2013) were merged and mapped as Group A (mixed beech-podocarp-broadleaved forest), and groups 'yellow silver pine-mānuka scrub' and 'mountain beech-/yellow-silver pine-pink pine forest' were merged and mapped as Group D (mānuka-mountain beech-podocarp shrubland). 'Mānuka shrubland' was mapped as Group G (mānuka-tussock-wire rush shrubland). The group 'Mānuka-Dracophyllum rockland' was a sandstone pavement vegetation group equivalent to Group J (low pākihi). 'Herbfield' was also included in Group J (low pākihi).

4.2.4 Extent of vegetation groups

The classification with the highest kappa were then used to calculate the areas for each section after converting the classified rasters into polygons. Southern rātā-mountain beech-podocarp forest (B) was the most common vegetation group, followed by low pākihi (J) as shown in Table 19. Note that the total area in Table 15 excludes the active mining areas (i.e., Stockton and Cypress mines) which were included in the drone imagery. The location and distribution of the vegetation types is shown in Figure 36.

Table 19: Extent of vegetation groups at the Buller Plateaux*.

Classes	Extent (ha)	% Area
Mixed beech-podocarp-broadleaved forest (A)	1,107.3	10.9
Southern rātā-mountain beech-podocarp forest (B)	2,485.6	24.5
Silver beech-mountain beech forest (C)	163.0	1.6
Mānuka-mountain beech-podocarp shrubland (D)	1,467.8	14.5
Mānuka/Gahnia-wire rush shrubland (E)	145.1	1.4
Weedy shrubland (F)	163.7	1.6
Mānuka-tussock-wire rush shrubland (G)	943.0	9.3
Mānuka-mountain flax/wire rush shrubland (H)	120.0	1.2
Low pākihi (J)	2,083.3	20.6
Weedy low pākihi (K)	11.5	0.1
Exotic grassland (L)	2.5	0.02
Tussock-mountain flax shrubland (M)	110.9	1.1
Leatherwood shrubland (N)	50.1	0.5
Herbfield	0.3	0.024
Bare Rock	885.0	8.7
Cleared vegetation	358.8	3.5
Total	**10,129.29**	**100%**

Note: *excludes active mining areas

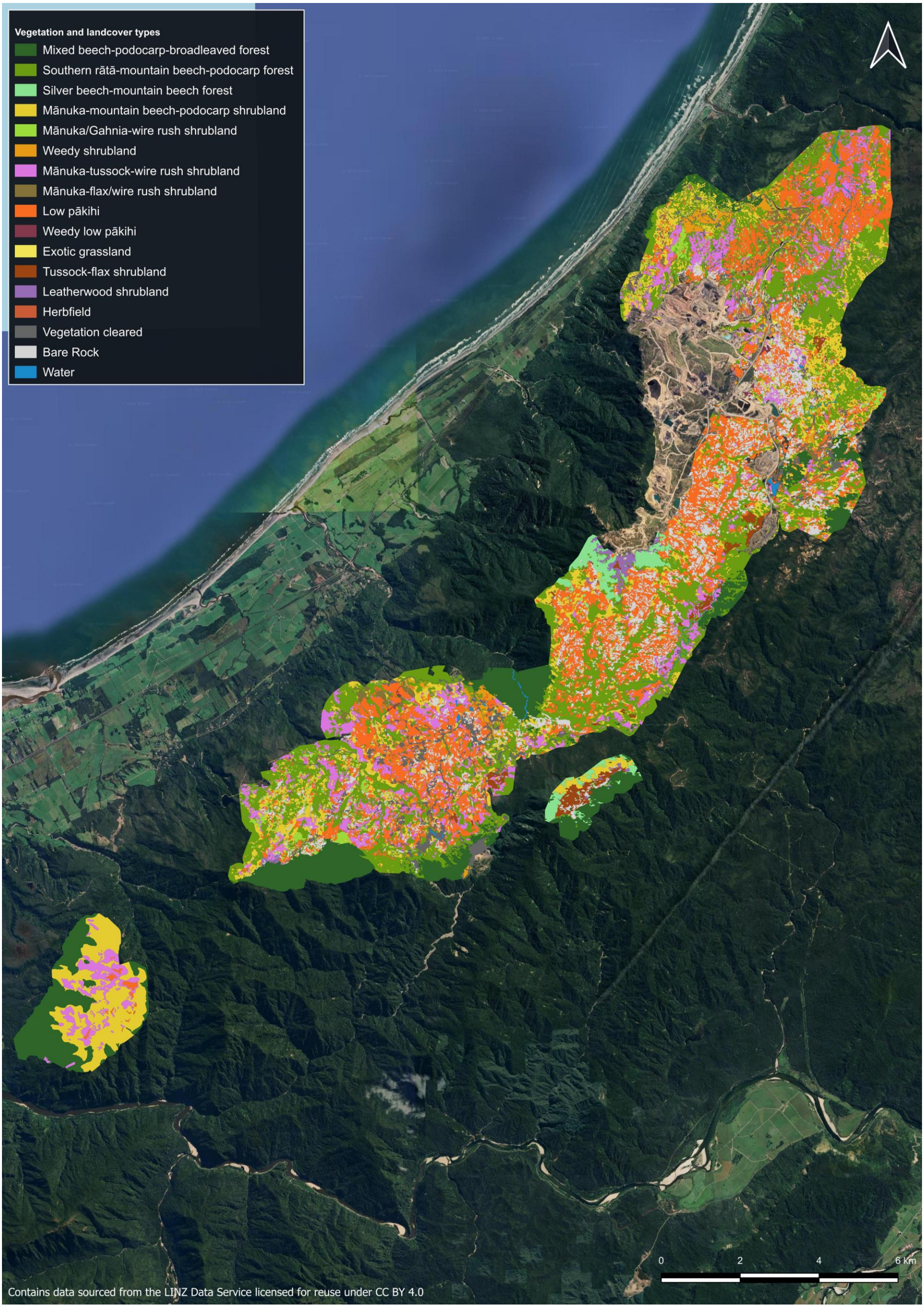


Figure 35: Vegetation within the Mapped Area.

5.0 References

Alliance Ecology 2025. Pest Mammal Survey: Buller Plateau Pest Monitoring. Unpublished report prepared for Bathurst Resources Limited

Anderson, M. J., & Willis, T. J. (2003). Canonical Analysis of Principal Coordinates: A useful method for constrained ordination. *Ecology* (Vol. 84, Issue 2).

Anderson, M. J., Ellingsen, K. E., & McArdle, B. H. (2006). Multivariate dispersion as a measure of beta diversity. Ecology letters, 9(6), 683-693.

Anderson, M.J. (2006). Distance-based tests for homogeneity of multivariate dispersions. Biometrics, 62, 245–253.

Anderson, M. J. (2017). Permutational multivariate analysis of variance (PERMANOVA). Wiley StatsRef: Statistics Reference Online. Chichester, UK: John Wiley & Sons Ltd.

Atkinson, I. 1985. Derivation of vegetation mapping units for an Ecological survey of Tongariro National North Island, New Zealand. *New Zealand Journal of Botany, 23*:3, 361-378.

Clarke, K. R., & Green, R. H. (1988). Statistical design and analysis for a'biological effects' study. Marine Ecology Progress Series, 213-226.

Clarkson, B. R. 2013. A vegetation tool for wetland delineating in New Zealand. New Zealand: Landcare Research.

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

Duncan, R. P., Norton, D. A., & Woolmore, C. B. 1990. The lowland vegetation pattern, south Westland, New Zealand 2. Ohinemaka Forest. *New Zealand Journal of Botany, 28*, 131-140.

Ecological Solutions Limited. 2025. Contextual study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited. Kāeo, Northland. October 2024. 91 pages + appendices.

Faraway, J. J. 2006. *Extending the linear model with R: generalized linear, mixed effects and non-parametric regression*. Boca Raton, FL: Chapman & Hall.

Gelman, A., & Hill, J. 2007. *Data analysis using regression and multilevel/hierarchical models*. New York: Cambridge University Press.

Gosden, J. 2023. Mountain daisies: A guide to Celmisia in Aotearoa/New Zealand. Mānuka Press, Cromwell. 185 pp.

Glenny, D. 2012. Bryophytes and lichens in the proposed Escarpment Mine area, Denniston Plateau. Prepared for Buller Coal Limited. Landcare Research Contract Report LC 1131.

Glenny, D. 2024. Riccardia dimorpha sp. nov. (Hepaticophyta, Aneuraceae) from Western Nelson, New Zealand, exhibiting sexually determined morphological dimorphism, an overlooked feature of some liverworts. Telopea 27: 73–83

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson, G.B., Reardon, J.T., van Winkel, D., Rolfe, J. and Michel, P. 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35. Department of Conservation, Wellington. 15 pp.

Hurst, J.M. and Allen, R.B. 2007. The RECCE method for describing New Zealand vegetation – expanded manual, version 4. Landcare Research Contract Report

(LC0708/029), Manaaki Whenua – Landcare Research, Lincoln.

Hurst, J.M., Allen, R.B. & Fergus, A.J. 2022. The Recce method for describing New Zealand vegetation – expanded manual. Version 5.

Knightbridge et. al. 2002. Comparison of the vegetation of Te Kuha with the vegetation surveyed for the Ngakawau Protected Natural Areas report. Internal Department of Conservation report. Hokitika.

Kruskal, J. B. 1964. Nonmetric multidimensional scaling: a numerical method. *Psychometrics, 29*, 115-129.

Leathwick, J. R. 1987. *Waipapa Ecological Area: A Study of Vegetation Pattern in a Scientific Reserve*.

Legendre, P., & Legendre, L. (2012). Numerical Ecology (Third English Edition ed.): Elsevier.

Lloyd, B. D. 2012. *Analyses of Powelliphanta Snail Survey Data for the Escarpment Mine Project*.

Mahan, R. P. (1991). Circular statistical methods: Applications in spatial and temporal performance analysis.

McArdle, B.H. & Anderson, M.J. (2001). Fitting multivariate models to community data: a comment on distance-based redundancy analysis. Ecology, 82, 290–297.

McHugh, M. L. 2012. Interrater reliability: the kappa statistic. *Biochemia medica, 22*(3), 276-282.

McEwen, M. 1987. *Ecological Regions and Districts of New Zealand.* Third Revised Edition. Department of Conservation, Wellington, New Zealand.

Minchin, P. R. 1987. An evaluation of relative robustness of techniques for Ecological ordination. *Vegetation, 69*, 89-107.

Ministry for the Environment. (2021). Wetland delineation hydrology tool for Aotearoa, New Zealand. Wellington: Ministry for the Environment.

Ministry for the Environment. (2022). Wetland delineation protocols. Wellington: Ministry for the Environment.

Mitchell Partnerships and Landcare Research Limited. 2001. Vegetation and fauna of the proposed Te Kuha mine site. Unpublished report prepared for Rangitira Developments Ltd.

Mitchell Partnerships. 2013. Vegetation and fauna of the proposed Te Kuha mine site. Unpublished report prepared for Te Kuha Limited Partnership.

Newell, C. 1990. *Vegetation classification of an area on coal measures, Buller, New Zealand*. [Bachelor of Science (Honours) dissertation, University of Cantebury]. 52 pp.

Nichol, R. 2021. *Mine Creek Sump Proposal Stockton*. Unpublished draft report prepared for BT Mining by Richard Nichol Ecology Ltd.

Nichol & Overmars, 2008; Vegetation and Flora Baseline Survey, L&M Coal Ltd Escarpment Mine Project, Buller Plateau. Prepared for Resource and Environmental Management Ltd

Norton, D. A., & Leathwick, J. R. 1990. The lowland vegetation pattern, south Westland, New Zealand 1. Saltwater Ecological Area. *New Zealand Journal of Botany, 28*, 41-51.

Oksanen, J., Blanchet, F., Kindt, R., Legendre, P., Minchin, P. R., O'Hara, R. B., . . . H., W. 2011. Community Ecology Package: Package 'vegan' (Version 2.0-2). CRAN. Retrieved from http://cran.r-project.org, http://vegan.r-forge.r-project.org/

Overmars F.B.; Kilvington M.J. and Gibson R.S. 1998. *Ngakawau Ecological District: Survey report for the Protected Natural Areas Programme*. New Zealand Protected Natural Areas Programme Series No. 11. Department of Conservation, Hokitika. 178 pp.

Overmars, F. B., & Lloyd, B. D. 2012. *Proposed Escarpment Mine: Vegetation Survey of Trent Stream Area and Southern Denniston Plateau*.

Roberts, D. W. 2011. Ordination and Multivariate Analysis for Ecology: Package 'labdsv' (Version 1.4-1). CRAN. Retrieved from http://ecology.msu.montana.edu/labdsv/R

Templeton, L. and McMorran, T. 2020. *Geomorphological Assessment of the Stockton Plateau*. Golder Associates.

Tukey, J. 1977. *Exploratory Data Analysis*. Reading, Mass.: Addison-Wesley Pub. Co.

Walker, K. J. 2003. Recovery plans for *Powelliphanta* land snails. Threatened Species Recovery Plan (Vol. 49, pp. 208). Wellington: Department of Conservation.

Walker, K.J., Trewick, S.A. and Barker, G.M., 2008. Powelliphanta augusta, a new species of land snail, with a description of its former habitat, Stockton coal plateau, New Zealand. Journal of the Royal Society of New Zealand, 38(3), pp.163-186.

Walker, K.J., Walton, K., Edwards, E., Hitchmough, R., Payton, R., Barker, G. and Michel, P. 2024. Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and snails) Part 3. Rhytididae (carnivorous snails), 2022. Department of Conservation, Wellington. 32 pp.

Wildland Consultants Limited. 2010. *Mapping of vegetation and habitats on the Stockton and Denniston plateaux, northern Westland*. Wildlands contract report No. 2334. Prepared for Department of Conservation, West Coast Tai Poutini Conservancy, Hokitika.

Williams, P.A.; Courtney, S. 1998. The flora endemic to western Nelson. *New Zealand Botanical Society Newsletter 53*: 9–13.

Wood, S. N. 2003. Thin plate regression splines. *J. R. Statist. Soc., B 65*, 95-114.

APPENDIX A

Plant Species List

Code	Scientific Name	Common Name	Wetland Indicator Rating	Biostatus Origin	Conservation Status (de Lange et al. 2023)
ABRLIN	*Abrotanella linearis*		FACW	Endemic	Not Threatened
ACTNOV	*Actinotus novae-zelandiae*	New Zealand flannel flower	OBL	Endemic	Not Threatened
AGRCAP	*Agrostis capillaris*	browntop	FACU	Exotic	N/A
ANABEL	*Anaphalioides bellidioides*	native everlasting daisy	FACU	Endemic	Not Threatened
ANATRI	*Anaphalioides trinervis*		N/A	Endemic	Not Threatened
ANDEMP	*Androstoma empetrifolium*		FACW	Endemic	Not Threatened
ANIARO	*Anisotome aromatica*	common aniseed	FACU	Endemic	Not Threatened
ANIFLE	*Anisotome flexuosa*		N/A	Endemic	Not Threatened
ANTODO	*Anthoxanthum odoratum*	sweet vernal	FACU	Exotic	N/A
APOBIF	*Aporostylis bifolia*	odd-leaved orchid	FACW	Endemic	Not Threatened
ARCTRA	*Archeria traversii*		N/A	Endemic	Not Threatened
ASPFLA	*Asplenium flaccidum*	hanging spleenwort	UPL	Non-endemic	Not Threatened
ASTFRA	*Astelia fragrans*	kakaha	FACU	Endemic	Not Threatened
ASTLIN	*Astelia linearis*		OBL	Endemic	Not Threatened
ASTNER	*Astelia nervosa*	mountain astelia	FACU	Endemic	Not Threatened
ASTSUB	*Astelia subulata*		OBL	Endemic	At Risk – Naturally Uncommon
AUSRIC	*Austroderia richardii*	toetoe	FAC	Endemic	Not Threatened
BAUTER	*Baumea teretifolia*		FACW	Non-endemic	Not Threatened
BLEDIS	*Blechnum discolor*	crown fern	N/A	Endemic	Not Threatened
BLEMON	*Blechnum montanum*	mountain kiokio	FACU	Endemic	Not Threatened
BLENOV	*Blechnum novae-zelandiae*	horokio	FAC	Endemic	Not Threatened
BLEPEN	*Blechnum penna-marina*		FAC	Non-endemic	Not Threatened
BLEPRO	*Blechnum procerum*	small kiokio	FACU	Endemic	Not Threatened
BRABEL	*Brachyglottis bellidioides*		N/A	Endemic	Not Threatened
BRABUC	*Brachyglottis buchananii*		N/A	Endemic	Not Threatened
CALADE	*Caladenia species*		N/A	N/A	N/A
CARALP	*Carpha alpina*	carpha	N/A	Non-endemic	Not Threatened
CARGAU	*Carex gaudichaudiana*	gaudichaud's sedge	FACW	Non-endemic	Not Threatened
CARGEM	*Carex geminata*	rautahi	FACW	Endemic	Not Threatened
CARSER	*Carpodetus serratus*	marbleleaf	FACU	Endemic	Not Threatened
CELALP	*Celmisia alpina*	mountain daisy	N/A	Endemic	Not Threatened
CELDAL	*Celmisia dallii*	dall's mountain daisy	N/A	Endemic	Not Threatened
CELDUB	*Celmisia dubia*	mountain daisy	N/A	Endemic	Not Threatened
CELGRA	*Celmisia gracilenta*	pekapeka	FAC	Endemic	Not Threatened
CELINC	*Celmisia incana*	white mountain daisy	N/A	Endemic	Not Threatened

CELLAR	*Celmisia laricifolia*	needle-leaved mountain daisy	N/A	Endemic	Not Threatened
CELLAT	*Celmisia lateralis*	shrub daisy	N/A	Endemic	Not Threatened
CELLIN	*Celmisia x linearis*		N/A	N/A	N/A
CELMIS	*Celmisia species*		N/A	N/A	N/A
CELSES	*Celmisia sessiliflora*	white cushion mountain daisy	FACU	Endemic	Not Threatened
CELSIM	*Celmisia similis*		N/A	Endemic	Not Threatened
CENCIL	*Centrolepis ciliata*	centrolepis	OBL	Endemic	Not Threatened
CENUNI	*Centella uniflora*	centella	FACW	Non-endemic	Not Threatened
CHIAUS	*Chionochloa australis*	carpet grass	N/A	Endemic	Not Threatened
CHICON	*Chionochloa conspicua*	hunangamoho	N/A	Endemic	Not Threatened
CHICOR	*Chiloglottis cornuta*	bird orchid	N/A	Non-endemic	Not Threatened
CHIFLA	*Chionochloa flavescens*	broad-leaved snow tussock	N/A	Endemic	Not Threatened
CHIJUN	*Chionochloa juncea*	North Westland snow tussock	FAC	Endemic	At Risk – Declining
CHIJXR	*N/A*		N/A	N/A	N/A
CHIRUB	*Chionochloa rubra*	red tussock	FAC	Endemic	Not Threatened
COPAUT	*Coprosma autumnalis*	kanono	N/A	Endemic	Not Threatened
COPCOL	*Coprosma colensoi*		N/A	Endemic	Not Threatened
COPCRE	*Coprosma crenulata*		FACU	Endemic	Not Threatened
COPCUN	*Coprosma cuneata*		N/A	Endemic	Not Threatened
COPDMO	*Coprosma dumosa*		FAC	Endemic	Not Threatened
COPFOE	*Coprosma foetidissima*	stinkwood	FACU	Endemic	Not Threatened
COPINT	*Coprosma elatirioides*		FACW	Endemic	Not Threatened
COPLIN	*Coprosma linariifolia*	mikimiki	UPL	Endemic	Not Threatened
COPLUC	*Coprosma lucida*		N/A	Endemic	Not Threatened
COPMIC	*Coprosma microcarpa*	small-seeded coprosma	N/A	Endemic	Not Threatened
COPPSE	*Coprosma pseudocuneata*		N/A	Endemic	Not Threatened
COPRIG	*Coprosma rigida*		N/A	Endemic	Not Threatened
COPROB	*Coprosma robusta*	karamū	FACU	Endemic	Not Threatened
COPROS	*Coprosma species*		N/A	N/A	N/A
CORACU	*Corybas acuminatus*	spider orchid	N/A	Endemic	Not Threatened
COROBL	*Corybas oblongus*	spider orchid	N/A	Endemic	Not Threatened
CORYBA	*Corybas species*		N/A	N/A	N/A
CRAMIN	*Craspedia minor*	small craspedia	N/A	Endemic	Not Threatened
CRAUVU	*Craspedia uniflora var. uniflora*	woollyhead	N/A	Endemic	Not Threatened
CTEHET	*Ctenopteris heterophylla*	taupeka	UPL	Endemic	Not Threatened

CYACOL	*Cyathea colensoi*	mountain tree fern	N/A	Endemic	Not Threatened
CYTPUM	*Cyathodes pumila*		N/A	Non-endemic	Not Threatened
CYTSCO	*Cytisus scoparius*	wild broom	UPL	Exotic	N/A
DACCUP	*Dacrydium cupressinum*	rimu	FACU	Endemic	Not Threatened
DIANIG	*Dianella nigra*	turutu	UPL	Endemic	Not Threatened
DICFIB	*Dicksonia fibrosa*	wheki-ponga	UPL	Endemic	Not Threatened
DICSQU	*Dicksonia squarrosa*	wheki	FACU	Endemic	Not Threatened
DIGPUR	*Digitalis purpurea*	foxglove	UPL	Exotic	N/A
DONNOV	*Donatia novae-zelandiae*	donatia	OBL	Endemic	Not Threatened
DRADEN	*Dracophyllum densum*		N/A	Endemic	At Risk – Declining
DRAELE	*Dracophyllum elegantissimum*	grass tree	N/A	Endemic	Not Threatened
DRALON	*Dracophyllum longifolium*	inaka	FACU	Endemic	Not Threatened
DRAOLI	*Dracophyllum oliveri*		FACW	Endemic	Not Threatened
DRAPAL	*Dracophyllum palustre*	swamp neinei	OBL	Endemic	Not Threatened
DRAPOL	*Dracophyllum politum*		FACW	Endemic	Not Threatened
DRAPRO	*Dracophyllum pronum*	trailing neinei	FACW	Endemic	Not Threatened
DRAROS	*Dracophyllum rosmarinifolium*	common grass tree	N/A	Endemic	Not Threatened
DRATOW	*Dracophyllum townsonii*		N/A	Endemic	Not Threatened
DRATRA	*Dracophyllum traversii*	mountain neinei	N/A	Endemic	Not Threatened
DROARC	*Drosera arcturi*	sundew	OBL	Non-endemic	Not Threatened
DROSPA	*Drosera spatulata*	sundew	FACW	Non-endemic	Not Threatened
DROSTE	*Drosera stenopetala*	sundew	OBL	Endemic	Not Threatened
EARAUT	*Earina autumnalis*	raupeka	N/A	Endemic	Not Threatened
ELAHOO	*Elaeocarpus hookerianus*	pōkākā	N/A	Endemic	Not Threatened
EMPMIN	*Empodisma minus*	wire rush	OBL	Non-endemic	Not Threatened
EPAALP	*Epacris alpina*		N/A	Endemic	Not Threatened
EPAPAU	*Epacris pauciflora*	tamingi	FACW	Endemic	Not Threatened
EPIPER	*Epilobium pernitens*	willowherb	FACW	Endemic	Not Threatened
EUPWET	*Euphrasia wettsteiniana*	eyebright	OBL	Endemic	At Risk - Declining
EXOBID	*Exocarpos bidwillii*		N/A	Endemic	Not Threatened
FORMAC	*Forstera mackayi*		N/A	Endemic	Not Threatened
GAHPRO	*Gahnia procera*	giant sedge	FACU	Endemic	Not Threatened
GAHRIG	*Gahnia rigida*	gahnia	FACW	Endemic	Not Threatened
GAISET	*Gaimardia setacea*	gaimardia	N/A	Non-endemic	Not Threatened
GAUANT	*Gaultheria antipoda*	bush snowberry	N/A	Endemic	Not Threatened
GAURUP	*Gaultheria rupestris*		N/A	Endemic	Not Threatened

GENMMS	*Gentianella montana subsp. montana var. stolonifera*		N/A	Endemic	Not Threatened
GENMON	*Gentianella montana*		N/A	Endemic	Not Threatened
GENSPE	*Gentianella spenceri*	spencer's gentian	N/A	Endemic	Not Threatened
GENTIA	*Gentiana species*		N/A	N/A	N/A
GLEALP	*Gleichenia alpina*	alpine tangle fern	FACW	Non-endemic	Not Threatened
GLEDIC	*Gleichenia dicarpa*	tangle fern	FACW	Endemic	Not Threatened
GLEINC	*Gleichenia inclusisora*	tangle fern	N/A	Endemic	Not Threatened
GLEMIC	*Gleichenia microphylla*	carrier tangle fern	FAC	Endemic	Not Threatened
GONMIC	*Gonocarpus micranthus*		FAC	Non-endemic	Not Threatened
GONOCA	*Gonocarpus species*		N/A	N/A	N/A
GRABIL	*Grammitis billardierei*	common strap fern	N/A	Non-endemic	Not Threatened
GRILIT	*Griselinia littoralis*	broadleaf	UPL	Endemic	Not Threatened
GUNMON	*Gunnera monoica*	native gunnera	FAC	Endemic	Not Threatened
HALBID	*Halocarpus bidwillii*	bog pine	FAC	Endemic	Not Threatened
HALBIF	*Halocarpus biformis*	pink pine	FAC	Endemic	Not Threatened
HEBMOO	*Hebe mooreae*	moore's hebe	N/A	Endemic	Not Threatened
HEBODO	*Hebe odora*	hebe	N/A	Endemic	Not Threatened
HEDARB	*Hedycarya arborea*	porokaiwhiri	UPL	Endemic	Not Threatened
HERNOV	*Herpolirion novae-zelandiae*	grass lily	FAC	Non-endemic	Not Threatened
HIENOV	*Hierochloe novae-zelandiae*	alpine holy grass	N/A	Endemic	Not Threatened
HISINC	*Histiopteris incisa*	water fern	FAC	Non-endemic	Not Threatened
HOLLAN	*Holcus lanatus*	yorkshire fog	FAC	Exotic	N/A
HUPVAR	*Huperzia varia*	clubmoss	UPL	Non-endemic	Not Threatened
HYMDEM	*Hymenophyllum demissum*	drooping filmy fern	UPL	Endemic	Not Threatened
HYMENO	*Hymenophyllum species*		N/A	N/A	N/A
HYMFLA	*Hymenophyllum flabellatum*	filmy fern	N/A	Non-endemic	Not Threatened
HYMLYA	*Hymenophyllum lyallii*	filmy fern	N/A	Non-endemic	Not Threatened
HYMMUL	*Hymenophyllum multifidum*	much-divided filmy fern	UPL	Endemic	Not Threatened
HYMRAR	*Hymenophyllum rarum*	filmy fern	N/A	Non-endemic	Not Threatened
HYMREV	*Hymenophyllum revolutum*	filmy fern	N/A	Endemic	Not Threatened
HYMRUF	*Hymenophyllum rufescens*	filmy fern	N/A	Endemic	Not Threatened
HYMVIL	*Hymenophyllum villosum*	hairy filmy fern	N/A	Endemic	Not Threatened
HYPAMB	*Hypolepis ambigua*		UPL	Endemic	Not Threatened
HYPRAD	*Hypochaeris radicata*	catsear	FACU	Exotic	N/A
JUNBUF	*Juncus bufonius*	toad rush	N/A	Exotic	N/A
JUNCAN	*Juncus canadensis*	tailed-seeded rush	OBL	Exotic	N/A

JUNEDG	*Juncus edgariae*	wiwi	FACW	Endemic	Not Threatened
JUNEFF	*Juncus effusus*	soft rush	FACW	Exotic	N/A
JUNSQU	*Juncus squarrosus*	heath rush	FACW	Exotic	N/A
KELDIE	*Kelleria dieffenbachii*		N/A	Non-endemic	Not Threatened
LEPAUS	*Lepidosperma australe*	square sedge	FACW	Endemic	Not Threatened
LEPINT	*Lepidothamnus intermedius*	yellow silver pine	FAC	Endemic	Not Threatened
LEPJUN	*Leptecophylla juniperina*	mingimingi	N/A	Endemic	Not Threatened
LEPLAX	*Lepidothamnus laxifolius*	pygmy pine	FAC	Endemic	Not Threatened
LEPLXI	*Lepidothamnus laxifolius x intermedius*	pygmy pine	N/A	Endemic	Not Threatened
LEPSCO	*Leptospermum scoparium*	mānuka	FAC	Non-endemic	Not Threatened
LEPSUP	*Leptopteris superba*	heruheru	N/A	Endemic	Not Threatened
LEPXIN	*Leptopteris xintermedia*		N/A	N/A	N/A
LEUFAS	*Leucopogon fasciculatus*	mingimingi	N/A	Endemic	Not Threatened
LIBBID	*Libocedrus bidwillii*	pāhautea	N/A	Endemic	Not Threatened
LIBMIC	*Libertia micrantha*	mikoikoi	N/A	Endemic	Not Threatened
LIPGUN	*Liparophyllum gunnii*		OBL	Non-endemic	Not Threatened
LOBANG	*Lobelia angulata*	pratia	FAC	Endemic	Not Threatened
LOTPED	*Lotus pedunculatus*	lotus	FAC	Exotic	N/A
LUZCON	*Luzula congesta*		FACU	Exotic	N/A
LUZPAR	*Luzuriaga parviflora*	nohi	N/A	Non-endemic	Not Threatened
LUZRUF	*Luzula rufa*	red woodrush	N/A	Endemic	Not Threatened
LUZULA	*Luzula species*		N/A	N/A	N/A
LYCDIF	*Lycopodiella diffusa*		OBL	Non-endemic	Not Threatened
LYCFAS	*Lycopodium fastigiatum*	alpine clubmoss	FAC	Non-endemic	Not Threatened
LYCLAT	*Lycopodium laterale*		OBL	N/A	N/A
LYCSCA	*Lycopodium scariosum*	creeping clubmoss	N/A	Non-endemic	Not Threatened
LYCVOL	*Lycopodium volubile*	climbing clubmoss	FACU	Non-endemic	Not Threatened
MACCOL	*Macrolearia colensoi*	tupare	N/A	Endemic	Not Threatened
MACTER	*Machaerina teretifolia*		N/A	Non-endemic	Not Threatened
METPAR	*Metrosideros parkinsonii*	parkinson's rātā	N/A	Endemic	Not Threatened
METPER	*Metrosideros perforātā*	akatea	N/A	Endemic	Not Threatened
METUMB	*Metrosideros umbellata*	southern rātā	UPL	Endemic	Not Threatened
MICAVE	*Microlaena avenacea*	bush rice grass	N/A	Non-endemic	Not Threatened
MICPUS	*Microsorum pustulatum*	fragrant fern	UPL	Non-endemic	Not Threatened
MYRDIV	*Myrsine divaricata*	weeping matipo	FAC	Endemic	Not Threatened
MYRDXS	*Myrsine divaricata x salicina*		N/A	N/A	N/A
MYRSAL	*Myrsine salicina*	toro	N/A	Endemic	Not Threatened

NEOPED	*Neomyrtus pedunculata*	rōhutu	FAC	Endemic	Not Threatened
NERBAL	*Nertera balfouriana*		FACW	Endemic	Not Threatened
NERCIL	*Nertera ciliata*		FAC	Endemic	Not Threatened
NERDEP	*Nertera depressa*	nertera	FACU	Non-endemic	Not Threatened
NERTER	*Nertera species*		N/A	N/A	N/A
NERVIL	*Nertera villosa*	hairy forest nertera	N/A	Endemic	Not Threatened
NOTBIL	*Notogrammitis billardierei*	common strap fern	N/A	Non-endemic	Not Threatened
NOTCLI	*Nothofagus solandri var. cliffortioides*	mountain beech	FAC	Endemic	Not Threatened
NOTFUS	*Nothofagus fusca*	red beech	N/A	Endemic	Not Threatened
NOTHET	*Notogrammitis heterophylla*	taupeka	N/A	Endemic	Not Threatened
NOTMEN	*Nothofagus menziesii*	silver beech	N/A	Endemic	Not Threatened
NOTOGR	*Notogrammitis species*		N/A	N/A	N/A
NOTSOL	*Nothofagus solandri*	black beech	N/A	Endemic	Not Threatened
OLEAVI	*Olearia avicenniifolia*	mountain akeake	N/A	Endemic	Not Threatened
OREIMP	*Oreobolus impar*	comb sedge	OBL	Endemic	Not Threatened
OREPEC	*Oreobolus pectinatus*	cushion sedge	OBL	Endemic	Not Threatened
ORESTR	*Oreobolus strictus*	comb sedge	OBL	Endemic	Not Threatened
ORESUB	*Oreostylidium subulatum*		OBL	Endemic	Not Threatened
OZOLEP	*Ozothamnus leptophyllus*	tauhinu	FAC	Endemic	Not Threatened
OZOVAU	*Ozothamnus vauvilliersii*	mountain tauhinu	N/A	Endemic	Not Threatened
PAESCA	*Paesia scaberula*	lace fern	FACU	Endemic	Not Threatened
PENPUM	*Pentachondra pumila*		FAC	Endemic	Not Threatened
PHLEGM	*Phlegmariurus species*		N/A	N/A	N/A
PHLVAR	*Phlegmariurus varius*	clubmoss	N/A	Non-endemic	Not Threatened
PHOCOO	*Phormium cookianum*	mountain flax	FACU	Endemic	Not Threatened
PHOTEN	*Phormium tenax*	harakeke	FACW	Endemic	Not Threatened
PHYALP	*Phyllocladus alpinus*	mountain celery pine	FACU	Endemic	Not Threatened
PIMGNI	*Pimelea gnidia*	pimelea	N/A	Endemic	Not Threatened
PITCOL	*Pittosporum colensoi*		FACU	Endemic	Not Threatened
PITRIG	*Pittosporum rigidum*		N/A	Endemic	Not Threatened
PNEPEN	*Pneumatopteris pennigera*	gully fern	FACU	Non-endemic	Not Threatened
PODLAE	*Podocarpus laetus*	mountain tōtara	N/A	Endemic	Not Threatened
POLVES	*Polystichum vestitum*	pūniu	N/A	Endemic	Not Threatened
PRACOL	*Prasophyllum colensoi*	leek orchid	FAC	Endemic	Not Threatened
PRUFER	*Prumnopitys ferruginea*	miro	N/A	Endemic	Not Threatened
PSECOL	*Pseudowintera colorātā*	red horopito	N/A	Endemic	Not Threatened
PSECRA	*Pseudopanax crassifolius*	horoeka	FACU	Endemic	Not Threatened

PSECVT	*Pseudopanax colensoi var. ternatus*		N/A	Endemic	Not Threatened
PSELIN	*Pseudopanax linearis*		N/A	Endemic	Not Threatened
PSETRA	*Pseudowintera traversii*		N/A	Endemic	At Risk – Naturally Uncommon
PTEBAN	*Pterostylis banksii*	tutukiwi	N/A	Endemic	Not Threatened
PTEMON	*Pterostylis montana*	greenhood	N/A	Endemic	Not Threatened
PTEROS	*Pterostylis species*		N/A	N/A	N/A
PTEVEN	*Pterostylis venosa*	greenhood	N/A	Endemic	Not Threatened
QUISER	*Quintinia serrātā*	tāwheowheo	UPL	Endemic	Not Threatened
RANREP	*Ranunculus repens*	buttercup	FAC	Exotic	N/A
RAUANO	*Raukaua anomalus*		FACU	Endemic	Not Threatened
RAUEDG	*Raukaua edgerleyi*	raukawa	N/A	Endemic	Not Threatened
RAUSIM	*Raukaua simplex*	haumakoroa	UPL	Endemic	Not Threatened
RIPSCA	*Ripogonum scandens*	supplejack	FACU	Endemic	Not Threatened
RUBCIS	*Rubus cissoides*	tātaramoa	N/A	Endemic	Not Threatened
RUBFRU	*Rubus fruticosus*	blackberry	FAC	Exotic	N/A
RYTGRA	*Rytidosperma gracile*	dainty bristle grass	FACU	Non-endemic	Not Threatened
RYTNIG	*Rytidosperma nigricans*	bristle grass	FACW	Endemic	Not Threatened
SCHAUS	*Schizaea australis*	southern comb fern	FAC	Non-endemic	Not Threatened
SCHPAU	*Schoenus pauciflorus*	bog rush	FACW	Endemic	Not Threatened
THECYA	*Thelymitra cyanea*	swamp sun orchid	FACW	Non-endemic	Not Threatened
THELYM	*Thelymitra species*		N/A	N/A	N/A
THEPUL	*Thelymitra pulchella*	striped sun orchid	FACW	Endemic	Not Threatened
TMETAN	*Tmesipteris tannensis*	fork fern	N/A	Endemic	Not Threatened
TRISTR	*Trichomanes strictum*	erect bristle fern	OBL	Non-endemic	Not Threatened
ULEEUR	*Ulex europaeus*	gorse	FACU	Exotic	N/A
UNCBAN	*Uncinia banksii*	fine-leaved bastard grass	N/A	Endemic	Not Threatened
UNCFIL	*Uncinia filiformis*	hook sedge	N/A	Endemic	Not Threatened
UNCINI	*Uncinia species*		N/A	N/A	N/A
UTRDIC	*Utricularia dichotoma*		OBL	Non-endemic	Not Threatened
VERCAN	*Veronica canterburiensis*	hebe	N/A	Endemic	Not Threatened
VERONI	*Veronica species*		N/A	N/A	N/A
VERSAL	*Veronica salicifolia*	koromiko	N/A	Non-endemic	Not Threatened
WAISTE	*Waireia stenopetala*	yellow beaks	N/A	Endemic	Not Threatened
WEIRAC	*Weinmannia racemosa*	kāmahi	FACU	Endemic	Not Threatened
ZOTTHO	*Zotovia thomsonii*		FACW	Endemic	Not Threatened

APPENDIX B

RECCE Plot Vegetation Types

Vegetation Group A: Mixed beech-podocarp-broadleaf forest

Plot reference	Survey	Plot vegetation description
EM6	Nichol & Overmars, 2008	Mixed beech-cedar-broadleaved forest
EM14	Nichol & Overmars, 2008	Southern rātā-beech/broadleaved forest
MR 14	Lloyd & Overmars, 2012	Southern rātā-mixed beech-podocarp/Archeria forest
BCP12	Ecological Solutions, 2024	Southern rātā-beech broadleaved low forest
BCP19	Ecological Solutions, 2024	(Rimu)/mixed beech-broadleaved forest
BCP23	Ecological Solutions, 2024	Silver beech-mountain beech/Archeria-podocarp forest
BCP24	Ecological Solutions, 2024	Silver beech-(Southern rātā)/Dracophyllum-Archeria forest
BCP25	Ecological Solutions, 2024	Red beech-silver beech/Southern rātā-broadleaved forest
BCP26	Ecological Solutions, 2024	(Rimu-Hall's totara)/silver beech-mountain beech-broadleaved forest
BCP28	Ecological Solutions, 2024	Red beech-Hall's totara/Southern rātā-broadleaved forest
DC03	Ecological Solutions, 2024	Silver beech-mountain beech forest
DC11	Ecological Solutions, 2024	Silver beech-mountain beech forest

Vegetation Group B: Southern rātā-mountain beech-podocarp forest

Plot reference	Survey	Plot vegetation description
EM4	Nichol & Overmars, 2008	Mixed beech-cedar-broadleaved forest
OTS 23	Lloyd & Overmars, 2012	Mixed beech/podocarp-mānuka-broadleaved forest
BCP02	Ecological Solutions, 2024	(Rimu)/silver beech-mountain beech-broadleaved forest
BCP04	Ecological Solutions, 2024	(Southern rātā)-mountain beech/broadleaf
BCP31	Ecological Solutions, 2024	Southern rātā-broadleaved low forest
DC04	Ecological Solutions, 2024	Southern rātā-mountain beech forest

Vegetation group C: Silver beech-mountain beech forest

Plot reference	Survey	Plot vegetation description
EM7	Nichol & Overmars, 2008	Podocarp/beech-Southern rātā-Archeria forest
EM13	Nichol & Overmars, 2008	Mixed beech-podocarp-Southern rātā forest
TS 53	Lloyd & Overmars, 2012	Mountain beech/mānuka-podocarp forest
TS 56	Lloyd & Overmars, 2012	Podocarp-mountain beech forest
MR 11	Lloyd & Overmars, 2012	Podocarp-mountain beech forest
BCP07	Ecological Solutions, 2024	(Southern rātā)-mountain beech/broadleaved forest
BCP15	Ecological Solutions, 2024	(Southern rātā-pahautea)/mountain beech-broadleaved forest
DC08	Ecological Solutions, 2024	Southern rātā-mountain beech forest
DC09	Ecological Solutions, 2024	Southern rātā-podocarp-broadleaved forest
DC13	Ecological Solutions, 2024	Mountain beech-pahautea forest

ESC02	Ecological Solutions, 2024	Southern rātā/podocarp-beech-broadleaf forest
ESC07	Ecological Solutions, 2024	Southern rātā/podocarp-beech-broadleaf forest

Vegetation Group D: Mānuka-mountain beech-podocarp shrubland

Plot reference	Survey	Plot vegetation description
OTS 28	Lloyd & Overmars, 2012	(Southern rātā)-mānuka-mountain beech forest
TS 52	Lloyd & Overmars, 2012	Pink pine-mountain beech/mānuka-yellow-silver pine forest
TS 54	Lloyd & Overmars, 2012	Mānuka-mountain beech/yellow-silver pine forest
TS 55	Lloyd & Overmars, 2012	Mountain beech-pink pine/yellow-silver pine-mānuka forest
TS 57 OS	Lloyd & Overmars, 2012	(Southern rātā)/mānuka-pink pine forest
DC05	Ecological Solutions, 2024	Mānuka-mountain beech-yellow-silver pine forest
DC07	Ecological Solutions, 2024	(Southern rātā)-mānuka-mountain beech forest

Vegetation Group E: Mānuka/Gahnia-wire rush shrubland

Plot reference	Survey	Plot vegetation description
EM3	Nichol & Overmars, 2008	Mānuka/Gahnia shrubland
OTS 14	Lloyd & Overmars, 2012	Mānuka-mountain beech-podocarp shrubland
OTS 32	Lloyd & Overmars, 2012	Mānuka/Gahnia shrubland
OTS 34 OS	Lloyd & Overmars, 2012	Mānuka-podocarp/Gahnia shrubland
BCP27	Ecological Solutions, 2024	Mānuka/tangle fern-Gahnia shrubland
ESC06	Ecological Solutions, 2024	Mānuka/mountain flax-Astelia shrubland

Vegetation Group F: Weedy shrubland

Plot reference	Survey	Plot vegetation description
OTS 26	Lloyd & Overmars, 2012	(Southern rātā)-pink pine-mountain beech shrubland
BCP18	Ecological Solutions, 2024	Coprosma dumosa/Carex-Juncus sedgeland
DS04	Ecological Solutions, 2024	Kamahi-mānuka-red beech/flax shrubland
DS05	Ecological Solutions, 2024	Mānuka-kamahi shrubland

Vegetation Group G: Mānuka-tussock-wire rush shrubland

Plot reference	Survey	Plot vegetation description
EM2	Nichol & Overmars, 2008	Mānuka/tangle fern shrub-rushland
EM12	Nichol & Overmars, 2008	Mānuka-tangle fern-tussock-rushland
OTS 2	Lloyd & Overmars, 2012	Mānuka-tangle fern-tussock-rushland
OTS 3	Lloyd & Overmars, 2012	Mānuka/tangle fern shrub-rushland
OTS 5	Lloyd & Overmars, 2012	Mānuka/tussock-rushland
OTS 7	Lloyd & Overmars, 2012	Mānuka-Chionochloa juncea/wire rush shrubland

OTS 8	Lloyd & Overmars, 2012	Mānuka/tussock-rushland
OTS 15	Lloyd & Overmars, 2012	Mānuka/tussock-wire rush-grassland
OTS 16	Lloyd & Overmars, 2012	Mānuka/tangle fern shrub-rushland
OTS 17	Lloyd & Overmars, 2012	Mānuka-tangle fern-rushland
OTS 18	Lloyd & Overmars, 2012	Mānuka/tangle fern-tussock-rushland
OTS 19	Lloyd & Overmars, 2012	Mānuka-tussock-rush-shrubland
OTS 24	Lloyd & Overmars, 2012	Mānuka-tussock-tanglefern rushland
OTS 25	Lloyd & Overmars, 2012	Mānuka-tussock rushland
OTS 27	Lloyd & Overmars, 2012	Mānuka-tussock-tanglefern rushland
OTS 29	Lloyd & Overmars, 2012	Mānuka/wire rush-shrubland
OTS 30	Lloyd & Overmars, 2012	Mānuka/tussock-wire rush-shrubland
OTS 33 OS	Lloyd & Overmars, 2012	Mānuka/tangle fern-tussock rushland
TS 36	Lloyd & Overmars, 2012	Mānuka/Dracophyllum-wire rush shrubland
TS 38	Lloyd & Overmars, 2012	Mānuka-tussock/tangle fern-rushland
TS 39	Lloyd & Overmars, 2012	Mānuka-tussock/tangle fern-rushland
TS 45	Lloyd & Overmars, 2012	Mānuka-tussock/wire rush shrubland
TS 46	Lloyd & Overmars, 2012	Mānuka/tussock-shrubland
TS 47	Lloyd & Overmars, 2012	Mānuka-tussock/tangle fern rushland
TS 48	Lloyd & Overmars, 2012	Mānuka-tussock/tangle fern rushland
MR 04	Lloyd & Overmars, 2012	Mānuka-tussock/wire rush shrubland
MR 12	Lloyd & Overmars, 2012	Mānuka-tussock/wire rush shrubland
BCP03	Ecological Solutions, 2024	Mānuka-tussock-tanglefern rushland
BCP08	Ecological Solutions, 2024	Mānuka/wire rush-pakihi rush-tanglefern shrubland
BCP30	Ecological Solutions, 2024	Mānuka/tangle fern-wire rush shrubland
DC02	Ecological Solutions, 2024	Mānuka-tussock/wire rush shrubland
ESC01	Ecological Solutions, 2024	Mānuka/wire rush-pakihi rush shrubland
ESC03	Ecological Solutions, 2024	Mānuka/tangle fern/wire rush shrubland
ESC05	Ecological Solutions, 2024	Mānuka-tangle fern/wire rush shrubland
D-01	Roxburgh 2012	Pink pine/yellow-silver pine-mānuka shrubland
D-09	Roxburgh 2012	Mānuka-pink pine-mountain flax shrubland
S-007	Roxburgh 2012	Mānuka/pākihi rush-wire rush shrubland
S-015	Roxburgh 2012	Mānuka-yellow silver pine-wire rush shrubland
S-039	Roxburgh 2012	Mānuka-flax-tussock shrubland
S-040	Roxburgh 2012	Mānuka-tussock/wire rush shrubland
S-041	Roxburgh 2012	Mānuka-pākihi rush/tussock-wire rush shrubland
S-106	Roxburgh 2012	Mānuka/tussock-wire rush shrubland
S-107	Roxburgh 2012	Mānuka-tussock/wire rush shrubland
S-112	Roxburgh 2012	Mānuka/Carpha-wire rush rushland
S-114	Roxburgh 2012	Mānuka-yellow silver pine-inaka shrubland

Vegetation Group H: Mānuka-mountain flax/wire rush shrubland

Plot reference	Survey	Plot vegetation description
OTS 1	Lloyd & Overmars, 2012	Pink pine-Gahnia/mānuka shrubland
MR 10	Lloyd & Overmars, 2012	Mānuka-mountain flax-red tussock shrubland
BCP17	Ecological Solutions, 2024	Mountain flax-tangle fern-red tussock/wire rush shrubland
DC12	Ecological Solutions, 2024	Leatherwood/mountain flax-Gahnia-Chionochloa juncea shrubland
ESC08	Ecological Solutions, 2024	(Mountain flax)/mānuka-wire rush shrubland
ESC09	Ecological Solutions, 2024	Mānuka-tussock/wire rush shrubland
D-09A	Roxburgh 2012	Mānuka-mountain flax-pink pine/wire rush shrubland
D-23	Roxburgh 2012	Mānuka-pink pine/tussock shrubland
S-002	Roxburgh 2012	Mānuka-mountain flax/wire rush shrubland
S-053S	Roxburgh 2012	Mānuka-mountain flax-tussock/wire rush shrubland

Vegetation Group J: Low pākihi

Plot reference	Survey	Plot vegetation description
EM1	Nichol & Overmars, 2008	(Chionochloa juncea)/mānuka-wire rush shrubland
EM5	Nichol & Overmars, 2008	(Chionochloa juncea)/mānuka-wire rush shrubland
EM8	Nichol & Overmars, 2008	Mānuka-square sedge shrubland
EM9	Nichol & Overmars, 2008	[Mānuka-Chionochloa juncea]/wire rush shrubland
EM10	Nichol & Overmars, 2008	(Red tussock-Lepidothamnus)/mānuka-wire rush shrubland
EM11	Nichol & Overmars, 2008	Pakihi rush/mānuka-wire rush rushland
EM15	Nichol & Overmars, 2008	(Mānuka)/wire rush rushland
OTS 4	Lloyd & Overmars, 2012	Mānuka-carpet grass shrub-rushland
OTS 6	Lloyd & Overmars, 2012	Chionochloa juncea/mānuka-wire rush shrubland
OTS 9	Lloyd & Overmars, 2012	Mānuka-pink pine tussock-shrubland
OTS 10	Lloyd & Overmars, 2012	Mānuka-Chionochloa juncea tussock-shrubland
TS 37	Lloyd & Overmars, 2012	Mānuka-Chionochloa juncea tussock-shrubland
TS 40	Lloyd & Overmars, 2012	Mānuka-Chionochloa juncea-wire rush shrubland
TS 44	Lloyd & Overmars, 2012	Mānuka-wire rush rushland
MR 15	Lloyd & Overmars, 2012	(Mānuka-Chionochloa juncea)/wire rush shrubland
BCP05	Ecological Solutions, 2024	Mānuka-wire rush shrubland
BCP10	Ecological Solutions, 2024	Mānuka-red tussock-tanglefern tussock-shrubland
BCP11	Ecological Solutions, 2024	Red tussock/tanglefern-wire rush tussock-shrubland
BCP16	Ecological Solutions, 2024	Red tussock/Celmisia alpina herbfield
BCP20	Ecological Solutions, 2024	(Mānuka-pakihi rush)/Chionochloa juncea shrub-rushland
BCP21	Ecological Solutions, 2024	Machaerina-square sedge shrub-rushland
BCP29	Ecological Solutions, 2024	Red tussock-tanglefern/wire rush shrubland

DC06	Ecological Solutions, 2024	(Mānuka-Chionochloa juncea)/wire rush shrubland
DS06	Ecological Solutions, 2024	Toetoe/mānuka-heath rush shrubland
ESC04	Ecological Solutions, 2024	(Mānuka-Chionochloa juncea)/wire rush rushland
NSTO1	Nichol 2025	Pākihi rush/tanglefern-wire rush rushland
NSTO2	Nichol 2025	(Tāmingi-mānuka)/tangle fern-wire rush rushland
NSTO3	Nichol 2025	(Gahnia rigida)/tanglefern-wire rush rushland
NSTO4	Nichol 2025	(Tāmingi)/tanglefern-wire rush fernland
NSTO5	Nichol 2025	Pākihi rush/tanglefern-wire rush fernland
D-24	Roxburgh 2012	Mānuka/tussock-wire rush shrubland
S-025	Roxburgh 2012	Mānuka-wire rush-tanglefern rushland
S-042	Roxburgh 2012	Yellow-silver pine/mānuka-wire rush shrubland
S-043	Roxburgh 2012	Mānuka-tussock/wire rush shrubland
S-048	Roxburgh 2012	Mānuka-tussock/wire rush shrubland
S-119	Roxburgh 2012	Mānuka/tussock-wire rush shrubland
S-120	Roxburgh 2012	Silver beech/mānuka-tussock-wire rush shrubland

Vegetation Group K: Weedy low pākihi

Plot reference	Survey	Plot vegetation description
BCP01	Ecological Solutions, 2024	Red tussock/tangle fern-swamp neinei-wire rush rushland
DC01	Ecological Solutions, 2024	Mānuka tussock-shrubland
DS03	Ecological Solutions, 2024	Southern rātā/heath rush-wire rush shrubland

Vegetation Group L: Exotic grassland

Plot reference	Survey	Plot vegetation description
DS01	Ecological Solutions, 2024	Heath rush grassland
DS02	Ecological Solutions, 2024	Toetoe/heath rush tussock-shrubland

Vegetation Group M: Tussock-mountain flax shrubland

Plot reference	Survey	Plot vegetation description
OTS 31	Lloyd & Overmars, 2012	Dracophyllum-Coprosma/wire rush shrubland
BCP09	Ecological Solutions, 2024	Leatherwood-mountain flax shrubland
BCP13	Ecological Solutions, 2024	Chionochloa flavescens/wire rush shrubland
BCP22	Ecological Solutions, 2024	Mountain flax-red tussock shrubland

Vegetation Group N: Leatherwood shrubland

Plot reference	Survey	Plot vegetation description
BCP14	Ecological Solutions, 2024	Leatherwood-silver beech-weeping mapou shrubland
DC10	Ecological Solutions, 2024	(Silver beech)/leatherwood tussock-shrubland
BCP06	Ecological Solutions, 2024	(Coprosma dumosa-broadleaf)/mountain flax-gorse shrubland

APPENDIX C

Buller Plateaux Continuation Project Escarpment Extended Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026c)

ecoLogical Solutions
Environmental Consultants







August 2026

Buller Plateaux Continuation Project
Escarpment Extended Project Sub-Area Baseline Surveys

Prepared for Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by:

[redacted]
Ecologist

[redacted]
Ecologist

[redacted]
Ecologist

[redacted]
Herpetologist
(Lizard sections only)

Reviewed by:

[redacted]
Terrestrial Ecology Team Leader

Status: Final **Issued:** 7 August 2026

ecoLogical solutions

tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 4/195 main highway,
ellerslie, Auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

nelson office
p: 021 172 2091

www.ecoLogicalsolutions.co.nz

Executive Summary

This report describes the specific ecological surveys, including methods and survey results, used to inform an assessment of ecological values of the Escarpment Extended (ESE) Project sub-area which forms part of the larger Buller Plateaux Continuation Project ("the Project" or "the BPCP"). This report does not include the values assessment or consider the effects of the Project, which are both provided in the Buller Continuation Project Terrestrial Ecological Impact Assessment (Ecological Solutions Limited 2026a).

The ESE Project sub-area is c. 584.7 hectares in size and includes c. 502.9 hectares of disturbance (both new and existing). The vegetation within the ESE Disturbance Area includes forest, shrubland, low vegetation, cleared vegetation (e.g., tracks) and small areas of open water and (mostly historic) mining infrastructure. Within the ESE Disturbance area, 260.5ha (52%) is a 'natural inland wetland' in terms of the National Policy Statement for Freshwater Management (2020). A further 68.5ha (13.6%) comprises vegetation affected by weeds or cleared areas (roads, tracks and the like). In general, the vegetation within the Disturbance Area is indigenous, intact and demonstrates natural ecological patterns and gradients. The ESE Project sub-area also includes naturally uncommon ecosystems (sandstone erosion pavement, seepages and flushes, boulderfields of acidic rocks, pākihi wetlands and small tarns).

Vegetation within the ESE Project sub-area includes 12 vascular plants considered to be 'At Risk' and also provides habitat for 21 bryophyte and four lichen species which are considered to be 'Threatened' or 'At Risk'.

The bird fauna is relatively intact, with birds present in moderate numbers, although repeated call count data suggests bird numbers may be declining. Six bird species which are considered 'Threatened' or 'At Risk' have been recorded within the ESE Project sub-area. Roroa/great spotted kiwi are widespread, but sparsely distributed, and call counts indicate roroa numbers are approximately stable.

The ESE Project sub-area provides good quality habitats for the lizard fauna present, including two 'Threatened' and one 'At Risk' species. The ESE Project sub-area also includes a relatively large amount of suitable habitat for the land snail *Powelliphanta patrickensis*. Mark-recapture studies show that snail abundance is declining, probably due to increased predation by weka.

The terrestrial invertebrate communities within the ESE Project sub-area are predominantly indigenous and include a good abundance of a high diversity of taxa. The invertebrate communities include widespread species, species endemic to the North Westland area, species adapted to high elevation, wet environments, species which are thought to be local endemics and 'Threatened' and 'At Risk' species.

Pest mammal abundance within the ESE Project sub-area varies both seasonally and annually, as well as in response to mast years. Monitoring shows that mammalian pests are often present at levels that would most likely adversely affect indigenous species.

Table of Contents

Executive Summary ii
1.0 Introduction 1
1.1 Background 1
1.2 Escarpment Mine 3
1.3 Scope and Purpose 3
2.0 Methods 5
2.1 Vegetation 5
2.1.1 Mapping vegetation types 5
2.1.2 Identifying wetland vegetation types 5
2.1.3 Bryophytes and lichens 7
2.2 Avifauna 7
2.2.1 Background 7
2.2.2 Five-minute bird counts 7
2.2.3 Roroa call count surveys 9
2.3 Lizards 9
2.4 Land Snails 11
2.5 Other Terrestrial Invertebrates 11
2.6 Mammalian Pests 14
3.0 Results 16
3.1 Vegetation 16
3.1.1 Summary 16
3.1.2 Forest vegetation 18
3.1.3 Shrubland vegetation 18
3.1.4 Low vegetation 19
3.1.5 Other landcover types 19
3.1.6 'Threatened' and 'At Risk' plant species 19
3.2 Wetlands 20
3.3 Bryophytes 22
3.4 Lichens 24
3.5 Avifauna 26
3.5.1 Five-minute bird counts 26
3.5.2 Roroa listening surveys 27
3.6 Lizards 28
3.7 Land Snails 30
3.8 Other Terrestrial Invertebrates 30

3.9 Mammalian Pests 32
4.0 Conclusion 34
5.0 References 35

Index to Tables

Table 1: Location of terrestrial invertebrate sampling sites and the vegetation type present within the ESE Project sub-area. 14
Table 2: Extent of vegetation types within the ESE Project sub-area. 16
Table 3: 'Threatened' and 'At Risk' bryophytes recorded within the ESE Project sub-area. 23
Table 4: Lichens of conservation concern recorded within the ESE Project sub-area. 24

Index to Figures

Figure 1: Buller Plateaux Continuation Project sub-areas. 2
Figure 2: Location of the DBEA and DPPA in relation to the ESE Project sub-area. 4
Figure 3: Extent of the Mapped Area at the Buller Plateaux. 6
Figure 4: Location of five-minute bird counts in relation to the ESE Project sub-area. 8
Figure 5: Location of roroa listening stations on the Denniston Plateau. 10
Figure 6: Location of snail mark-recapture plots and snail surveys on the Denniston Plateau. 12
Figure 7: Location of invertebrate sampling sites within the ESE Project sub-area. 13
Figure 8: Pest monitoring device locations on the Denniston Plateau (From Alliance Ecology 2025). 15
Figure 9: Vegetation and land cover types within the ESE Disturbance Area and associated Indirect Effects Contingency area. 17
Figure 10: The extent and location of wetlands within the ESE Disturbance area. 21
Figure 11: Location of bryophytes and lichens of conservation concern within the ESE Project sub-area. 25
Figure 12: Average number of birds recorded in 5MBCs at Escarpment East. 26
Figure 13: Average number of birds recorded in 5MBCs at Escarpment West. 27
Figure 14: Mean number of roroa calls per hour at the Denniston Plateau. 27
Figure 15: Overview of all kiwi observations during the 2022 survey (from Nichol 2022). 28
Figure 16: Locations of lizards found during the 2020 survey by Alliance Ecology. 29
Figure 17: Invertebrate species richness at each sampling site within the ESE Project sub-area. 31
Figure 18: Invertebrate abundance at each sampling site within the ESE Project sub-area. 32
Figure 19: Terrestrial invertebrate community composition at each site within the Extended Escarpment Project sub-area. 32

Figure 20: Approximate rat tracking indices 2014 - 2024 in the DBEA (data adapted from Department of Conservation annual reports). 33

Figure 21: Approximate mouse tracking indices 2014 - 2024 in the DBEA (data adapted from Department of Conservation annual reports). 33

Appendices

Appendix A – Vegetation plots within the ESE Project sub-area.

Appendix B – Bryophytes recorded within the ESE Project sub-area.

Appendix C – Invertebrate taxa collected within the ESE Project sub-area.

1.0 Introduction

1.1 Background

Bathurst Resources Limited (including its subsidiary companies Bathurst Coal Ltd and Buller Coal Ltd, and joint venture company BT Mining Ltd) (collectively referred to here as 'Bathurst') are seeking approvals through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('BPCP', or the Project').

The purpose of the Project is to reconsent the existing infrastructure and mining operations associated with the Stockton Mine and provide access to additional coal mining areas across parts of both the Denniston and Stockton Plateau, collectively referred to here as 'the Buller Plateaux'. The coal resource at the current Stockton Mine is close to depletion and access to further coal resource is required.

The Project Area is located approximately 35 kilometres (km) northeast of Westport. The Project is a complex proposal which seeks to enable a mix of ongoing and new mining activities. The land tenure is a mix of Crown, private and Bathurst owned land. The approvals required for the proposed activities are being bundled into a single application to proceed through the FTAA process.

As shown in Figure 1, the Project has been divided into five Project sub-areas for the purpose of the FTAA application:

- Stockton (including the Ngakawau Coal Handling Facility and Aerial Ropeway, 'Stockton').
- Cypress Mining Area ('Cypress').
- Mount Frederick South ('MFS').
- Escarpment Extended (including the Waimangaroa storage area, 'ESE').
- Transport Corridor known as the Upper Waimangaroa Haul Road ('UWHR').

The Project will enable 20 million tonnes of coking coal to be mined, utilising existing infrastructure facilities over a 16-year timeframe to support and extend the life of the current Stockton Mine operations.

This "Project sub-area report" describes the methods, survey results and ecological values of the Extended Escarpment (ESE) Project sub-area as shown in Figure 1. The effects assessments for each Project sub-area are provided in the Buller Plateaux Continuation Project Terrestrial Ecological Impact Assessment (Ecological Solutions Limited 2026a) and combined in the overall Assessment of Environmental Effects for the Project (Mitchell Daysh Limited 2026).

Disturbance Areas within each Project sub-area are where disturbance will occur (for example, mining, mining infrastructure, roading, buildings). The ESE Disturbance Area includes both 'new' disturbance and what Bathurst defines as 'existing' disturbance because existing/previously disturbed areas may still contain vegetation and habitats suitable for species.

The ESE Project sub-area occupies c. 584.7ha[1] including provision for edge effects, while the ESE Disturbance area within that covers c. 502.9ha[2].

[1] Based on shapefiles released 15 October 2025.
[2] Based on shapefiles released 4 December 2025.

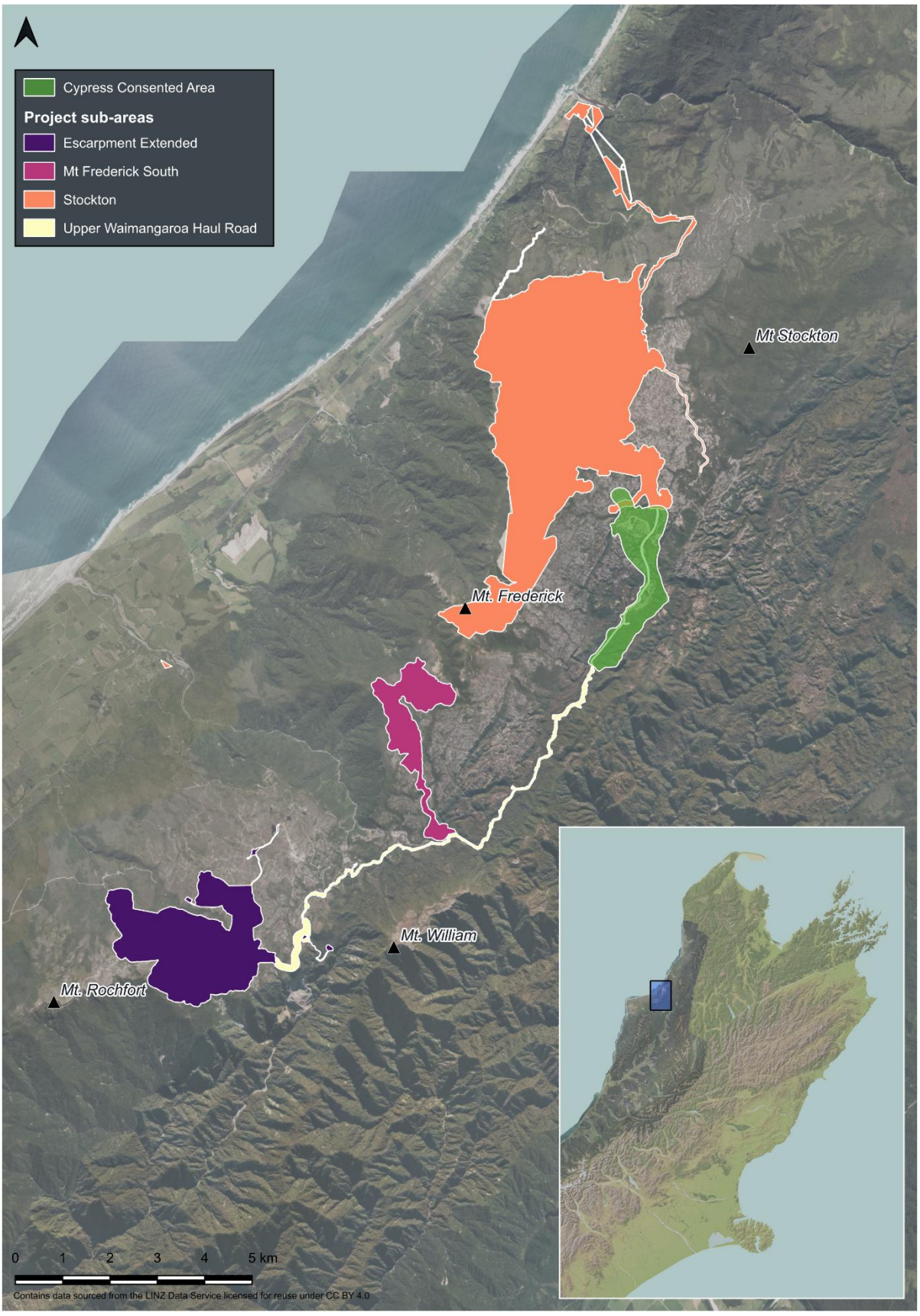


Figure 1: Buller Plateaux Continuation Project sub-areas.

1.2 Escarpment Mine

West Coast Regional and Buller District Councils granted Resource Consents (RC1093/1-16 and RC10/70A-H) to construct and operate Escarpment Mine in 2012. Escarpment Mine (EM) forms part of the ESE Project sub-area and is currently operated under care and maintenance. Only construction activities took place up until the 2016-17 annual work plan (AWP) period, after which the site was transitioned into care and maintenance, which has remained the case. The suite of resource consents that permit activities at EM include requirements for monitoring (Conditions 115-117) and a biodiversity compensation package (Conditions 145-149) which Bathurst have continued to comply with. This includes providing financial compensation (known as 'the BCL Denniston compensation funding') to the Department of Conservation to undertake weed and animal pest control within c. 4,400ha of the Denniston Plateau and surrounding forest known as the Denniston Biodiversity Enhancement Area ("the DBEA"). Within the DBEA is a smaller Denniston Permanent Protection Area ("the DPPA"). Monitoring within the DBEA and DPPA has continued since resource consents were granted and the results have been published in annual reports up to the period ending 30 June 2024 (Department of Conservation 2024). This information has been included here where relevant and the location of the DBEA and DPPA in relation to the ESE Project sub-area is shown in Figure 2.

1.3 Scope and Purpose

In preparing for the Project, Bathurst has undertaken a range of surveys since 2020, both across the Buller Plateaux generally and at specific locations of interest. In addition, Bathurst has also undertaken regular monitoring of a range of species at various locations in order to inform their effects management and compliance reporting. This has produced a large amount of ecological information in a variety of documents. This report summarises the information relevant to the ESE Project sub-area and provides technical detail sufficient to support the Terrestrial Ecological Impact Assessment (Ecological Solutions Limited 2026a) and the overall Assessment of Ecological Effects for the Project (Mitchell Daysh Limited 2026) as a standalone document. The purpose is to minimise the information provided in those larger documents, whilst still providing sufficient detail to inform decision makers.

This document includes five sections as follows:

- This introduction (Section 1.0).
- Section 2.0 sets out the methods used to survey vascular and non-vascular vegetation, wetlands, avifauna, lizards, land snails, other terrestrial invertebrates and mammalian pests. Section 2.0 also identifies any relevant key documents to be read in conjunction with this report.
- Section 3.0 sets out the results of the surveys described in Section 2.
- Section 4.0 provides a conclusion with respect to the ecological values present.
- Section 5.0 provides the references used in compiling this report.

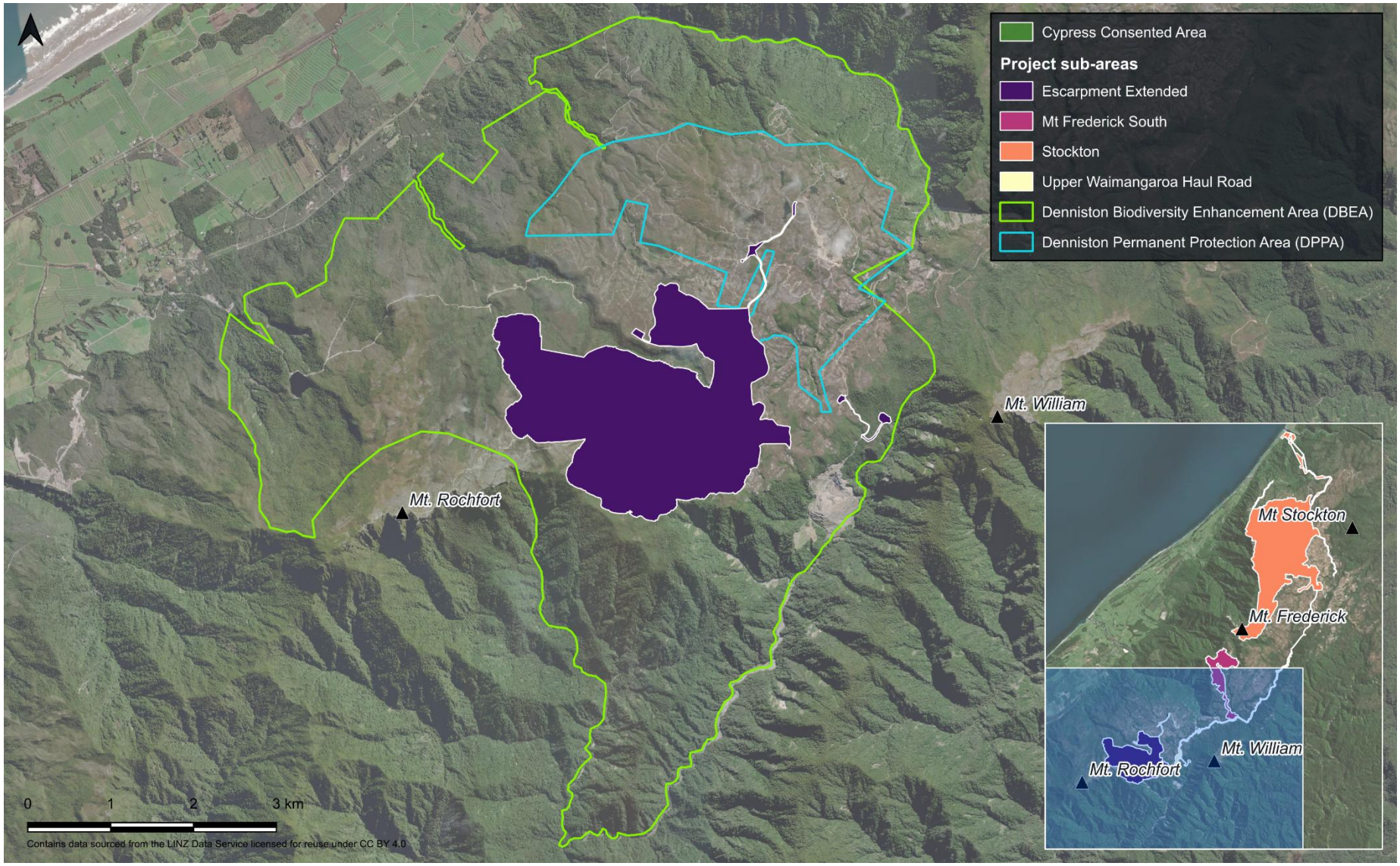


Figure 2: Location of the DBEA and DPPA in relation to the ESE Project sub-area.

2.0 Methods

2.1 Vegetation

2.1.1 Mapping vegetation types

Terrestrial and wetland vegetation within c. 10,129ha of the Buller Plateaux and surrounds (referred to as "the Mapped Area") was mapped and described using 152 10 x 10m vegetation plots collected between 2008 and 2024 across both the Stockton and Denniston Plateaux, combined with ordination and multivariate analysis as well as classification of 45,690 aerial photographs of the Mapped Area collected between July 2019 and January 2024 (Ecological Solutions Limited 2026b).

As shown in Figure 3, the Mapped Area includes the ESE Project sub-area and surrounds. Of the 152 plots used to inform the vegetation mapping study, 60 plots were located within the ESE Project sub-area (Ecological Solutions Limited 2026b). A list of these plots is provided in Appendix A. Most of these plots date from earlier field surveys (as early as 2008), but 10 plots contributing to the wider mapping study were surveyed between 16 January and 17 February 2024 and located within or near the ESE Project sub-area.

The methods used to compile the vegetation map are briefly summarised here. For more detail see Ecological Solutions Limited (2026b). Vegetation plot data collected using the RECCE method (Hurst et al. 2022) was ordinated using non-metric multi-dimensional scaling (NMDS) combined with generalised linear modelling (GLM) and principal components analysis (PCA) to discriminate vegetation types and identify underlying ecological drivers. The PCA indicated that altitude, slope, aspect and percentage of rock cover were strong ecological drivers of the vegetation type present.

Concurrently, drone imagery was used to create georeferenced orthomaps which were separated into distinct vegetation types using machine learning via two types of algorithms (RF and SVM) informed by training samples which were assigned to one of the vegetation types identified from the ordination by those personnel involved in the field surveys. Three additional land cover types were identified during that verification process including bare rock (mostly sandstone erosion pavement), water (often historic mine infrastructure) and cleared vegetation.

2.1.2 Identifying wetland vegetation types

The specific method for identifying wetlands is detailed in Ecological Solutions Limited (2026b). To summarise, the wetland vegetation tests identified in the wetland delineation protocols (Ministry for the Environment 2020a) were applied to each of the 152 vegetation plots to determine whether that plot met the definition of 'natural inland wetland' set out in the National Policy Statement for Freshwater Management (2020 and subsequent amendments, "the NPS-FM") or not. For vegetation types where all the plots met the relevant tests, those vegetation types were identified as natural inland wetlands. For vegetation types where only some of the plots met the relevant tests, professional judgement was used to determine whether the vegetation was a wetland type or not. Where none of the plots met the relevant tests, those vegetation types were not identified as wetlands.

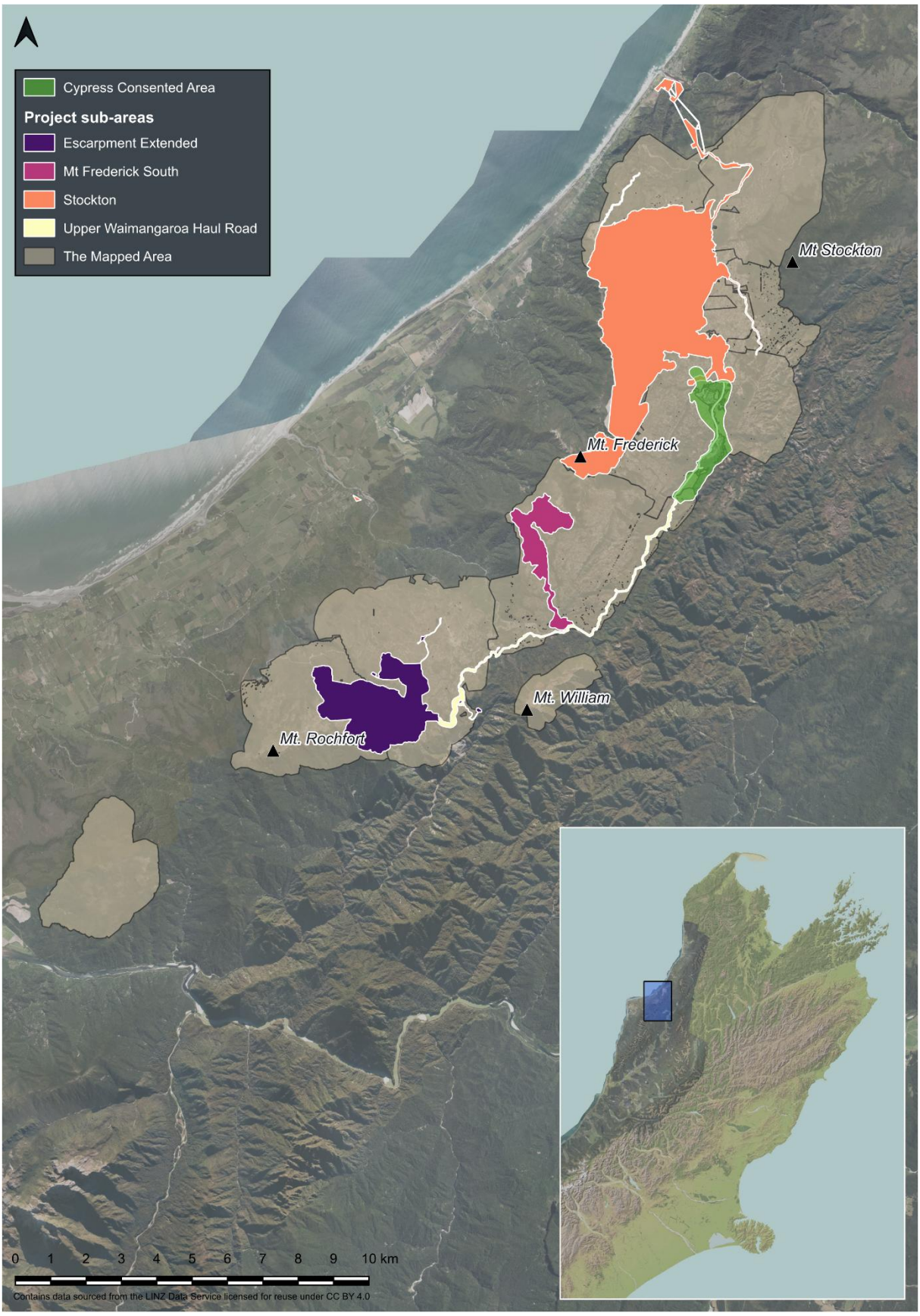


Figure 3: Extent of the Mapped Area at the Buller Plateaux.

2.1.3 Bryophytes and lichens

Previous bryophyte and lichen surveys from the Buller Plateaux and Ngakawau Ecological District are summarised in Ecological Solutions Limited (2026c). This included identification of the vegetation type (or habitat) where bryophytes and lichens considered 'Threatened' or 'At Risk' by de Lange et al. (2018, 2020) and Michel et al. (2026) had been recorded previously so as to inform an assessment of the likely ecological value of parts of the ESE Project sub-area which could not be surveyed directly.

Within the ESE Project sub-area, nine 5 x 5 metre (m) plots located within the larger RECCE plots used to assist in mapping vegetation were surveyed for bryophytes in January 2024 in order to inform the description of the bryophyte communities within the Project Area.

No specific search was undertaken for lichens. The location of any easily identifiable species considered to be 'Threatened' or 'At Risk' by de Lange et al. (2018) encountered during vegetation surveys were recorded on a handheld Garmin GPS unit.

2.2 Avifauna

2.2.1 Background

Previous surveys and/or monitoring reports relating to birds in the vicinity are summarised in Ecological Solutions Limited (2026c).

Bird surveys within the Buller Plateaux have used a variety of methods including five-minute bird counts (5MBC), acoustic recorder surveys for diurnal birds, standard call count surveys (e.g., for roroa/great spotted kiwi (*Apteryx maxima*)) and acoustic recorder surveys for nocturnal birds. Acoustic recorders have the advantage of increasing detectability (particularly for cryptic species), avoiding disturbance to birds due to an observer, easily increasing survey area or duration without substantial additional effort and providing permanent recordings (which can be shared with others if required, e.g., to identify rare species).

During the vegetation, bryophyte and terrestrial invertebrate surveys undertaken specifically for the Project, any birds encountered were also recorded.

2.2.2 Five-minute bird counts

Since 2011, 60 5MBC stations in the EM footprint and 60 within the DPPA have been monitored biennially as required by the relevant conditions of the resource consents, access arrangement and Wildlife Act authorities associated with EM (Boffa Miskell 2015, Nichol 2023). Forty-one of these 5MBC stations were located within the ESE Project sub-area with the remainder nearby as shown in Figure 4.

During each annual survey, each 5MBC station was visited by two different observers to generate 120 counts for each area per survey (i.e., per year). Site E58 was discontinued after 2021 due to safety risks around accessibility. Sites were generally separated by a minimum distance of 200m, however, the closest station was 167m from its nearest neighbour. There are now 15 years of data from these 5MBC stations.

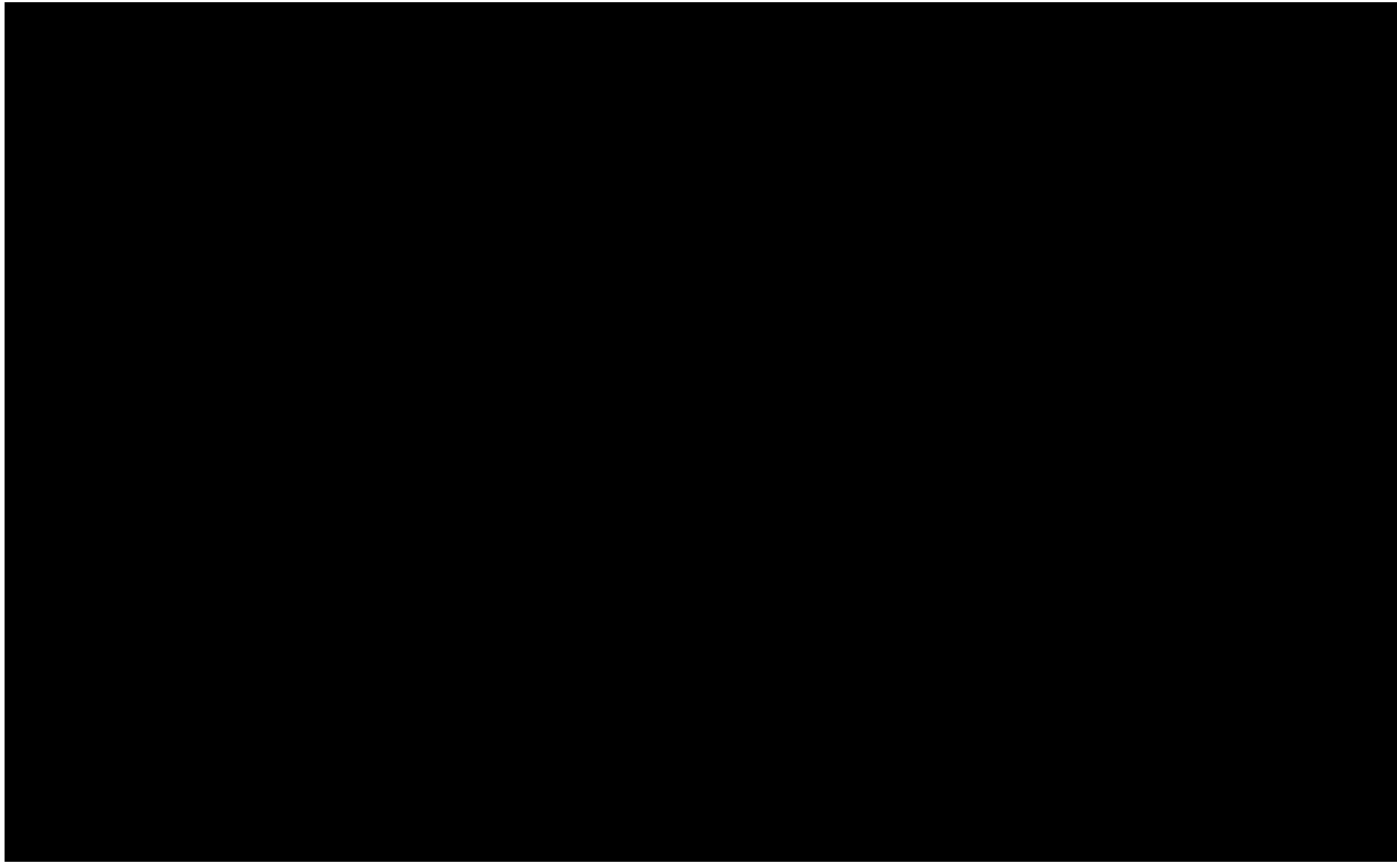


Figure 4: Location of five-minute bird counts in relation to the ESE Project sub-area.

2.2.3 Roroa call count surveys

Approximately biannual roroa call count surveys have been conducted on the Denniston Plateau (including within the ESE Project sub-area and the DPPA) since 2013 (Nichol 2022). Surveys were conducted in 2013, 2015, 2017, 2019 and 2022 at 19 established listening stations shown in Figure 5.

The call count surveys were undertaken generally according to the national protocol using the method outlined in Nichol (2022). Counts involved listening for a period of three hours from sunset and recording all individual calls, their sex, distance and direction. Environmental variables such as temperature, wind, precipitation, noise, ground conditions, darkness and cloud cover were collected for each hour of survey. Weka (*Gallirallus australis*) calls were also recorded during this survey but are not reported here.

2.3 Lizards

Previous lizard surveys undertaken within the Buller Plateaux are summarised in Ecological Solutions Limited (2026c).

Alliance Ecology undertook lizard surveys on the Denniston Plateau and Waimangaroa Valley over five days on 15–16 January and 3–5 March 2020 when the weather was warm (> 12°C) and geckos were most likely to be active. Methods used to locate lizards included manual day searching and nocturnal spotlighting.

Manual searching included the use of binoculars and/or the naked eye to target species including West Coast green gecko (*Naultinus tuberculatus*) and basking Westland speckled skink (*Oligosoma* aff. *newmani* "Westland"). Visual searching targeted lizards within all habitat types in the Project sub-area that provided suitable habitat and that were conducive to detecting lizards. Manual searching also included hand-searching for the presence of inactive forest gecko (*Mokopirirakau granulatus*) and Westland speckled skink. Hand-searching entailed crevice inspections (by torchlight) and careful lifting of rock slabs and other surface debris, taking care to return disturbed items to their original positions.

Searching was undertaken in forest margins, low prostrate vegetation, shrubland, rock outcrops and pavement. Despite providing suitable habitat, searching was not undertaken in tall shrubland or native forest habitat or on steep slopes due to the reduced likelihood of detecting lizards (e.g., geckos located in tall trees) and/or health and safety concerns.

Nocturnal searches were undertaken to detect active forest or West Coast green geckos using powerful torches (minimum 800 lumens) and binoculars to 'spotlight' and capture lizards. Searching was undertaken on foot and also while driving (1–5 kilometres per hour (km/hr)) along selected drivable tracks that were readily accessible and surrounded by suitable and readily searchable habitat.

Irrespective of method, searches were timed to provide a measure of catch per unit effort, i.e., catches per person hour. All captured lizards were released at their capture site. Capture locations were recorded using a Garmin GPS and recorded on Data Collector.

For each lizard captured during surveys, the following information was recorded:

- Date and time of capture and weather conditions;
- Capture methodology;
- Capture location (GPS coordinates), capture methodology, habitat type; and
- Species; sex (reproductive status for females); age class; snout to vent length (SVL); tail status (regenerating versus original tail); and overall health and condition.



Figure 5: Location of roroa listening stations on the Denniston Plateau.

At least one photograph of each captured lizard was taken, including at least one photograph showing the dorsal surface clearly.

2.4 Land Snails

Previous snail surveys and/or monitoring reports are summarised in Ecological Solutions Limited (2026c).

Lloyd (2024a) used two 70m square plots for capture-recapture monitoring of *Powelliphanta* snails between 2014 and 2024. The plots were located in the north-west of the Denniston Plateau, approximately 650m above sea level as shown in Figure 6. Both plots comprised habitat typical to the Denniston Plateau. Snail searches were carried out between mid-November and mid-April 2014–15, 2016–17, 2018–19, 2019–20 (curtailed by COVID-19), 2020–21 and 2023–24, i.e., six capture-recapture events.

Capture-recapture monitoring involved 3-7 nights of searches for live snails. All snails greater than or equal to 20 millimetres (mm) in diameter were captured and had their weight, diameter and condition recorded, and were marked with a numbered polyethylene tag. When previously tagged snails were recaptured, their tag number and condition were recorded.

Results of surveys were analysed using closed population models, and robust design capture-recapture model, both of which compensated for edge effects. The von Bertalanffy growth equation (used to model age from length in animals) was also used and a condition index was created based on diameter and weight measurements.

2.5 Other Terrestrial Invertebrates

Previous invertebrate surveys and reports from the Buller Plateaux and surrounds are summarised in Ecological Solutions Limited (2026c).

Additional invertebrate surveys were undertaken within the ESE Project sub-area in January 2024 as described below. The survey approach relied on a broad sampling effort covering a range of vegetation types present across the ESE Project sub-area, rather than attempting to achieve a high intensity survey at specific locations or within particular habitats.

The aim of the surveys was to characterise the invertebrate communities by sampling as many vegetation types and locations as practicable in order to capture variation in invertebrate communities based on the vegetation and any differences in invertebrate communities at different elevations. Additional, or targeted, sampling effort would certainly detect other species; however, many of New Zealand's invertebrate species remain undescribed and even for those that have been described, there is often a lack of basic ecological information (e.g., habitat requirements and distribution) on which to base meaningful interpretations of conservation significance and assessments of effects (Toft 2011).

Sampling at each of 11 survey locations across the ESE Project sub-area included three pitfall traps, one malaise trap, sweep netting, beat sampling, and hand searching (where suitable habitat was available). The sampling sites are described in Table 1 and shown in Figure 7.

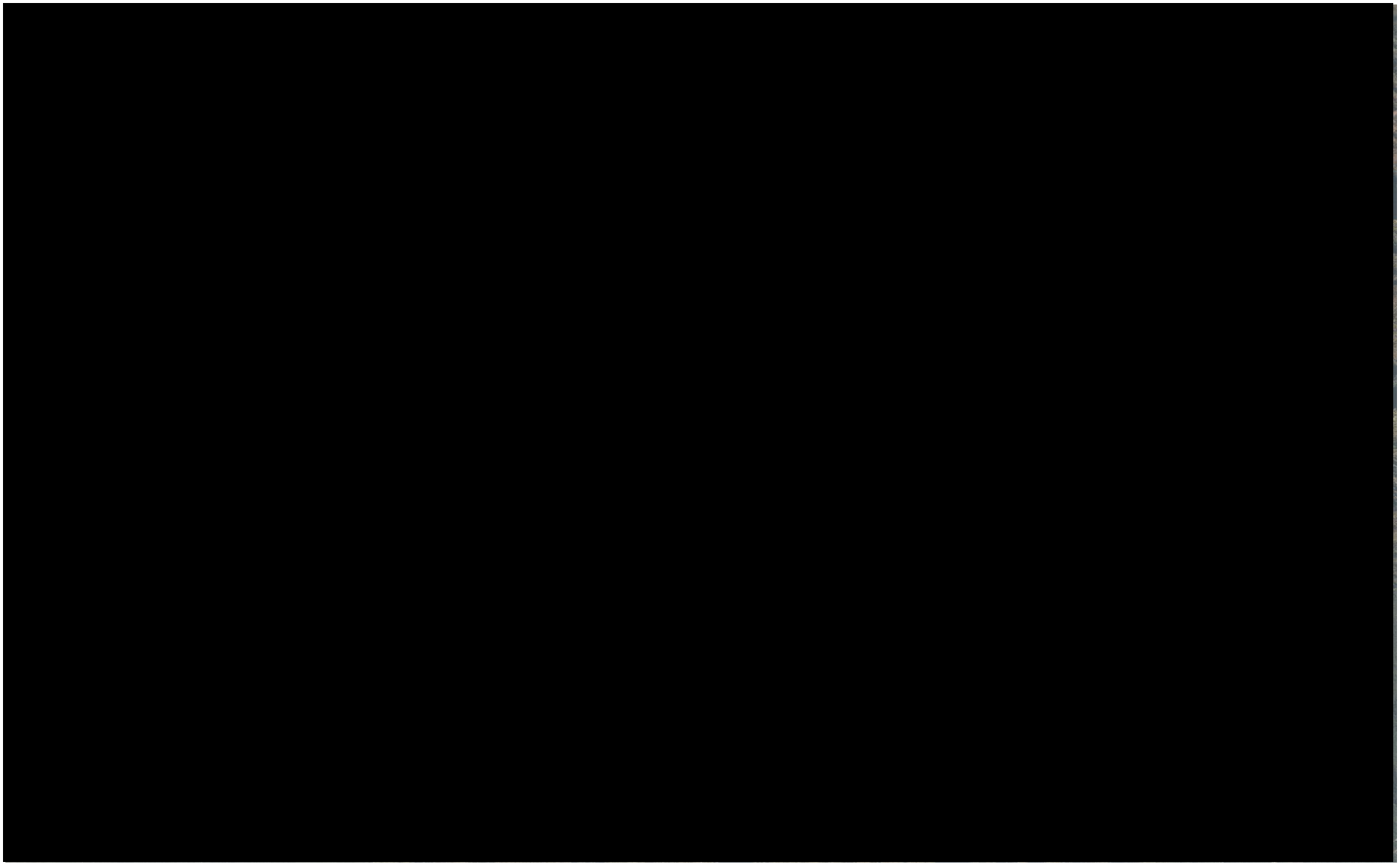


Figure 6: Location of snail mark-recapture plots and snail surveys on the Denniston Plateau.



Figure 7: Location of invertebrate sampling sites within the ESE Project sub-area.

Table 1: Location of terrestrial invertebrate sampling sites and the vegetation type present within the ESE Project sub-area.

Site #	Vegetation Classification	NZTM 2000	
		Easting	Northing
ESC1	Low pākihi	[redacted]	
ESC2	Moderate height mānuka-tussock-wire rush shrubland	[redacted]	
ESC3	Low pākihi	[redacted]	
ESC4	Bare Rock	[redacted]	
ESC5	Southern rātā-mountain beech-podocarp forest	[redacted]	
ESC6	Mānuka/Gahnia-wire rush shrubland	[redacted]	
ESC7	Southern rātā-mountain beech-podocarp forest	[redacted]	
ESC8	Low pākihi	[redacted]	
ESC9	Vegetation cleared	[redacted]	
DS4	Weedy shrubland	[redacted]	
DS6	Low pākihi	[redacted]	

2.6 Mammalian Pests

Pest monitoring has been undertaken as part of ongoing ecosystem management at the DBEA since November 2014. Rodents and stoats have been monitored quarterly in most years using tracking tunnels. Tracking tunnels are an effective, relatively sensitive tool for establishing indices of rodent densities, with the advantage that the method is nationally standardised (Gillies and Williams 2013). In contrast, tracking tunnels have a low sensitivity for detection of stoats, so should be regarded as an indication of presence only (Smith and Weston 2017). Tracking tunnels were placed on transects in both sandstone pavement and in forest, with results summarised in Parkes (2020) and Williams (2024). Possums were monitored using wax-tags before and after aerial baiting with 1080 (sodium monofluoroacetate) in 2015, 2017, 2019, 2020 and 2023 (Williams 2024). Recent pest monitoring used four lines each of tracking tunnels (targeting rodents), chew cards (targeting rodents and possums) and motion-detecting trail cameras (targeting mustelids, feral cats and ungulate species, Alliance Ecology 2026) set according to the national protocols or, in the case of cameras, broadly accepted methods. The location and layout of these monitoring devices on the Denniston Plateau is shown in Figure 8.

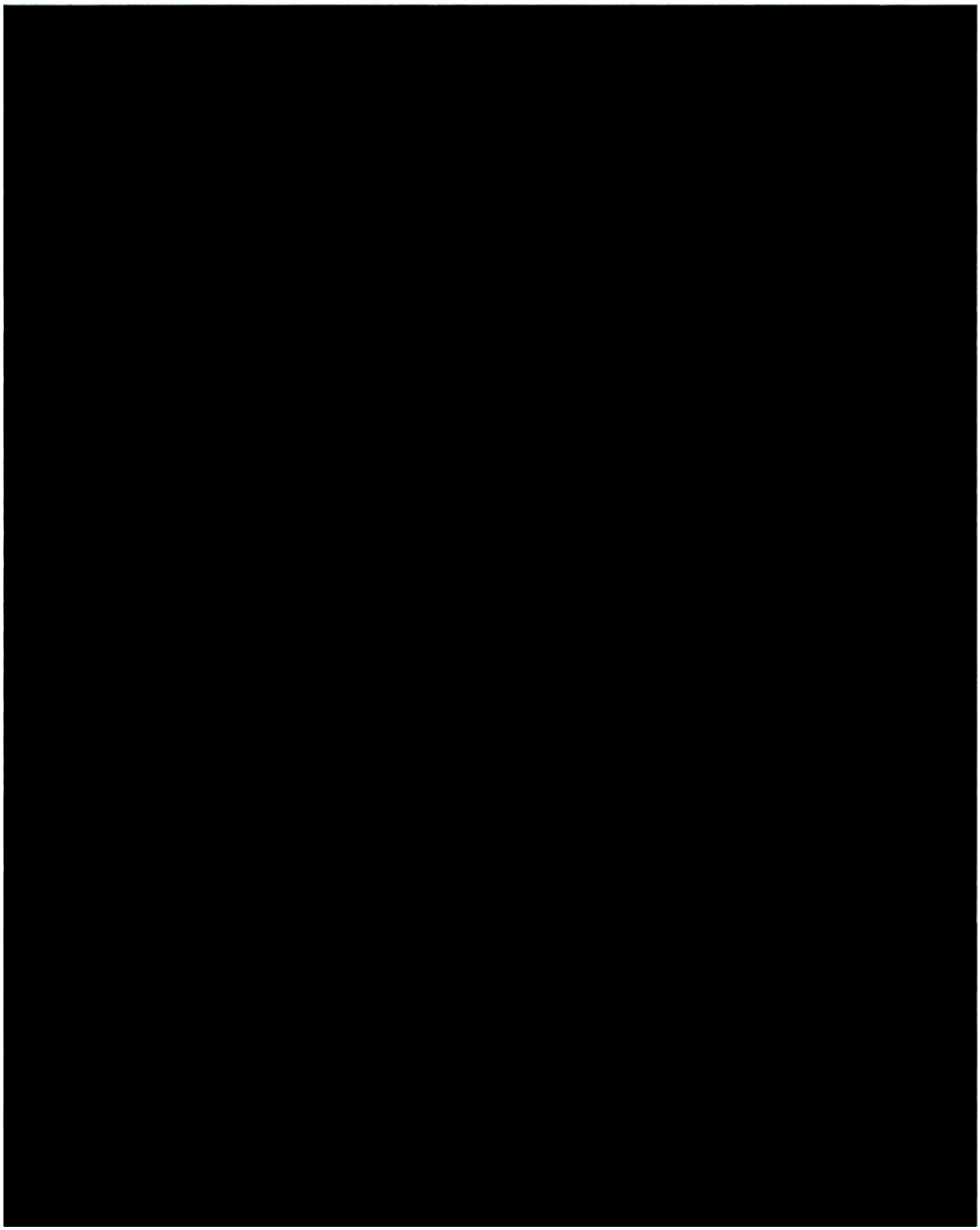


Figure 8: **Pest monitoring device locations on the Denniston Plateau (From Alliance Ecology 2025).**

3.0 Results

3.1 Vegetation

3.1.1 Summary

The extent of each vegetation and landcover type present within the ESE Disturbance Area. and associated Indirect Effects Contingency area (to provide for edge effects) is set out in Table 2 and the distribution and location of each cover type is shown in Figure 9. Each vegetation type present is described in more detail in Sections 3.1.2– 3.1.4. The ESE Disturbance Area comprises mostly Southern rātā-mountain beech-podocarp forest (128.8ha, c. 26% of total area) and low pākihi (122.1ha, c. 24% of total area). Shrubland vegetation of various types comprises 148.5ha (c. 30%) of the Disturbance Area, most of which is mānuka-tussock-wire rush shrubland. Non-vegetated land cover within the Disturbance Area makes up the remaining c. 20%, comprising bare rock (sandstone erosion pavement, c. 41.8ha) and cleared areas (c. 58ha).

The ESE Indirect Effects Contingency area covers a further c.42.6ha of the same vegetation types with Southern rātā-mountain beech-podocarp forest making up the majority (c. 15.6ha) as summarised in Table 2.

Table 2: Extent of vegetation types within the ESE Project sub-area.

	Area (ha)			
	Total (Disturbance + Indirect Effects Contingency)	**Disturbance area**	**Indirect Effects Contingency**	**Disturbance as a % of total Disturbance area**
Forest				
Mixed beech-podocarp-broadleaved forest	1.4	0.4	1.0	0.1
Southern rātā-mountain beech-podocarp forest	144.4	128.8	15.6	25.6
Shrubland				
Mānuka-mountain beech-podocarp shrubland	42.9	39.5	3.4	7.9
Mānuka/Gahnia-wire rush shrubland	9.4	8.7	0.7	1.7
Weedy shrubland	12.0	10.5	1.5	2.1
Mānuka-tussock-wire rush shrubland	91.6	88.3	3.3	17.6
Mānuka-mountain flax/wire rush shrubland	1.6	1.5	0.0	0.3
Low vegetation				
Low pākihi	132.7	122.1	10.6	24.3
Low pākihi with exotic component	0.0	0.0	0.0	0.0
Tussock-mountain flax shrubland	0.4	0.2	0.2	0.0
Exotic grassland	0.9	0.8	0.1	0.2
Non-vegetated land cover				
Bare Rock	45.2	41.8	3.4	8.3
Vegetation cleared	60.9	58.0	2.9	11.5
Water	2.2	2.1	0.1	0.4
Total	**545.4**	**502.8**	**42.6**	**100%**

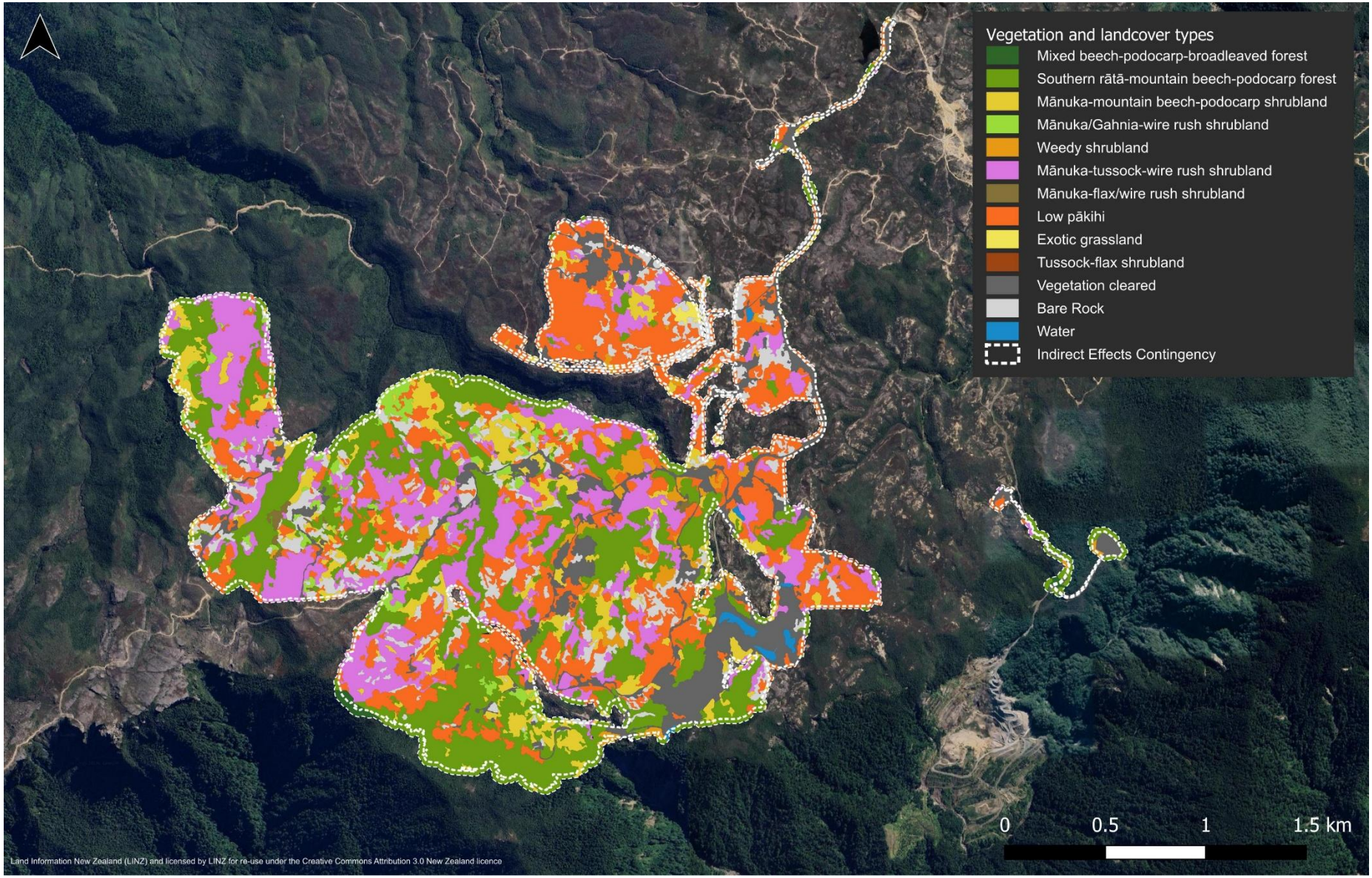


Figure 9: Vegetation and land cover types within the ESE Disturbance Area and associated Indirect Effects Contingency area.

3.1.2 Forest vegetation

Two forest types were present within the ESE Disturbance Area. Southern rātā-mountain beech-podocarp forest was the most common (covering c. 144ha including Indirect Effects Contingency area), and occurred mainly in gullies and sheltered sites throughout, particularly in the south. This forest had a mean height of c. 7.5m, with a sparse emergent layer dominated by Southern rātā (*Metrosideros umbellata*). Pāhautea (*Libocedrus bidwillii*) formed a sparse but conspicuous component of the canopy in sheltered areas, typically near waterways. The canopy layer was dense, with abundant mountain beech (*Fuscospora cliffortioides*), common podocarps (principally yellow-silver pine (*Lepidothamnus intermedius*) and pink pine (*Halocarpus bidwillii*)) and occasional silver beech (*Lophozonia menziesii*). The understorey had a high species richness, including species such as weeping māpou (*Myrsine divaricata*), mountain toatoa (*Phyllocladus alpinus*), pseudopanax species (*Pseudopanax colensoi* var. *ternata*, *P. linearis*) and various *Coprosma* and *Dracophyllum* species. Ground cover comprised mainly gahnia (*Gahnia procera*), *Astelia nervosa*, ferns and tree/shrub seedlings.

A small area (c. 0.4ha) of mixed beech-podocarp-broadleaved forest extended into the south-western part of the Disturbance Area. This forest type was widespread at lower elevation sites including the lower parts of the plateaux or at sites comprising more fertile colluvial material. This forest type is characterised by tall (mean height c.12.4 m), dense, old growth forest, dominated by large forest trees such as red beech (*Fuscospora fusca*), silver beech, Hall's tōtara (*Podocarpus laetus*) and Southern rātā, with rimu (*Dacrydium cupressinum*) and red beech dominating the emergent layer. Other common species in the canopy and sub-canopy included kāmahi (*Pterophylla racemosa*), quintinia (*Quintinia serrata*) and dracophyllum (*Dracophyllum elegantissimum, D. traversii*). Ground cover was mainly dominated by ferns (small kiokio (*Parablechnum procerum*), crown fern (*Lomaria discolor*), *Hymenophyllum* species) and bush rice grass (*Microlaena avenacea*).

3.1.3 Shrubland vegetation

The most common shrubland type present was mānuka-tussock-wire rush shrubland, which occupied approximately 88.3ha within the ESE Disturbance Area. This short vegetation had a mean height of c. 0.83m, with mānuka (*Leptospermum scoparium* agg.) dominating the canopy. *Dracophyllum* species (particularly *D. rosmarinifolium*), *Gahnia* spp. and tangle fern (*Gleichenia* spp.) were often present in the lower tiers. Ground cover was primarily mānuka and wire rush (*Empodisma minus*), with coal measures tussock (*Chionochloa juncea*) forming a conspicuous component.

Mānuka-mountain beech-podocarp shrubland occupied c. 39.5ha of the ESE Disturbance Area. This shrubland was c. 3.9m tall on average, with the canopy dominated by mānuka and mountain beech, with yellow-silver pine, pink pine and Southern rātā also present in varying proportions. The understorey layer comprised saplings of canopy species, and shrubs such as *Coprosma* spp., prickly mingimingi (*Leucopogon fasciculatus*) and weeping mapou. Gahnia, mountain flax (*Phormium cookianum*) and wire rush were abundant in the ground layer. This vegetation was widely distributed across the ESE Project sub-area, often forming an ecotone between taller forest on more well-drained slopes and stunted shrubland and pākihi communities.

Weedy shrubland covered c. 10.5ha of the ESE Disturbance Area and was often located near cleared vegetation. This mixed species shrubland was of medium stature (mean height 2m) and comprised a range of indigenous and exotic species, including mānuka, kāmahi, pink pine, gorse (*Ulex europaeus*), *Juncus* species (soft rush (*Juncus effusus*), tailed seeded rush (*J. canadensis*) and heath rush (*J. squarrosus*)) and exotic grasses such as browntop (*Agrostis capillaris*) and Yorkshire fog (*Holcus lanatus*).

Mānuka/Gahnia-wire rush shrubland occupied approximately 8.7ha of the ESE Disturbance

Area and had a mean height of 2.8m, with the canopy dominated by dense mānuka and to a lesser extent mountain beech, yellow-silver pine and mountain toatoa. Ground cover was predominantly wire rush and *Gahnia procera*, with occasional low growing *Dracophyllum* species, prickly mingimingi and mountain flax.

Approximately 1.5ha of mānuka-mountain flax/wire rush shrubland was present across the ESE Disturbance Area. This vegetation was similar in structure to mānuka-tussock-wire rush shrubland, but included mountain flax as a conspicuous sub-dominant species. Ground cover was dominated by mānuka and wire rush. Red tussock (*Chionochloa rubra*), coal measures tussock, *Dracophyllum* species and podocarps formed a minor component of the upper tiers. This vegetation was sparsely distributed across the ESE Disturbance Area.

Tussock-flax shrubland (mean height 0.93 m) occupied c. 0.2ha in the eastern part of the ESE Disturbance Area. This vegetation was dominated by red tussock, along with occasional mountain flax and *Dracophyllum* spp. Wire rush and tangle fern were present in the ground layer.

3.1.4 Low vegetation

Low pākihi was abundant across the ESE Disturbance Area occupying approximately 122.1ha, (24%) and usually occurring on gently sloping, exposed areas associated with sandstone pavement, particularly in the north. This short vegetation (mean height c. 0.27m) was dominated by prostrate mānuka and wire rush, with occasional red tussock, coal measures tussock and carpet grass (*Chionochloa australis*). *Carpha alpina*, cushion plant (*Donatia novae-zelandiae*), tangle fern (*Gleichenia dicarpa*) and sundews (*Drosera* spp.) were common in the ground layer. At more poorly drained locations this vegetation included common pākihi rush (*Machaerina teretifolia*), square sedge (*Lepidosperma australe*) and *Rytidosperma* spp. with occasional *Chionochloa* spp.

Exotic grassland associated with areas of historic disturbance and cleared vegetation occupied c. 0.8ha of the ESE Disturbance Area. This short vegetation (mean height c. 0.31m) was dominated by heath rush, along with exotic grasses such as browntop and Yorkshire fog. Exotic herbs such as catsear (*Hypochaeris radicata*) were also present, along with small amounts of native grasses and low-growing shrubs.

3.1.5 Other landcover types

The ESE Disturbance Area includes approximately 41.8ha of bare rock. This mostly comprises sandstone erosion pavement with a low proportion prostrate/low growing vegetation cover including species such as carpet grass, pygmy pine (*Lepidothamnus laxifolius*) prostrate *Dracophyllum* spp. and prostrate mānuka.

As well as the vegetation, there was approximately 58ha of cleared areas, and 2.1ha of water (typically historical mine infrastructure) within the ESE Disturbance Area.

3.1.6 'Threatened' and 'At Risk' plant species

Ecological Solutions Limited (2026b) identified a total of approximately 542 vascular plant taxa which have been recorded from the Buller Plateaux since 1990. The majority (469 (87%)) of those were indigenous, and 70 (13%) were exotic species. Thirty-one species (c. 6%) are of conservation concern. The flora of the ESE Project sub-area includes 'At Risk' vascular plants (de Lange et al. 2024) as well as local endemics and species with disjunct (discontinuous) distributions.

No plants currently regarded as 'Threatened' are known to occur within the ESE Project sub-area, but 12 'At Risk' plants are known or expected to occur there including:

- *Chionochloa juncea* – 'At Risk – Declining';

- *Dracophyllum densum* – 'At Risk – Declining';
- *Euphrasia wettsteiniana* – 'At Risk – Declining';
- Red mistletoe (*Peraxilla tetrapetala*) – 'At Risk – Declining';
- *Astelia subulata* – 'At Risk – Naturally Uncommon';
- *Carex carsei* – 'At Risk – Naturally Uncommon';
- *Carex dallii* – 'At Risk – Naturally Uncommon';
- *Euphrasia disperma* – 'At Risk – Naturally Uncommon';
- *Pseudowintera traversii* – 'At Risk – Naturally Uncommon';
- *Schizacme helmsii* – 'At Risk – Naturally Uncommon';
- *Sticherus tener* – 'At Risk – Naturally Uncommon'; and
- *Sticherus urceolatus* – 'At Risk – Naturally Uncommon'.

3.2 Wetlands

Most of the Denniston Plateau exhibits hydrological and soil characteristics typical of wetlands, including soil saturation, surface water, stunted plants, a shallow aquitard (i.e., sandstone basement rock) and highly leached gley soils. The high annual rainfall contributes to maintaining these wetland features.

Low pākihi, mānuka-tussock-wire rush shrubland, mānuka-mountain beech-podocarp shrubland, mānuka/Gahnia-wire rush shrubland, mānuka-mountain flax/wire rush shrubland, weedy low pākihi and tussock-flax shrubland all met the vegetation tests to be considered natural inland wetlands (Ecological Solutions Limited 2026b).

Mixed beech-podocarp-broadleaf forest and Southern rātā-mountain beech-podocarp forest are not natural inland wetlands (Ecological Solutions Limited 2026b). Despite, inconclusive outcomes for the wetland tests and small sample sizes, weedy shrubland and exotic grassland were not considered to be wetland types, but these vegetation types may require more site-specific consideration to confirm their status.

The total extent of natural inland wetland within the ESE Disturbance Area is approximately 260.5ha (52%) as shown in Figure 10. A further 18.1ha of natural inland wetland occurs within the Indirect Effects Contingency Area and would be subject to edge effects.

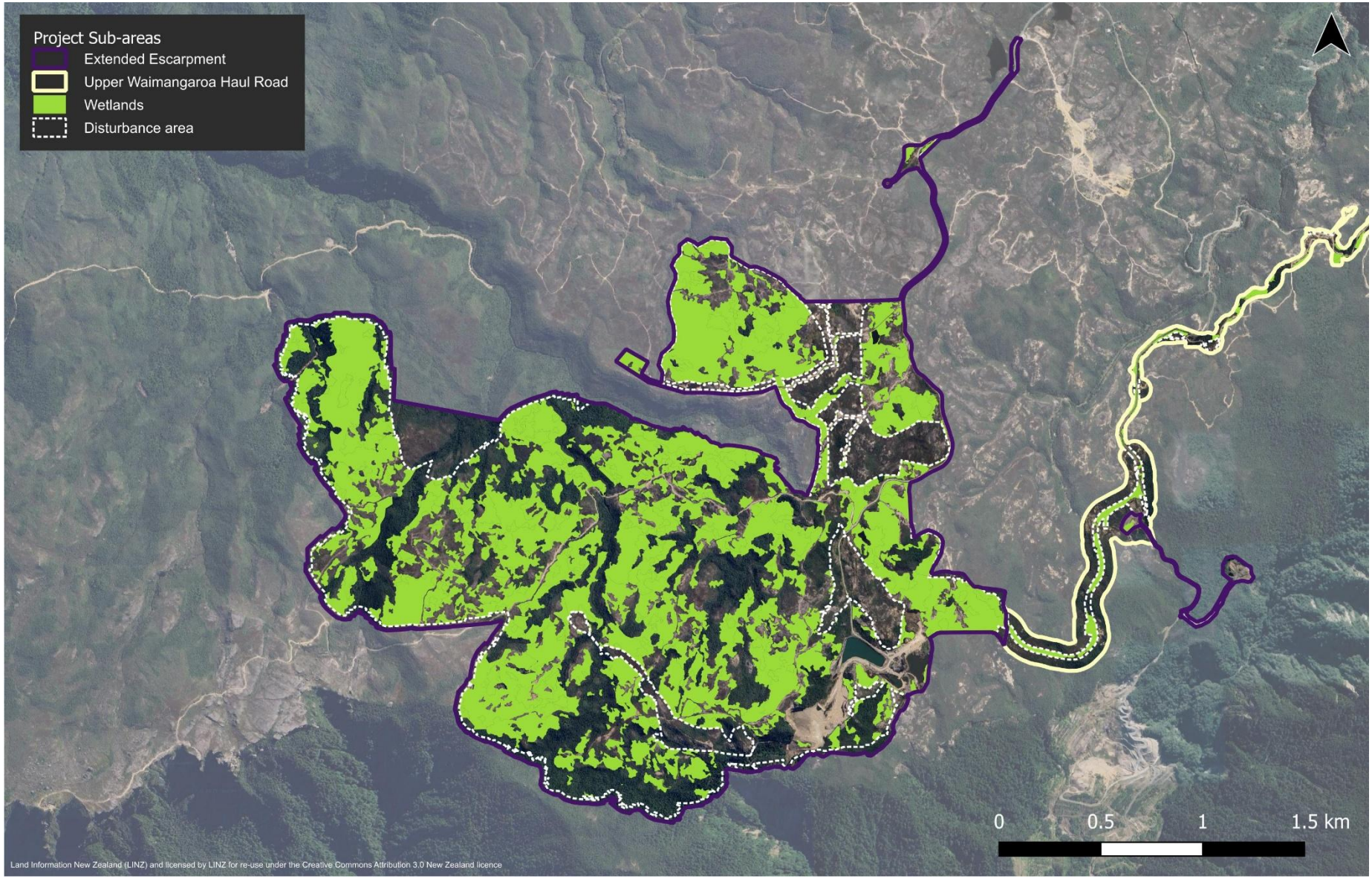


Figure 10: The extent and location of wetlands within the ESE Disturbance area.

3.3 Bryophytes

Twenty-one bryophytes considered to be 'Threatened' or 'At Risk' by de Lange et al. (2020) and Michel et al. (2026) are known to occur within the ESE Project sub-area as listed in Table 3. Of those:

- Two are considered 'Threatened – Nationally Critical';
- Two are considered 'Threatened – Nationally Vulnerable';
- One is considered 'At Risk – Declining'; and
- 16 are considered 'At Risk – Naturally Uncommon'.

The location records of these species are shown in Figure 11. A list of bryophytes recorded from the plot survey within the ESE Project sub-area and surrounds is provided in Appendix B.

The moss *Pulchrinodus inflatus*, although currently classified as 'Not Threatened' by Michel et al. (2026), is of botanical interest because it has never been observed with reproductive capsules (sporophytes). This species is found growing in pākihi ecotones, mānuka shrublands and sandstone erosion pavement across the Buller Plateaux and has been recorded within the ESE Project sub-area.

Additional species that may also be present within the ESE Project sub-area based on the presence of suitable habitat or nearby records, but which have not been recorded there to date, include: *Allisoniella scottii,* which is considered 'Threatened – Nationally Critical' by de Lange et al. (2020), along with eight 'At Risk – Naturally Uncommon' species including: *Acromastigum interstisiale, Andrewsianthus perigonialis, Heteroscyphus billardierei, Kurzia nivicola, Lepidozia fugax, Riccardia multicorpora, Schistochila pluriciliata,* and *Zoopsis matawaia,* and three 'Data Deficient' species *Ceramanus tuberifera*, *Cheilolejeunea novae-zelandiae* and *Riccardia exilis*.

Bryophytes of conservation concern within the ESE Project sub-area were most frequently recorded from the following vegetation and habitat types as shown in Table 3:

- Southern rātā-mountain beech-podocarp forest;
- Mānuka-tussock-wire rush shrubland;
- Mānuka-mountain beech-podocarp shrubland;
- Low pākihi; and
- Tussock-flax shrubland.

Table 3: 'Threatened' and 'At Risk' bryophytes recorded within the ESE Project sub-area.

Species	Potential habitat
Threatened – Nationally Critical	
Isolembidium anomalum var. *anomalum*	Southern rātā-mountain beech-podocarp forest, mānuka/ Gahnia-wire rush shrubland, mānuka-tussock-wire rush shrubland, low pākihi and tussock-flax shrubland, including vegetation within open sandstone pavement and riparian and vertical wet walls under forest or shrubland.
Neogrollea notabilis	Mānuka/ Gahnia-wire rush shrubland, mānuka-tussock-wire rush shrubland, low pākihi and tussock-flax shrubland, including vegetation within open sandstone pavement.
Threatened – Nationally Vulnerable	
Acromastigum verticale	Riparian and vertical wet walls under silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, tanglefern shrubland, and low pākihi.
Telaranea inaequalis	Riparian, stream sides and vertical wet walls under forest, Southern rātā-mountain beech-podocarp forest; and shrubland: mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, tanglefern shrubland and low pākihi.
At Risk – Declining	
Saccogynidium decurvum	Mixed beech-podocarp-broadleaved forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, low pākihi, tussock-flax shrubland. Also riparian, vertical wet walls and epiphytic on beech trees.
At Risk – Naturally Uncommon	
Acromastigum mooreanum	Low pākihi, mānuka-mountain beech-podocarp shrubland, silver beech-mountain beech forest. Also epiphytic on beech trees.
Andreaea subulata	Riparian / instream, low pākihi, mānuka-tussock-wire rush shrubland, mānuka-mountain flax/wire rush shrubland, mānuka-mountain beech-podocarp shrubland, and mānuka/Gahnia-wire rush shrubland.
Blindia immersa	Instream through tussock-flax shrubland and Southern rātā-mountain beech-podocarp forest.
Dicnemon dixonianum	Epiphyte in mixed beech-podocarp-broadleaved forest, mānuka-mountain beech-podocarp shrubland.
Herzogianthus sanguineus	Mānuka-tussock-wire rush shrubland, low pākihi, and mānuka-mountain beech-podocarp shrubland.
Herzogianthus vaginatus	Leatherwood shrubland, mānuka-tussock-wire rush shrubland, low pākihi, and Southern rātā-mountain beech-podocarp forest.
Isotachis westlandica	Riparian: sandy banks and stream edges under mixed beech-podocarp-broadleaved forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, and mānuka-tussock-wire rush shrubland.
Kurzia tenax	Silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, and mānuka-tussock-wire rush shrubland.
Lembidium longifolium	Densely shaded sites e.g. deep dark recesses, under Southern rātā-mountain beech-podocarp forest, and mānuka-tussock-wire rush shrubland.
Lepidolaena novae-zelandiae	Typically epiphytic on myrtaceous species, frequently on mānuka, also present on beech. Silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka/ Gahnia-wire rush shrubland, mānuka-tussock-wire rush shrubland, tussock-flax shrubland, and low pākihi.
Pallavicinia rubristipa	Riparian, Southern rātā-mountain beech-podocarp forest, tussock-flax shrubland, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, tanglefern shrubland, and low pākihi.
Pleurophascum ovalifolium	Silver beech-mountain beech forest, mixed beech-podocarp-broadleaved forest Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, tussock-flax shrubland, mānuka-tussock-wire rush shrubland, mānuka-flax/wire rush shrubland, mānuka/Gahnia-wire rush shrubland, sandstone erosion pavement ('bare rock'), tanglefern shrubland and low pākihi.
Riccardia furtiva	Silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, tussock-flax shrubland, and low pākihi. Also has been recorded from an area historically disturbed ('vegetation cleared').
Trichotemnoma corrugatum	Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, low pākihi and tanglefern shrubland.
Zoopsis bicruris	Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland
Zoopsis ceratophylla	Southern rātā-mountain beech-podocarp forest, mānuka-tussock-wire rush shrubland.

3.4 Lichens

Four lichens considered to be 'Threatened' or 'At Risk' by de Lange et al. (2018) and known to occur within the ESE Project sub-area are listed in Table 4 with the record locations shown in Figure 11. Of those:

- One is considered 'Threatened – Nationally Endangered';
- Two are considered 'Threatened – Nationally Vulnerable'; and
- One is considered 'At Risk – Naturally Uncommon'.

Lichens of conservation concern are most frequently recorded from sandstone erosion pavement and quartzite sands associated with ecotones between open areas and low pākihi, mānuka-mountain beech-podocarp shrubland, Southern rātā-mountain beech-podocarp forest and mānuka-tussock-wire rush shrubland.

Seven additional 'Threatened' and 'At Risk' lichens could be present within the ESE Project sub-area based on the presence of suitable habitat including: *Cladia fuliginosa* ('Threatened – Nationally Vulnerable') and six 'At Risk – Declining' species: *Cladia inflata, Degeliella rosulata, Leiorreuma exaltatum, Micarea isabellina, Ochrolechia frigida,* and *Pseudocyphellaria lindsayi.* The type locality for *P. lindsayi* is the Denniston Plateau.

At least eleven species which are considered 'Data Deficient' may also be present, and there is an unreliable record of *Parasiphula jamesii* recorded from the Denniston Plateau.

Table 4: Lichens of conservation concern recorded within the ESE Project sub-area.

Species	Potential habitat
Threatened – Nationally Endangered	
Pycnothelia caliginosa	Sandstone erosion pavement and quartzite sands ('bare rock') with ecotone associations: Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka/Gahnia-wire rush shrubland, tussock-flax shrubland, and low pākihi.
Threatened – Nationally Vulnerable	
Austropeltum glareosum	Sandstone erosion pavement and inundated quartzite sands ('bare rock') or peaty soils, with ecotone associations: mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, and low pākihi.
Knightiella splachnirima	Mānuka/Gahnia-wire rush shrubland, mānuka-tussock-wire rush shrubland, and low pākihi.
At Risk – Naturally Uncommon	
Calycidium cuneatum	Associated with tree bark, roots/buttress such as beech, or mossy rocks in moderate to deep shade; Southern rātā-mountain beech-podocarp forest, and mānuka-mountain beech-podocarp shrubland.

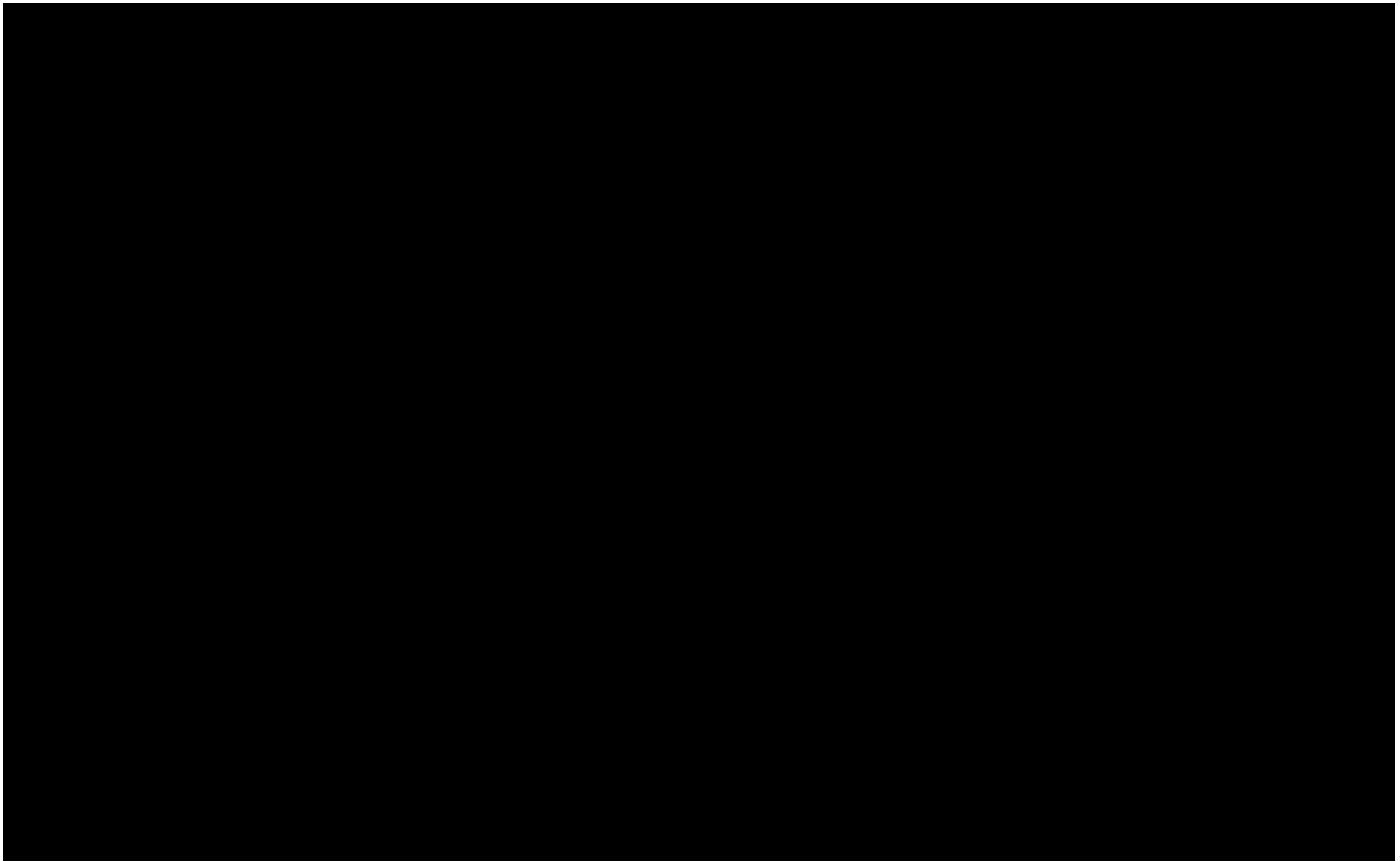


Figure 11: Location of bryophytes and lichens of conservation concern within the ESE Project sub-area.

3.5 Avifauna

3.5.1 Five-minute bird counts

Ecological Solutions Limited (2026c) recorded the presence of 39 species of bird across the Buller Plateaux including nine 'Threatened' or 'At-Risk' species. Twenty-nine species (82%) were recorded during five-minute bird counts at the ESE Project sub-area, including 21 native species and eight introduced and naturalised species.

Six species of conservation concern were recorded within the ESE Project sub-area included koekoeā/long-tailed cuckoo (*Eudynamys taitensis*), which is regarded as 'Threatened – Nationally Vulnerable', karearea/New Zealand bush falcon (*Falco novaeseelandiae ferox*), which is regarded as 'Threatened – Nationally Increasing', and pihoihoi/New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*), mātātā/South Island fernbird (*Poodytes punctatus*), kakaruwai/South Island robin (*Petroica australis*) and kākāriki/yellow-crowned parakeet (*Cyanoramphus auriceps*), all of which are regarded as 'At Risk – Declining' (Robertson et al. 2021).

Similar totals of native and exotic birds were seen at Escarpment East and Escarpment West sites, with both sites showing declining native bird counts since 2013 as shown in Figure 12 and Figure 13, although the decline was larger at Escarpment East. At both sites, indigenous birds were consistently recorded in higher numbers than exotic birds and exotic bird numbers have been approximately stable over the monitoring period.

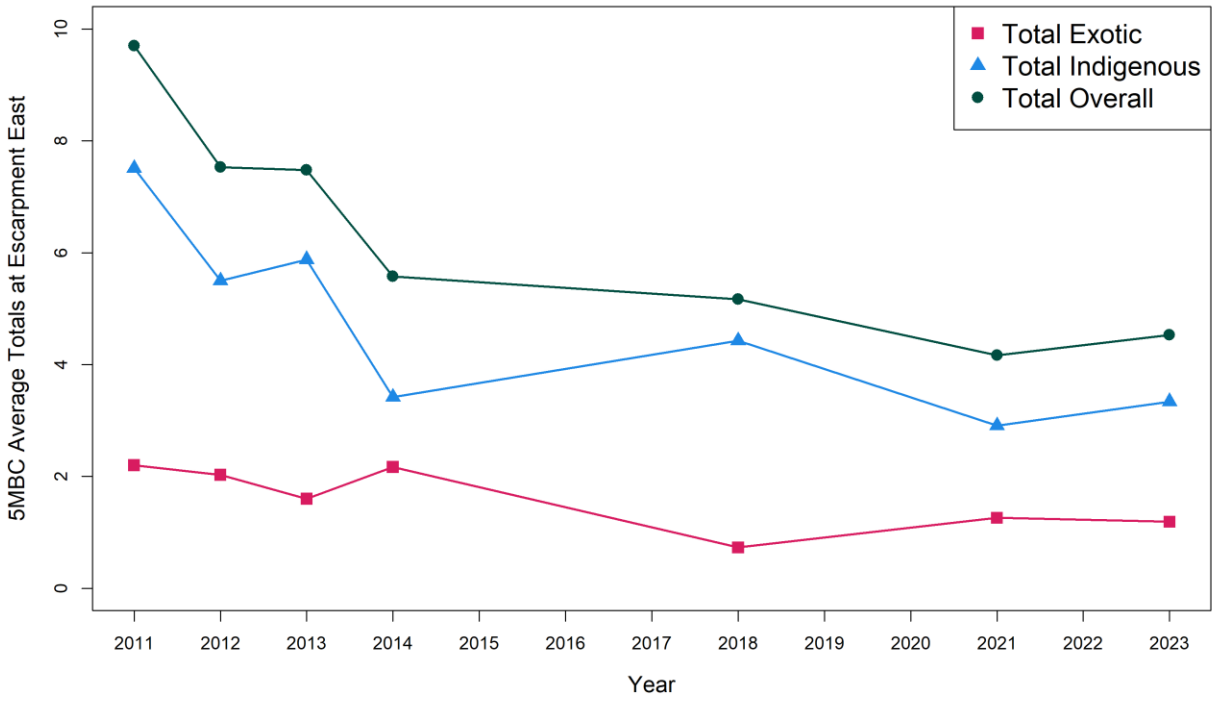


Figure 12: Average number of birds recorded in 5MBCs at Escarpment East.

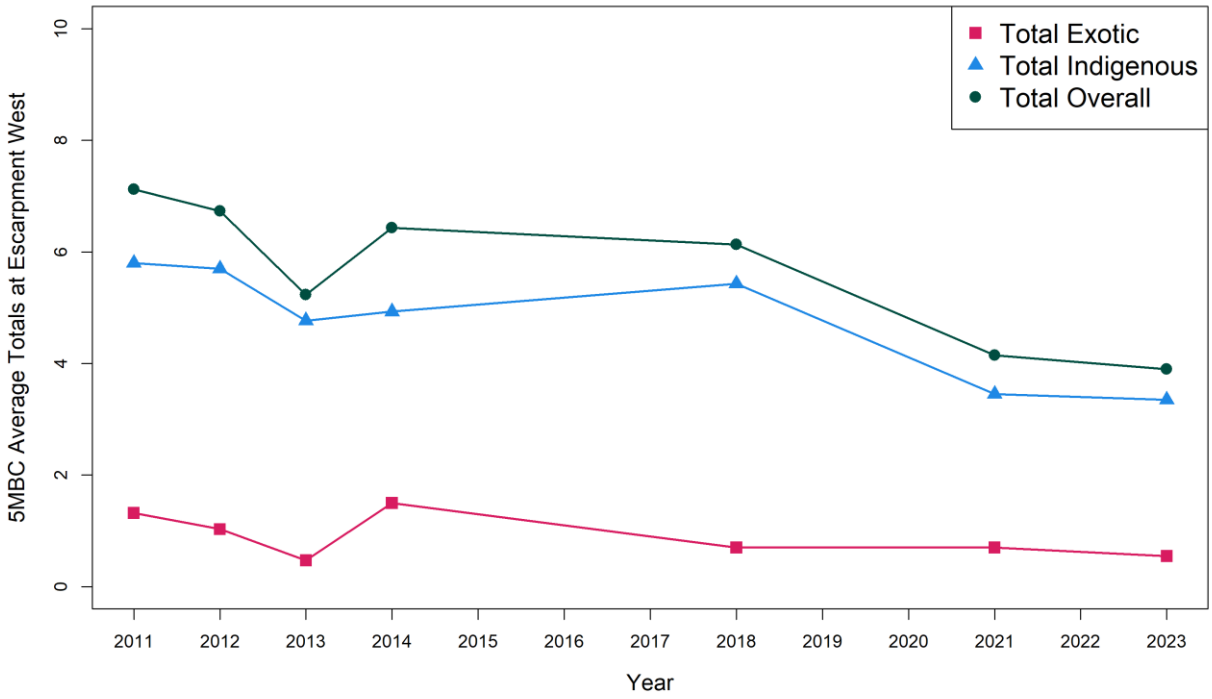


Figure 13: Average number of birds recorded in 5MBCs at Escarpment West.

3.5.2 Roroa listening surveys

In 2022, 55 roroa call sequences were recorded at 11 of the listening stations (Nichol 2022). This compares with 36 sequences for 2019, 60 in 2017 and 42 in 2015. Of the 55 sequences recorded in 2022, 35 were females and 20 were males. The mean number of calls recorded per hour was typically between 1 and 1.6, which is at the low – moderate range for roroa calls, indicating a low-density population (Toy et al. 2021). Call counts across the four years of surveys are shown in Figure 14.

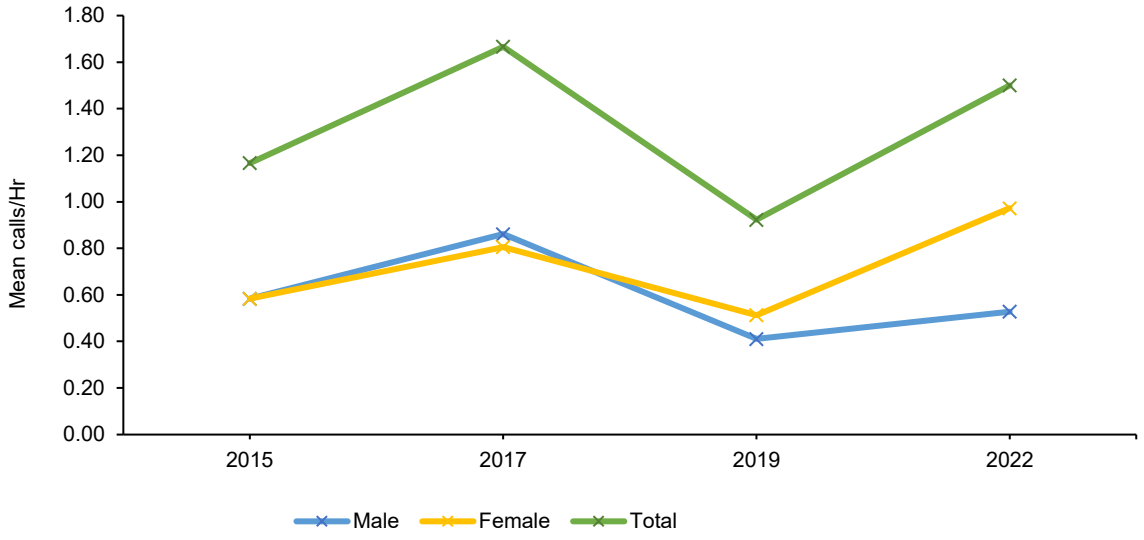


Figure 14: Mean number of roroa calls per hour at the Denniston Plateau.

These repeated listening surveys have demonstrated that many roroa frequent the edges of the Denniston Plateau, with fewer occupying exposed, high elevation parts of the plateau itself. The estimated location of birds based on 2022 call surveys is shown in Figure 15 where pink lines extend to the estimated call location for female (red) and male (purple) roroa from the listening station.

Birds were recorded at 11 stations in the 2022 survey. Birds were heard in the Rapid Stream catchment near the track to Sullivan West, in the Conglomerate Stream and Whareatea catchments, in Trent Stream, and near the southern boundary of the ESE Project sub-area.

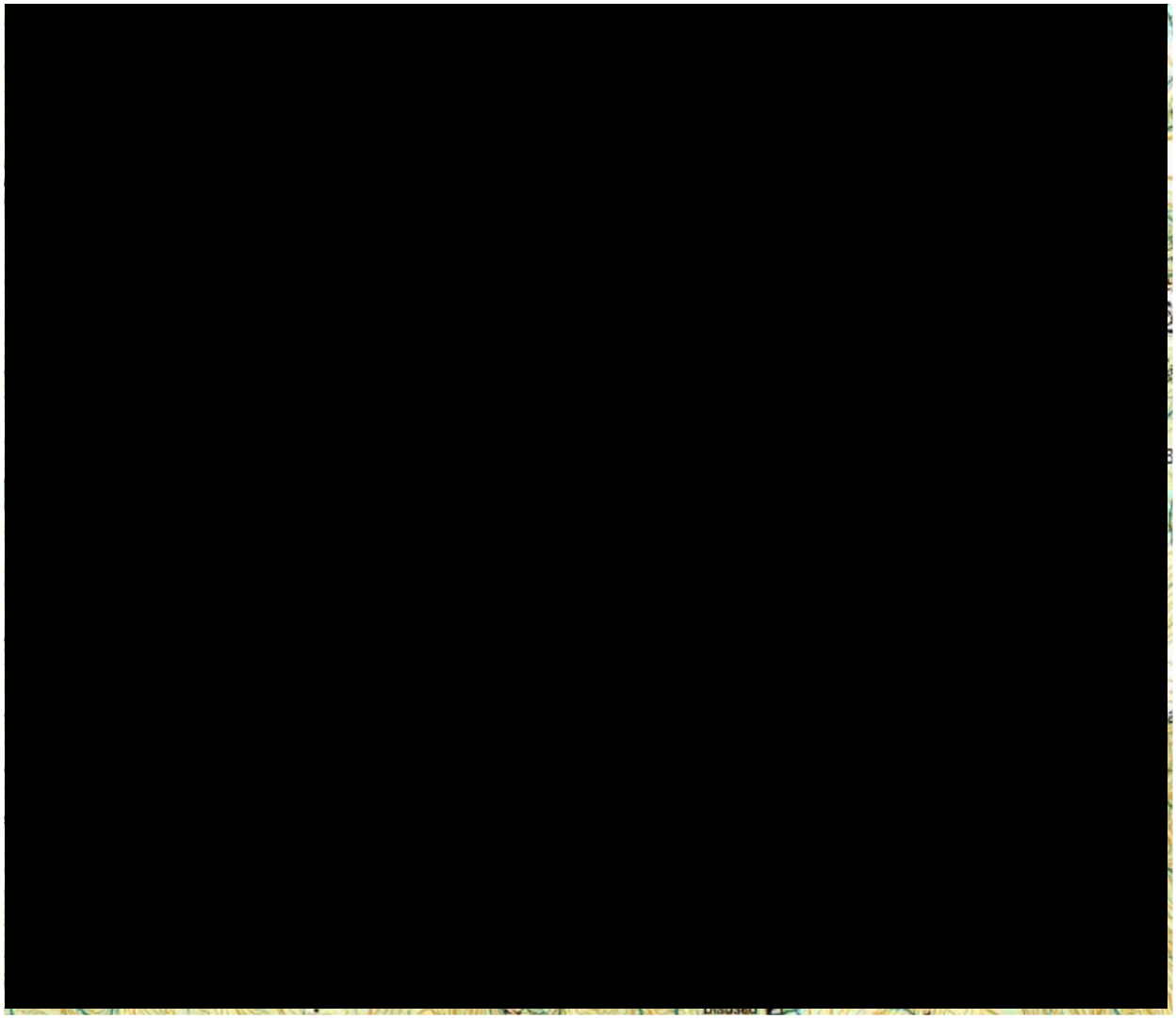


Figure 15: Overview of all kiwi observations during the 2022 survey (from Nichol 2022).

3.6 Lizards

Seventeen native lizards were found within and immediately surrounding the ESE Project sub-area as shown in Figure 16. The 17 records included seven forest gecko, eight West Coast green gecko and two Westland speckled skinks.



Figure 16: Locations of lizards found during the 2020 survey by Alliance Ecology.

West Coast green gecko and Westland speckled skink are listed as 'Threatened – Nationally Vulnerable', whilst forest gecko is regarded as 'At Risk – Declining' (Hitchmough et al. 2026).

West Coast Green gecko were found in low vegetation and shrubs, forest gecko were mostly found under rocks, in or under rock crevices and under artificial cover objects or logs, whilst Westland speckled skinks were found basking or under rocks.

While not unexpected given the habitats present, the field investigations confirmed the presence of species in parts of the ESE Project sub-area where they had not previously been recorded including within the Sullivan Coal Mining Licence (CML) and part of the ESE Project sub-area. These new records included forest gecko and Westland speckled skinks in the Sullivan CML part of the ESE Project sub-area.

Although most lizards were found in low and open vegetation, this is likely a result of increased detectability in these habitats compared with taller vegetation. An evaluation of habitats within the Project sub-area found that the highest value lizard habitats were those nearest areas of high topographical diversity such as forested gullies surrounded by sandstone pavement and pākihi.

3.7 Land Snails

Snails are present throughout the ESE Project sub-area in suitable habitats. The average number of snails found in 10 x 10m plots at Denniston during the 2012 plot-based surveys was 0.58 snails per plot (Lloyd 2012). Extrapolating these findings to the known species range on the Denniston Plateau yields an estimate of 118,430 findable snails with a total population estimate of 294,000–490,000 snails for Denniston Plateau in 2024. This estimate includes snails of all sizes (Lloyd 2024b).

Population estimates using data from the two mark-recapture plots within the DBEA indicates a decline of 64% and 60% in each plot population respectively over the 10-year monitoring period to 2023–2024 (Lloyd 2024a). Results from general linear modelling to adjust for differences between the sample designs of the 2012 and 2024 surveys indicate that this represents a 59% decline in the Denniston Plateau snail population between 2012 and 2024 (Lloyd 2024a). This decline has occurred in plots which have been unaffected by mining activity, indicating another agent of decline (probably predation) is an important factor in current snail population decline.

The proportion of *P. patrickensis* shells found during plot surveys with evidence of predation by weka (*Gallirallus australis*) increased from 6.2% of 658 in 2012 to 35% of 388 in 2024, while the proportion of intact shells declined from 75% to 35% (Lloyd 2024b). During a study of the effectiveness of Vegetation Direct Transfer (VDT) in maintaining snails, 66% of 61 shells showed evidence of weka predation (Lloyd 2024c).

3.8 Other Terrestrial Invertebrates

At least 3,618 specimens from 151 taxa were identified from the samples collected within the ESE Project sub-area. A list of taxa collected is provided in Appendix C. Species richness was highest at sites ESC2 (n = 79 species) and ESC6 (n = 56 species), where the habitats comprised Southern rātā-mountain beech-podocarp forest and mānuka/Gahnia-wire rush shrubland respectively, and lowest at DS6 (n = 14 species) where the habitat had been disturbed and not rehabilitated in the past and the vegetation comprised weedy low pākihi. The site with the second lowest species richness was ESC4 (n = 27 species) where the habitat was mostly bare rock. The species richness at each site is shown in Figure 17.

Most (87%) terrestrial invertebrates collected were native, with nineteen species of uncertain status and only one confirmed adventive species. Most individuals collected were

springtails (order Collembola) (n = 1,386) followed by flies (order Diptera) (n = 1,016), beetles (order Coleoptera) (n = 292) and ants/wasps/sawflies (order Hymenoptera) (n = 297). DS4, the disturbed site described above, had one of the lowest individual abundances (143, the lowest was 114 at ESC1), whilst traps at ESC2 and ESC6 captured the most individuals (816 and 750 respectively). This probably reflects the more complex habitat structure, better indigenous dominance and higher number of potential niches at those sites. The number of individuals captured at each sampling site is shown in Figure 18. The relative composition of the invertebrate communities at the different sampling sites is shown in Figure 19.

The only adventive species recorded during the survey was Hill's brown blowfly (*Calliphora hilli*). This species was recorded further north, at Millerton, in 2002 (Thomas and Toft 2002), and a similar species, the brown blowfly (*Calliphora stygia*), with the same ecological niche (Dear 1986) was recorded at Mt William North in 2010 (Toft 2011).

Two specimens of the 'Te Kuha tiger beetle' (*Neocicindela aureata* sp. nov.) were collected within the ESE Project sub-area. Pitfall trapping also collected a single specimen of the spider *Holarchaea* sp. cf. *novaeseelandiae,* one of few spider taxa which lacks venom glands. This was the first record of this species from the Buller Plateaux.

For many of the specimens collected, the invertebrate families could not be confirmed. This is unsurprising given that so many of New Zealand's invertebrate species remain undescribed. Unconfirmed families made up the bulk of invertebrate samples from all sampling methods (malaise, pitfall, sweep and beat).

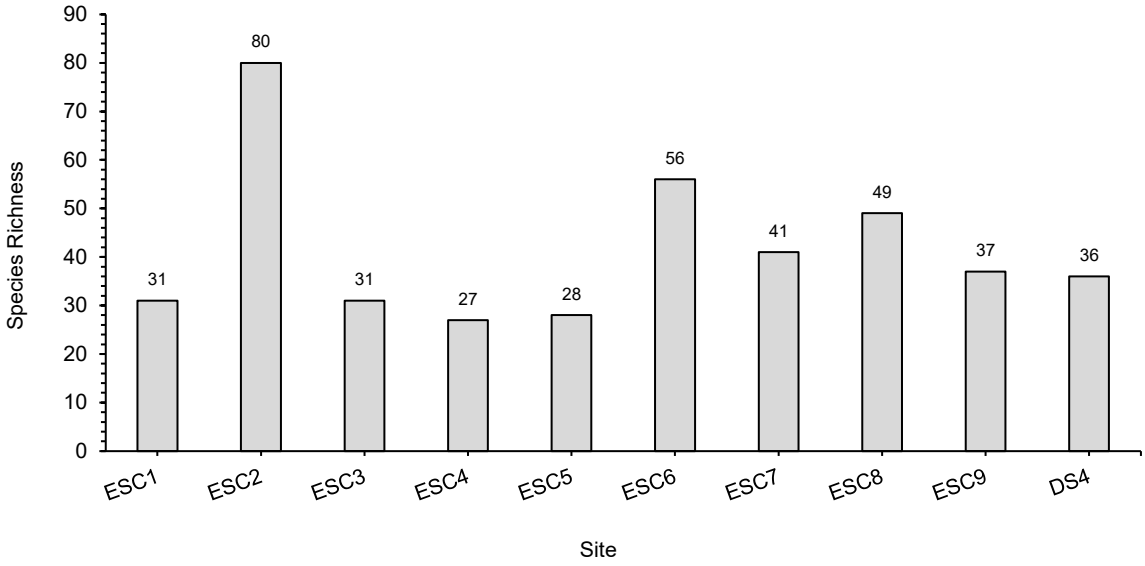


Figure 17: Invertebrate species richness at each sampling site within the ESE Project sub-area.

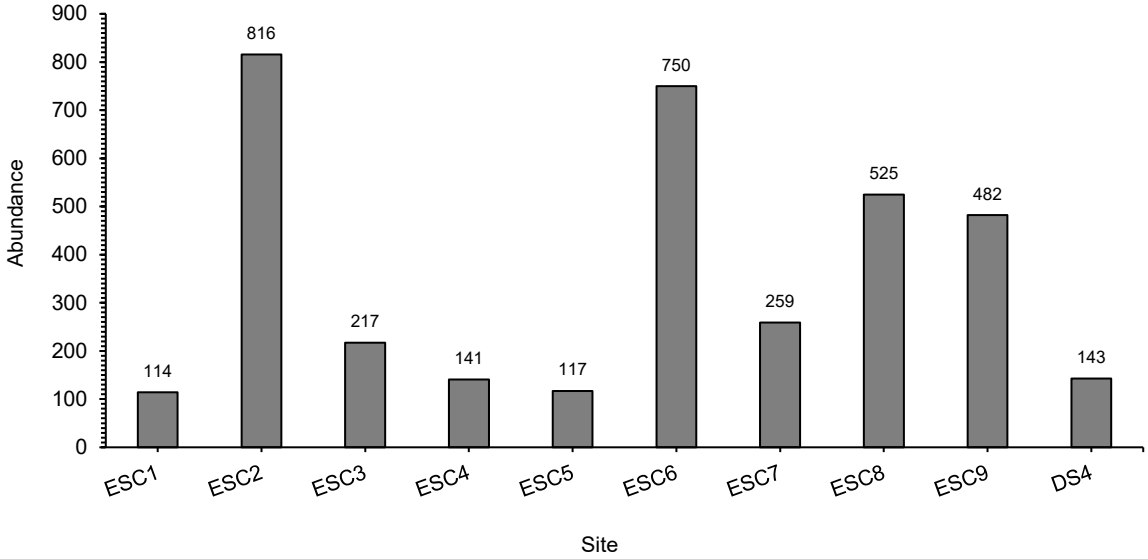


Figure 18: Invertebrate abundance at each sampling site within the ESE Project sub-area.

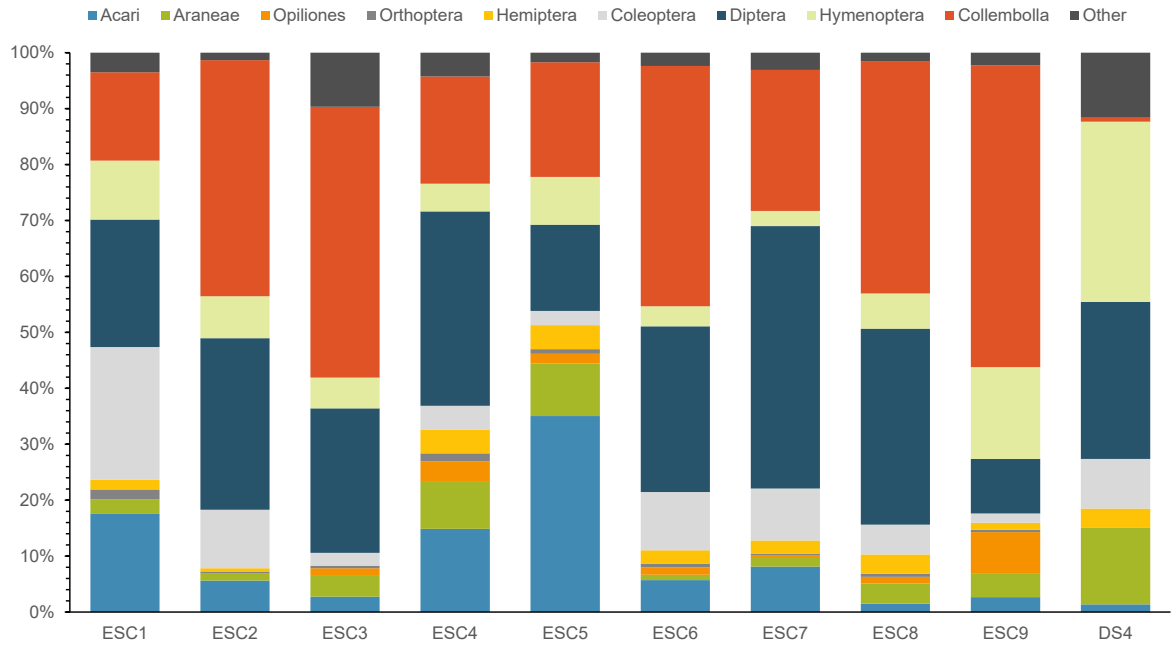


Figure 19: Terrestrial invertebrate community composition at each site within the Extended Escarpment Project sub-area.

3.9 Mammalian Pests

Mammalian pests known to occur on the Denniston Plateau include ship rats (*Rattus rattus*), mice (*Mus musculus*), possums (*Trichosurus vulpecula*), hares (*Lepus europaeus occidentalis*), deer (*Cervus elaphus*), weasels (*Mustela nivalis*) and stoats (*Mustela erminea*) while feral cats (*Felis catus*), pigs (*Sus scrofa*), goat (*Capra hircus*) and chamois (*Rupicapra rupicapra*) may occur, but have not been detected. Rodent monitoring using tracking tunnels in the DBEA since 2014 has shown that indices of rat abundance regularly exceed the 5% threshold as shown in Figure 20. Maintenance of tracking tunnel indices

below this threshold is regarded as important for protecting biodiversity. Mice densities are also highly variable and mice occasionally reach high densities as shown in Figure 21.

Pest monitoring since 2014 has shown that rodents occur on the Denniston Plateau at densities which frequently exceed levels known to result in biodiversity declines (Parkes 2020). Recent surveys found these levels to have been exceeded during the summer of 2024/2025 along with the presence of stoats, even in absence of masting that season (Alliance Ecology 2025). This is evidence that pest mammals are very likely to be negatively affecting vulnerable native fauna.

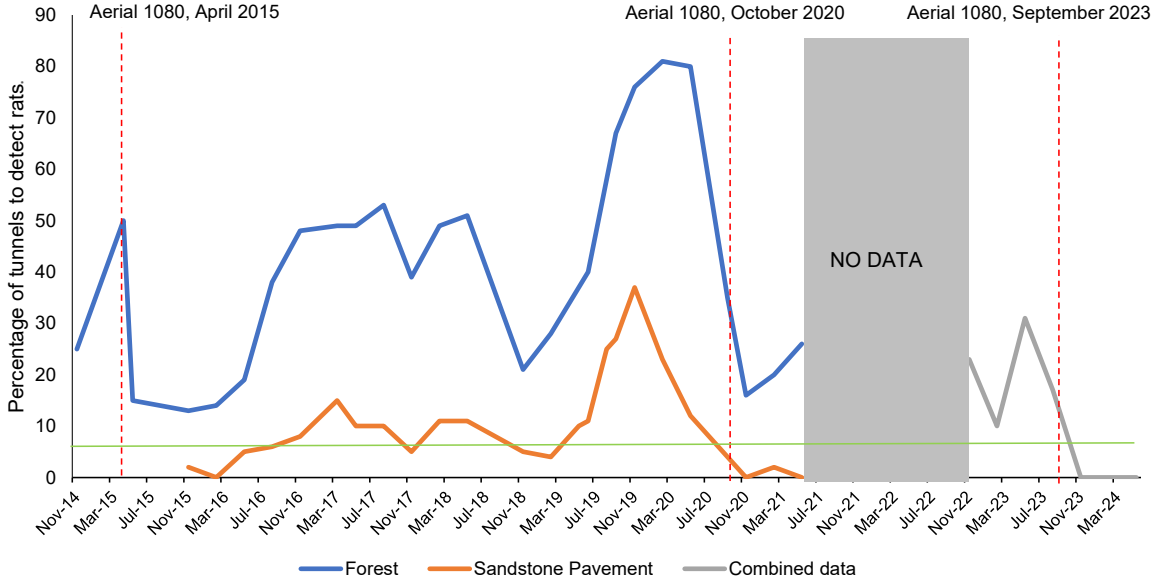


Figure 20: Approximate rat tracking indices 2014 - 2024 in the DBEA (data adapted from Department of Conservation annual reports).

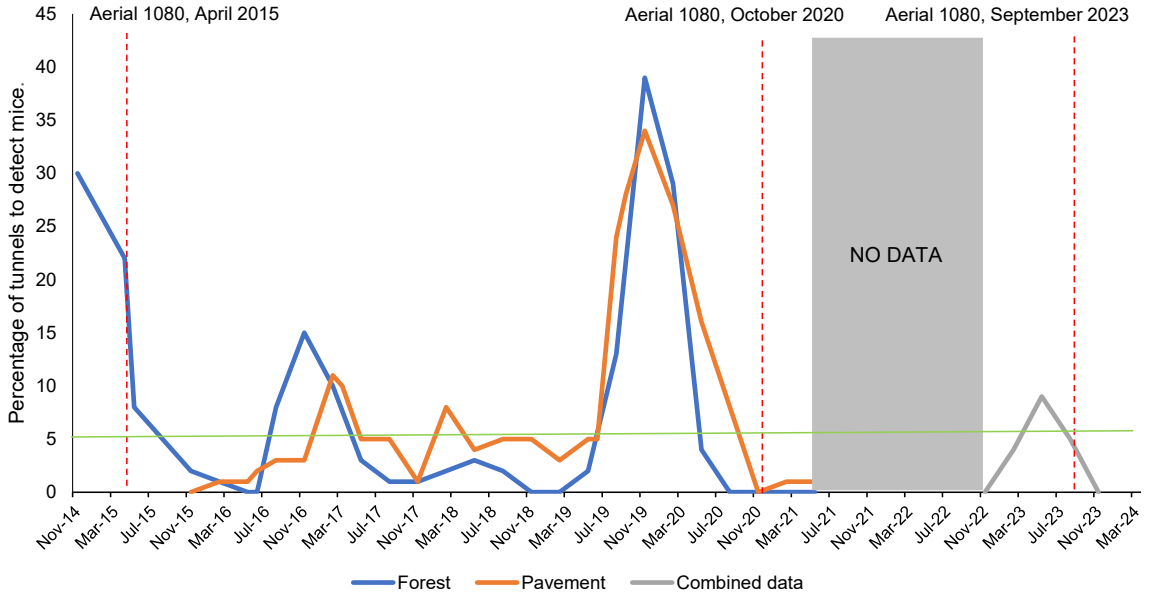


Figure 21: Approximate mouse tracking indices 2014 - 2024 in the DBEA (data adapted from Department of Conservation annual reports).

More recently, the average chew card index ('CCI') at the Denniston Plateau was 26% for mice and 22% for rats (Alliance Ecology 2025). One line of cards returned a 90% CCI for mice, suggesting a very high local population. The average CCI increased to 52% for mice and decreased to 18% for rats in the second survey.

Using tracking tunnels, rats were only detected on one tracking tunnel line, with an average TTI (tracking tunnel index) of 12% during the first survey and 4% on the second, while the TTI for mice was 42% for the first survey and 32% for the second.

Stoats were detected on the Denniston Plateau during the second survey. On one line, two different stoats could be distinguished in the pictures, and this line also had two images of a weasel. No possums were detected during either survey.

4.0 Conclusion

The ESE Project sub-area covers c. 584.7ha. Vegetation within the Disturbance Area (c. 502.9ha) includes approximately 129.2ha (25.7%) of forest vegetation, 148.6ha (29.5%) of shrubland, 123.2ha (24.5%) of low vegetation, 41.8ha (8.3%) of sandstone erosion pavement and other bare rock, 58ha (11.5%) of cleared vegetation and 2.1ha (0.4%) of water (mostly historic mining infrastructure). Approximately 69.3ha (13.8%) comprises vegetation affected by exotic species or cleared areas, the remaining c. 85.8% (less water) comprises indigenous vegetation which is representative, intact and demonstrates natural ecological patterns and gradients. Approximately 52% of the ESE comprises natural inland wetlands. The Indirect Effects Contingency area, where edge effects are likely, occupies an additional 42.6ha of the above habitats.

No 'Threatened' plants are known to be present within the ESE Project sub-area, but 12 species considered to be 'At Risk' have been confirmed, or are likely to occur there. The ESE Project sub-area also includes naturally uncommon ecosystems (sandstone erosion pavement, seepages and flushes, boulderfields of acidic rocks, pākihi wetlands and small tarns).

With respect to the non-vascular flora, the ESE Project sub-area is known to provide habitat for twenty-one bryophyte and four lichen species listed as 'Threatened' or 'At Risk' by de Lange et al. (2018, 2020) and Michel et al. (2026).

Important vegetation and habitat types where bryophytes and lichens of conservation concern are most frequently recorded within the ESE Project sub-area include:

- Sandstone erosion pavement and quartzite sands with ecotone associations;
- Southern rātā-mountain beech-podocarp forest;
- Mānuka-tussock-wire rush shrubland;
- Mānuka-mountain beech-podocarp shrubland;
- Low pākihi; and
- Tussock-flax shrubland.

Six of the ten key vegetation and habitat types valuable for bryophytes occur within the ESE Project sub-area. All five key habitat types valuable for lichens occur within the ESE Project sub-area.

Twenty-nine of the 39 bird species (74%) known to use Buller Plateaux habitats have been recorded from the ESE Project sub-area, including six species which are considered 'Threatened' or 'At Risk'. Bird numbers are moderate (within the range of 4 – 8 indigenous

bird calls/count), and appear to have been declining gradually since at least 2013, even in the absence of mining, although numbers at the western monitoring site are more stable than numbers at the eastern site. Introduced and naturalised (exotic) bird call rates in 5MBCs have remained approximately constant. Roroa are widespread, but sparsely distributed and call counts indicate roroa numbers are low to moderate (a low-density population) and approximately stable.

The ESE Project sub-area provides good quality habitats for lizard fauna and comprises a unique assemblage of species nationally, including two 'Threatened' and one 'At Risk' species.

The ESE Project sub-area includes suitable habitat for the land snail *Powelliphanta patrickensis*. The Buller Plateaux includes the entire known range of this snail and mark-recapture studies show that snail abundance there continues to decline, even in the absence of mining, probably due to increased predation by weka.

The terrestrial invertebrate communities are predominantly indigenous and, perhaps because of the complex mosaic of indigenous habitat with varying structural architecture, include a good abundance of a high diversity of taxa. This includes widespread species, species endemic to the North Westland area, species adapted to high elevation, wet environments, species which are thought to be local endemics as well as 'Threatened' and 'At Risk' species.

Pest mammal abundance within the ESE Project sub-area varies both seasonally and annually, as well as in response to mast years. Monitoring shows that mammalian pests are present at levels that would most likely adversely affect indigenous species.

5.0 References

Alliance Ecology Limited. 2025. Pest Mammal Survey: Buller Plateau Pest Monitoring. Unpublished report prepared for Bathurst Resources Limited.

Boffa Miskell Limited. 2015. Annual Monitoring Report of Fernbird, Pipit and Rifleman in the Escarpment Mine Area: 2014 Annual Monitoring Report. Report prepared by Boffa Miskell Limited for Bathurst Resources Limited.

Dear, J.P. 1986. Calliphoridae (Insecta: Diptera). *Fauna of New Zealand*, *8*. Published by Science Information Publishing Centre, DSIR.

de Lange, P., Blanchon, D., Knight, A., Elix, J., Lucking, R., Frogley, K., Harris, A., Cooper, J., and Rolfe, J. 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27. Department of Conservation, Wellington. 64 pp.

de Lange, P.J., Glenny, D., Frogley, K., Renner, M.A.M., von Konrat, M., Engel, J.J., Reeb, C., and Rolfe, J.R. 2020. Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31. Department of Conservation, Wellington. 30 pp.

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

Department of Conservation. 2024. Heaphy and Denniston Biodiversity Projects Annual Report 1 July 2023 – 30 June 2024. Department of Conservation, Westport.

Ecological Solutions Limited. 2026a. Buller Plateaux Continuation Project: Terrestrial

Ecological Impact Assessment Report. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 98 pages + appendices.

Ecological Solutions Limited. 2026b. Buller Plateaux Vegetation Mapping. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. January 2026. 65 pages + appendices.

Ecological Solutions Limited. 2026c. Buller Plateaux Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 101 pages + appendices.

Gillies, C.A., & Williams, D. 2013. DOC tracking tunnel guide v2. 5.2: Using tracking tunnels to monitor rodents and mustelids. *Hamilton, Department of Conservation*.

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson G.B., Reardon J.T., van Winkel, D., Makan, T., and Michel, P. 2026. Conservation status reptiles in Aotearoa New Zealand, 2025. New Zealand Threat Classification Series 50. Department of Conservation, Wellington. 32 pp.

Hurst, J.M., Allen, R.B. & Fergus, A.J. 2022. The Recce method for describing New Zealand vegetation – expanded manual. Version 5.

Lloyd, B.D. 2012. Analyses of *Powelliphanta* Snail Survey Data for the Escarpment Mine Project. Retrieved from Buller Coal Ltd., Westport.

Lloyd, B.D. 2024a. Capture-recapture monitoring *Powelliphanta patrickensis* snails in Denniston Permanent Protection Area, 2014 – 2024. Unpublished report prepared by Lloyd's Ecological Consulting for Bathurst Resources Limited.

Lloyd, B.D. 2024b. An Assessment of the Likely Impacts of the Stockton Extension Project on *Powelliphanta patrickensis* Snails. Unpublished draft report prepared by Lloyd's Ecological Consulting for Bathurst Resources Limited.

Lloyd, B.D. 2024c. Surveys for *Powelliphanta patrickensis* snails in areas rehabilitated after mining. Unpublished report prepared by Lloyd's Ecological Consulting for Bathurst Resources Limited.

Michel, P., deRegnier, R., Emmitt, T., Ford, M., Perrie, L., Pritchard, A.S.E. 2026. Conservation status of mosses in Aotearoa New Zealand, 2025. Report 1155. Department of Conservation, Wellington. New Zealand Threat Classification System Series 49.

Ministry for the Environment (MfE).2020a. Wetland delineation protocols. Wellington: Ministry for the Environment.

Ministry for the Environment (MfE). 2020b. National Policy Statement for Freshwater Management (NPS-FM) 2020. Amended December 2025.

Mitchell Daysh Limited. 2026. Buller Plateaux Continuation Project Assessment of Environmental Effects.

Nichol, R. 2022. Kiwi and Weka Survey, Winter 2022 Escarpment Mine and Denniston Permanent Protection Area Denniston Plateau. Unpublished report prepared by Richard Nichol Ecology Ltd.

Nichol, R. 2023. Denniston 2023 Bird Monitoring. Unpublished report prepared by Richard Nichol Ecology Ltd.

Nichol, R. and Overmars, F. 2008. Vegetation and Flora Baseline Survey, L&M Coal Ltd Escarpment Mine Project, Buller Plateau. Prepared for Resource and Environmental Management Ltd.

Overmars, F.B., & Lloyd, B. 2012. Proposed Escarpment Mine: Vegetation Survey of Trent Stream Area and Southern Denniston Plateau. Unpublished report by Sustainability Solutions Ltd and Lloyd's Ecological Consulting Ltd for Buller Coal Ltd. 100pp.

Parkes, J. 2020. Review of Pest Management on the Buller Plateau. Unpublished report 2020/021 by Kurahaupo Consulting for Bathurst Resources Limited. 28pp + appendices. Kurahaupo Consulting, Christchurch.

Robertson, H.A., Baird, K.A., Elliott, G.P., Hitchmough, R.A., McArthur, N.J., Makan, T.D., Miskelly, C.M., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A., and Michel, P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 pp.

Smith, D.H., & Weston, K.A. 2017. Capturing the cryptic: a comparison of detection methods for stoats (*Mustela erminea*) in alpine habitats. *Wildlife Research*, *44*(5), 418-426.

Thomas, B., & Toft, R.J. 2002. A survey for Terrestrial Fauna on the Millerton Block, January 2002. Landcare Research Contract Report. Prepared for Solid Energy Limited.

Toft, R.J. 2011. Terrestrial Invertebrates in the Mt William North Project Area. Prepared for Solid Energy New Zealand Ltd.

Toy, R.J, Toy, S., Mackenzie, D., Simister, K., and Yong, S. 2021. Distribution of great spotted kiwi (*Apteryx maxima*), 2012–2021. Notornis, 2021, 69(1):1–18.

Williams, J. 2024. Heaphy and Denniston Biodiversity Projects Annual Report 1 July 2023 – 30 June 2024. Unpublished report prepared by the Department of Conservation, Westport. 63 pp + appendices.

APPENDIX A

Vegetation plots within the ESE Project sub-area

Plot reference	Survey	Plot vegetation description
EM1	Nichol & Overmars, 2008	[Chionochloa juncea]/manuka-wire rush shrubland
EM2	Nichol & Overmars, 2008	Manuka/tangle fern shrub-rushland
EM3	Nichol & Overmars, 2008	Manuka/Gahnia shrubland
EM4	Nichol & Overmars, 2008	Mixed beech-cedar-broadleaved forest
EM5	Nichol & Overmars, 2008	[Chionochloa juncea]/manuka-wire rush shrubland
EM6	Nichol & Overmars, 2008	Mixed beech-cedar-broadleaved forest
EM7	Nichol & Overmars, 2008	Podocarp/beech-rata-Archeria forest
EM8	Nichol & Overmars, 2008	Manuka-square sedge shrubland
EM9	Nichol & Overmars, 2008	[Manuka-Chionochloa juncea]/wire rush shrubland
EM10	Nichol & Overmars, 2008	[Red tussock-Lepidothamnus]/manuka-wire rush shrubland
EM11	Nichol & Overmars, 2008	Pakihi rush/manuka-wire rush rushland
EM12	Nichol & Overmars, 2008	Manuka-tangle fern-tussock-rushland
EM13	Nichol & Overmars, 2008	Mixed beech-podocarp-southern rata forest
EM15	Nichol & Overmars, 2008	[Manuka]/wire rush rushland
OTS 1	Lloyd & Overmars, 2012	Pink pine-Gahnia/manuka shrubland
OTS 2	Lloyd & Overmars, 2012	Manuka-tangle fern-tussock-rushland
OTS 3	Lloyd & Overmars, 2012	Manuka/tangle fern shrub-rushland
OTS 5	Lloyd & Overmars, 2012	Manuka/tussock-rushland
OTS 6	Lloyd & Overmars, 2012	Chionochloa juncea/manuka-wire rush shrubland
OTS 14	Lloyd & Overmars, 2012	Manuka-mountain beech-podocarp shrubland
OTS 23	Lloyd & Overmars, 2012	Mixed beech/podocarp-manuka-broadleaved forest
OTS 28	Lloyd & Overmars, 2012	[Southern rata]-manuka-mountain beech forest
OTS 30	Lloyd & Overmars, 2012	Manuka/tussock-wire rush-shrubland
OTS 31	Lloyd & Overmars, 2012	Dracophyllum-Coprosma/wire rush shrubland
TS 36	Lloyd & Overmars, 2012	Manuka/Dracophyllum-wire rush shrubland
TS 37	Lloyd & Overmars, 2012	Manuka-Chionochloa juncea tussock-shrubland
TS 38	Lloyd & Overmars, 2012	Manuka-tussock/tangle fern-rushland
TS 39	Lloyd & Overmars, 2012	Manuka-tussock/tangle fern-rushland
TS 40	Lloyd & Overmars, 2012	Manuka-Chionochloa juncea-wire rush shrubland
TS 44	Lloyd & Overmars, 2012	Manuka-wire rush rushland
TS 45	Lloyd & Overmars, 2012	Manuka-tussock/wire rush shrubland
TS 46	Lloyd & Overmars, 2012	Manuka/tussock-shrubland
TS 47	Lloyd & Overmars, 2012	Manuka-tussock/tangle fern rushland
TS 48	Lloyd & Overmars, 2012	Manuka-tussock/tangle fern rushland
TS 52	Lloyd & Overmars, 2012	Pink pine-mountain beech/manuka-yellow-silver pine forest
TS 53	Lloyd & Overmars, 2012	Mountain beech/manuka-podocarp forest
TS 54	Lloyd & Overmars, 2012	Manuka-mountain beech/yellow-silver pine forest
TS 55	Lloyd & Overmars, 2012	Mountain beech-pink pine/yellow-silver pine-manuka forest
TS 56	Lloyd & Overmars, 2012	Podocarp-mountain beech forest

TS 57 OS	Lloyd & Overmars, 2012	[Southern rata]/manuka-pink pine forest
MR 04	Lloyd & Overmars, 2012	Manuka-tussock/wire rush shrubland
MR 15	Lloyd & Overmars, 2012	[Manuka-Chionochloa juncea]/wire rush shrubland
BCP21	Ecological Solutions, 2024	Machaerina-square sedge shrub-rushland
DS04	Ecological Solutions, 2024	Kamahi-manuka-red beech/flax shrubland
ESC01	Ecological Solutions, 2024	Manuka/wire rush-pakihi rush shrubland
ESC02	Ecological Solutions, 2024	Southern rata/podocarp-beech-broadleaf forest
ESC03	Ecological Solutions, 2024	Manuka/tangle fern/wire rush shrubland
ESC04	Ecological Solutions, 2024	[Manuka-Chionochloa juncea]/wire rush rushland
ESC05	Ecological Solutions, 2024	Manuka-tangle fern/wire rush shrubland
ESC06	Ecological Solutions, 2024	Manuka/mountain flax-Astelia shrubland
ESC07	Ecological Solutions, 2024	Southern rata/podocarp-beech-broadleaf forest
ESC08	Ecological Solutions, 2024	[Mountain flax]/manuka-wire rush shrubland
ESC09	Ecological Solutions, 2024	Manuka-tussock/wire rush shrubland
S-015	Roxburgh, 2012	Mānuka-yellow-silver pine/tussock shrubland
S-106	Roxburgh, 2012	Mānuka/tussock-wire rush shrubland
S-107	Roxburgh, 2012	Mānuka-tussock/wire rush shrubland
S-112	Roxburgh, 2012	Mānuka/tussock-wire rush shrubland
S-114	Roxburgh, 2012	Mānuka-podocarp-Dracophyllum shrubland
S-119	Roxburgh, 2012	Mānuka/tussock-wire rush shrubland
S-121	Roxburgh, 2012	Silver beech/mānuka-tussock shrubland

APPENDIX B

Bryophytes recorded within the ESE Project sub-area

Species of conservation concern are marked in bold (de Lange et al. 2020, Michel et al. 2026).

Location: Escarpment (Denniston Plateau)
Plot ID: E-01
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 16/01/24
Altitude: 774 m asl
Area: 5 x 5 m
Plot description: Moderate height mānuka-tussock-wire rush shrubland

Acromastigum marginatum
Campylopus clavatus
Campylopus introflexus
Clasmatocolea notophylla
Cryptochila nigrescens
Dicranoloma billardierei
Dicranoloma sp.
Frullania sp.
Goebeliella cornigera
Gymnostomum calcareum
Heteroscyphus billardierei ?
Holomitrium perichaetiale
Kurzia hippuroides
Leucobryum sp.
Metzgeria sp.
Neogrollea notabilis – ***'Threatened – Nationally Critical'***
Plagiobryum sp. *?*
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Radula sp.
Rhacocarpus purpurascens
Riccardia bipinnatifida
Riccardia sp.
Telaranea herzogii
Tetracymbaliella decipiens
Wijkia extenuata
Zoopsis setulosa

Location: Escarpment (Denniston Plateau)
Plot ID: E-02
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 17/01/24
Altitude: 777 m asl
Area: 5 x 5 m
Plot description: Southern rātā-mountain beech-podocarp forest

Acrobolbus setulosus
Acrochila biserialis
Acromastigum anisostomum
Acromastigum cavifolium
Acromastigum colensoanum
Adelanthus falcatus
Amphidium lapponicum ?
Bazzania involuta
Bazzania nitida
Campylopus introflexus
Clandarium xiphophyllum
Cryptolophocolea mitteniana

Dicranoloma billardierei
Dinckleria fruticella
Drepanolejeunea aucklandica
Frullania rostrata
Goebeliella cornigera
Gottschea pinnatifolia
Gottschea tuloides
Herbertus oldfieldianus
Heteroscyphus billardierei ?
Kurzia hippuroides
Lepidolaena novae-zelandiae – ***'At Risk – Naturally Uncommon'***
Lepicolea attenuata
Lepicolea scolopendra
Lepidozia bidens
Lepidozia kirkii
Lepidozia ulothrix
Leptoscyphus excipulatus
Leucobryum javense
Metzgeria sp.
Plagiochila ramosissima
Ptychomnion aciculare
Radula sp.
Riccardia crassa
Riccardia furtiva – ***'At Risk – Naturally Uncommon'***
Rhizogonium novae-hollandiae
Saccogynidium australe
Solenostoma inundatum
Telaranea sp.
Trichocolea mollissima
Wijkia extenuata

Location: Escarpment (Denniston Plateau)
Plot ID: E-03
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 17/01/24
Altitude: 672 m asl
Area: 5 x 5 m
Plot description: Moderate height mānuka-tussock-wire rush shrubland

Acrocladium chlamydophyllum
Acromastigum anisostomum
Andrea sp.
Bazzania novae-zelandiae
Cheilolejeunea campbelliensis
Cuspidatula monodon
Dicranoloma billardierei / fasciatum
Dicranoloma dicarpum
Frullania rostrata
Goebeliella cornigera
Heteroscyphus ciliatus
Hypnum cupressiforme
Leucobryum javense
Lepidolaena novae-zelandiae – ***'At Risk – Naturally Uncommon'***
Megalembidium insulanum
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Radula physoloba
Radula sp.
Riccardia cochleata
Riccardia crassa

Saccogynidium australe
Sauloma tenella
Syzygiella colorata
Wijkia extenuata

Location: Escarpment (Denniston Plateau)
Plot ID: E-04
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 17/01/24
Altitude: 671 m asl
Area: 5 x 5 m
Plot description: Low pākihi

Acromastigum anisostomum
Dicranoloma sp.
Frullania rostrata
Goebeliella cornigera
Gottschea tuloides
Kurzia hippuroides
Lepicolea scolopendra
Neogrollea notabilis – ***'Threatened – Nationally Critical'***
Radula physoloba
Radula uvifera
Rhacocarpus purpurascens
Riccardia crassa
Syzygiella colorata
Telaranea herzogii
Zoopsis setulosa

Location: Escarpment (Denniston Plateau)
Plot ID: E-05
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 18/01/24
Altitude: 701 m asl
Area: 5 x 5 m
Plot description: Moderate height mānuka-tussock-wire rush shrubland

Bryophytes:

Acrocladium chlamydophyllum
Adelanthus falcatus
Campylopus clavatus
Campylopus introflexus
Cuspidatula monodon
Dicranoloma billardierei
Dicranoloma fasciatum
Frullania rostrata
Goebeliella cornigera
Hedwigia sp.
Jensenia connivens
Kurzia compacta
Kurzia hippuroides
Lepidolaena novae-zelandiae – ***'At Risk – Naturally Uncommon'***
Lepicolea attenuata
Lepidozia kirkii
Metzgeria saccata
Rhacocarpus purpurascens
Riccardia cochleata

Riccardia crassa
Siphonolejeunea sp.
Telaranea herzogii
Tetracymbaliella decipiens
Tricholepidozia tetradactyla
Wijkia extenuata

Location: Escarpment (Denniston Plateau)
Plot ID: E-06
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 18/01/24
Altitude: 784 m asl
Area: 5 x 5 m
Plot description: Mānuka/Gahnia-wire rush shrubland

Acromastigum anisostomum
Breutelia pendula
Campylopus introflexus
Cuspidatula monodon
Dicranoloma billardierei
Frullania aterrima
Goebeliella cornigera
Heteroscyphus billardierei ?
Holomitrium perichaetiale
Kurzia hippuroides
Leucobryum javense
Lepidozia kirkii
Lepicolea scolopendra
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Ptychomnion aciculare
Radula sp.
Rhizogonium novae-hollandiae
Riccardia aequicellularis
Riccardia cochleata
Riccardia crassa
Siphonolejeunea sp.
Telaranea herzogii
Tricholepidozia tetradactyla
Wijkia extenuata

Location: Escarpment (Denniston Plateau)
Plot ID: E-07
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 19/01/24
Altitude: 650 m asl
Area: 5 x 5 m
Plot description: Southern rātā-mountain beech-podocarp forest

Acrobolbus cinerascens
Adelanthus occlusus
Acromastigum anisostomum
Acromastigum cunninghamii
Acromastigum marginatum
Bazzania involuta
Bazzania novae-zelandiae
Campylopus introflexus
Cheilolejeunea sp.
Cryptolophocolea mitteniana

Dicranoloma sp.
Dicranoloma fasciatum
Frullania rostrata
Goebeliella cornigera
Gottschea tuloides
Herbertus oldfieldianus
Heteroscyphus menziesii
Hypnodendron arcuatum
Isolembidium anomalum var. *anomalum* – ***'Threatened – Nationally Critical'***
Kurzia hippuroides
Lembidium nutans
Lepicolea scolopendra
Lepidozia hirta
Lepidozia spinosissima
Leptoscyphus excipulatus
Leptotheca gaudichaudii
Leucobryum javense
Macromitrium longipipes
Megalembidium insulanum
Metzgeria leptoneura
Mniodendron comosum var. *sieberi? ['Data Deficient']*
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Psiloclada clandestina
Racopilum strumiferum
Radula physoloba
Radula sp.
Riccardia aequicellularis
Riccardia cochleata
Riccardia crassa
Saccogynidium decurvum – ***'At Risk – Declining'***
Sphagnum falcatulum
Telaranea herzogii
Telaranea tetradactyla
Trichotemnoma corrugatum – ***'At Risk – Naturally Uncommon'***
Zoopsis setulosa
Indet. 'hepatic scrap, epiphytic' – Riccardia furtiva? ['At Risk – Naturally Uncommon']

Location: Escarpment (Denniston Plateau)
Plot ID: E-08
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 21/01/24
Altitude: 650 m asl
Area: 5 x 5 m
Plot description: Mānuka-flax/wire rush shrubland

Acrobolbus lophocoleoides
Acrochila biserialis
Campylopus introflexus
Cheilolejeunea sp.
Clandarium xiphophyllum
Dicranoloma billardierei
Diplasiolejeunea plicatiloba
Frullania rostrata
Goebeliella cornigera
Gottschea tuloides
Kurzia compacta
Kurzia hippuroides
Lepidolaena novae-zelandiae – ***'At Risk – Naturally Uncommon'***
Lepicolea scolopendra

Lepidozia spinosissima
Lepidoziaceae hippuroides
Leucobryum javense
Metzgeria decipiens
Metzgeria saccata
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Pseudomarsupidium piliferum
Ptychomnion aciculare
Radula sp.
Rhacocarpus purpurascens
Rhizogonium pennatum
Riccardia cochleata
Neolepidozia patentissima
Triandrophyllum subtrifidum
Wijkia extenuata

Location: Escarpment (Denniston Plateau)
Plot ID: E-09
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 21/01/24
Altitude: 700 m asl
Area: 5 x 5 m
Plot description: Mānuka-flax/wire rush shrubland

Andreaea ?flabellata
Campylopus bicolor
Campylopus clavatus
Campylopus introflexus
Chiloscyphus sp. *?*
Dicranoloma ?robustum
Dicranoloma billardierei
Frullania rostrata
Goebeliella cornigera
Hedwigia / Rhacocarpus sp.
Kurzia hippurioides
Lejeunea flava
Lepidozia digitata
Leucobryum javense
Neogrollea notabilis – ***'Threatened – Nationally Critical'***
Psiloclada clandestina
Radula pseudoscripta
Radula uvifera
Riccardia sp.
Rhacocarpus sp.
Telaranea herzogii
Weymouthia mollis
Wijkia extenuata.

APPENDIX C

Invertebrate taxa collected within the ESE Project sub-area

Order	Family	Species	Native (N), Adventive(A) or Unknown (?)	Total Abundance
Tricladida	Geoplanidae	Unid. sp.	N	7
Oligochaeta	Unid.	Unid. sp.	N	14
Oligochaeta				
Stylommatophora	Charopidae	?*Phacussa hypopolea*	N	1
Acari	Unid.	Unid. sp.	N	223
Araneae	Agelenidae?	Unid. sp.	N	2
Araneae	Amphinectidae?	Unid. sp.	N	3
Araneae	Araneidae	*Colaranea brunnea*	N	1
Araneae	Araneidae	*Socca pustulosa*	N	1
Araneae	Araneidae	Unid. sp.	N	4
Araneae	Clubionidae	Clubiona sp.	N	5
Araneae	Cycloctenidae	Unid. sp.	N	4
Araneae	Gnaphosidae	Unid. sp.	?	3
Araneae	Hahniidae	Unid. sp.	N	10
Araneae	Holarchaeidae	*Holarchaea* sp. cf. *novaeseelandiae*	N	1
Araneae	Idiopidae	*Cantuaria* sp.	N	1
Araneae	Linyphiidae	Unid. sp.	?	10
Araneae	Lycosidae	*Anoteropsis westlandica*	N	2
Araneae	Lycosidae	Unid. sp. juv.	N	8
Araneae	Malkaridae	*Tingotingo* sp.	N	1
Araneae	Pisauridae	*Dolomedes minor*	N	1
Araneae	Salticidae	Unid. sp.	N	4
Araneae	Synotaxidae	Unid. sp.	N	1
Araneae	Tetragnathidae	Unid. sp.	?	1
Araneae	Theridiidae	Unid. Sp.	?	1
Araneae	Thomisidae	*Diaea* sp.	N	2
Araneae	Thomisidae	*Sidymella* sp.	N	5
Araneae	Thomisidae	Unid sp.	?	2
Araneae	Zoropsidae	Uliodon sp.	N	8
Araneae	Unid.	Unid. sp.	?	38
Opiliones	Monoscutidae	*Forsteropsalis* sp.	N	60
Opiliones	Unid.	Unid. sp.	N	3
Pseudoscorpiones	Cheliferidae	*Philomaoria* nr. *hispida*	N	1
Amphipoda	Talitridae	Unid. sp.	N	12
Isopoda	Styloniscidae	*Notoniscus* sp.	N	1
Blattodea	Blattidae	*Celatoblatta* sp.	N	6
Orthoptera	Acrididae	*Sigaus crassicauda*	N	3
Orthoptera	Anostostomatidae	*Hemiandrus maculifrons*	N	4
Orthoptera	Anostostomatidae	*Hemiandrus* sp. cf. *electra*	N	1
Orthoptera	Rhaphidophoridae	Unid. sp.	N	10

Orthoptera	Trigonidiidae	*Bobilla* sp.	N	2
Hemiptera	Aphididae	Unid. sp.	N	1
Hemiptera	Auchenorrhyncha	Unid. sp.	?	4
Hemiptera	Cercopoidea	Unid. sp.	?	1
Hemiptera	Cicadellidae	*Paracephaleus curtus*	N	5
Hemiptera	Cicadellidae	Unid. sp.	N	16
Hemiptera	Cixiidae	*Koroana lanceloti*	N	1
Hemiptera	Cixiidae	*Malpha* sp.	N	2
Hemiptera	Coccoidea	Unid. sp.	?	14
Hemiptera	Delphacidae	Unid. sp.	N	3
Hemiptera	Lygaeidae	*Rhypodes* sp.	N	2
Hemiptera	Miridae	*Reuda* cf. *mayri*	N	2
Hemiptera	Psyllidae	Unid. sp.	?	14
Hemiptera	Rhyparochromidae	Unid. sp.	N	3
Hemiptera	Unid. nymph	Unid. sp.	?	5
Thysanoptera	Unid.	Unid. sp.	?	16
Psocodea	Unid.	Unid. sp.	N	7
Coleoptera	Belidae	*Agathinus tridens*	N	3
Coleoptera	Carabidae	*Amarotypus edwardsii*	N	3
Coleoptera	Carabidae	*Demetrida lineella*	N	10
Coleoptera	Carabidae	*Mecodema metallicum*	N	1
Coleoptera	Carabidae	*Neocicindela aureata*	N	2
Coleoptera	Carabidae	*Neoferonia* sp.	N	10
Coleoptera	Carabidae	Unid. Platynini	N	2
Coleoptera	Chrysomelidae	Unid. sp.	N	69
Coleoptera	Curculionidae	Unid. sp.	N	9
Coleoptera	Elateridae	Unid. sp.	N	4
Coleoptera	Eucnemidae	Unid. sp.	N	1
Coleoptera	Hydrophilidae	*Rygmodus alienus*	N	1
Coleoptera	Hydrophilidae	Unid. sp. "small browns"	N	3
Coleoptera	Latridiidae	Unid. sp.	N	1
Coleoptera	Leiodidae	Unid. sp.	N	1
Coleoptera	Melyridae	*Dasytes* sp.	N	1
Coleoptera	Pyrochroidae	*Techmessa* sp.	N	2
Coleoptera	Scarabaeidae	*Saphobius* sp.	N	126
Coleoptera	Scarabaeidae	*Sericospilus* sp.	N	1
Coleoptera	Staphylinidae	*Eupines* sp.	N	2
Coleoptera	Staphylinidae	Unid. Pselaphinae	N	8
Coleoptera	Staphylinidae	Unid. sp.	N	23
Coleoptera	Unid.	Unid sp.	?	9
Diptera	Calliphoridae	*Calliphora hillii*	A	2
Diptera	Calliphoridae	*Xenocalliphora neozelandica*	N	1
Diptera	Cecidomyiidae	Unid. sp.	N	243

Diptera	Ceratopogonidae	Unid. sp.	N	203
Diptera	Chironomidae	Unid. sp.	N	149
Diptera	Chloropidae	*Tricimba flaviseta*	N	1
Diptera	Ditomyiidae	*Nervijuncta hexachaeta*	N	1
Diptera	Dolichopodidae	*Hercostomus*? sp.	N	8
Diptera	Dolichopodidae	Unid. sp.	N	26
Diptera	Empididae	Unid. sp.	N	19
Diptera	Ephydridae	*Notiphilinae* sp. "black forelegs"	N	1
Diptera	Heleomyzidae	*Aneuria* cf. *tripunctata*	N	1
Diptera	Huttoninidae	*Huttonina elegans*	N	2
Diptera	Huttoninidae	*Huttonina* sp. nr. *abrupta*	N	1
Diptera	Keroplatidae	*Macrocera antennalis* grp	N	2
Diptera	Keroplatidae	*Macrocera* cf. *annulata*	N	1
Diptera	Keroplatidae	*Pyrtaula punctifusa*	N	3
Diptera	Keroplatidae	*Rypatula* nr. *brevis*	N	3
Diptera	Muscidae	Unid. sp.	?	10
Diptera	Mycetophilidae	*Allocotocera crassipalpis*	N	1
Diptera	Mycetophilidae	*Aneura longicauda*	N	2
Diptera	Mycetophilidae	*Aneura nitida*	N	1
Diptera	Mycetophilidae	*Austrosynapha pulchella*	N	6
Diptera	Mycetophilidae	*Brevicornu* sp.	N	5
Diptera	Mycetophilidae	*Exechia* cf. *novaezelandiae*	N	1
Diptera	Mycetophilidae	*Exechia hiemalis*	N	1
Diptera	Mycetophilidae	*Morganiella fusca*	N	1
Diptera	Mycetophilidae	*Morganiella* nov. sp.1 (of Toft)	N	3
Diptera	Mycetophilidae	*Mycetophila fagi*	N	4
Diptera	Mycetophilidae	*Mycetophila* nr. *minima*	N	1
Diptera	Mycetophilidae	*Mycetophila vulgaris* group	N	1
Diptera	Mycetophilidae	*Neoaphelomera* sp.	N	5
Diptera	Mycetophilidae	*Parvicellula* cf. *obscura*	N	1
Diptera	Mycetophilidae	*Parvicellula subhamata*	N	1
Diptera	Mycetophilidae	*Phthinia longiventris*	N	1
Diptera	Mycetophilidae	*Platurocypta immaculata*	N	1
Diptera	Mycetophilidae	*Sciophilinae* nov. gen. 1, sp.	N	4
Diptera	Mycetophilidae	*Sigmoleia similis*	N	1
Diptera	Mycetophilidae	*Tetragoneura ultima*	N	3
Diptera	Mycetophilidae	*Zygomyia* sp. 18 (of Toft)	N	1
Diptera	Phoridae	Unid. sp.	N	92
Diptera	Polleniidae	*Pollenia* sp.	N	12
Diptera	Psychodidae	Unid. sp.	N	10
Diptera	Sciaridae	*Epidapus* sp.	N	1

Diptera	Sciaridae	Unid. sp.	N	133
Diptera	Simulidae	*Austrosimulium* sp.	N	5
Diptera	Sphaeroceridae	"*Leptocera* (*Limosina*)" sp.	N	2
Diptera	Sphaeroceridae	*Howickia* cf. *myersi*	N	2
Diptera	Stratiomyiidae	Unid. sp.	N	1
Diptera	Syrphidae	*Melanostoma fasciatum*	N	3
Diptera	Tachinidae	Unid. sp.	N	9
Diptera	Tipulidae	*Amphineurus* sp.	N	1
Diptera	Tipulidae	*Gynoplistia* sp.	N	8
Diptera	Tipulidae	*Molophilus* sp.	N	9
Diptera	Unid.	Unid. sp.	?	6
Hymenoptera	Aphelinidae	Unid. sp. "metallic blue head"	N	2
Hymenoptera	Braconidae	Unid. sp.	?	7
Hymenoptera	Colletidae	*Hylaeus capitosus*	N	1
Hymenoptera	Encyrtidae	Unid. sp.*branched antennae	N	6
Hymenoptera	Formicidae	*Chelaner antarcticus*	N	91
Hymenoptera	Formicidae	*Huberia striata*	N	30
Hymenoptera	Formicidae	*Prolasius advena*	N	13
Hymenoptera	Ichneumonidae	Unid. sp.	?	29
Hymenoptera	Pompilidae	*Priocnemis conformis*	N	1
Hymenoptera	Pompilidae	*Priocnemis crawi*	N	5
Hymenoptera	Pompilidae	*Sphictostethus fugax*	N	1
Hymenoptera	Pompilidae	*Sphictostethus nitidus*	N	4
Hymenoptera	Unid. micro-parasitica	Unid. sp.	?	107
Plecoptera	Unid.	Unid. spp.	N	14
Trichoptera	Unid.	Unid. sp.	N	30
Lepidoptera	Unid.	Unid. sp.	N	20
Collembolla	Unid.	Unid. sp.	?	1386

APPENDIX D

Buller Plateaux Continuation Project Mt Frederick South Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026d)

ecoLogical Solutions
Environmental Consultants







August 2026

Buller Plateaux Continuation Project
Mt Frederick South Project Sub-Area Baseline Surveys

Prepared for Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by:	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
Reviewed by:	[redacted] Terrestrial Ecology Team Leader	[redacted]

Status: Final **Issued:** 7 August 2026

ecoLogical solutions

tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 4/195 main highway,
ellerslie, Auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

nelson office
p: 021 172 2091

www.ecoLogicalsolutions.co.nz

Executive Summary

This report describes the specific ecological surveys, including methods and results, used to inform an assessment of ecological values of the Mount Frederick South (MFS) Project sub-area which forms part of the larger Buller Plateaux Continuation Project ("the Project" or "the BPCP"). This report does not include the values assessment or consider the effects of the Project, which are both provided in the Buller Continuation Project Ecological Impact Assessment (Ecological Solutions Limited 2026a).

The MFS Project sub-area is c. 216 hectares (ha) in size and includes 175.4ha of new and existing disturbance. The vegetation within the MFS Disturbance area includes forest, shrubland, low vegetation and cleared vegetation associated with previous mining activity (late 1800s/ early 1900s). Approximately 70% (123.5ha) of the MFS Disturbance area is considered to be a 'natural inland wetland' because it meets the relevant tests in the National Policy Statement for Freshwater Management (2020). In general, the vegetation is indigenous, intact and demonstrates natural ecological patterns and gradients. The MFS Disturbance area also includes naturally uncommon ecosystems (sandstone erosion pavement, seepages and flushes, boulderfields of acidic rocks, pākihi wetlands and small tarns).

Vegetation within the MFS Project sub-area includes 11 'At Risk' vascular plant species and is known to provide habitat for five bryophyte and one lichen species listed as 'Threatened' or 'At Risk'.

The bird fauna is less intact than other parts of the Project Area, with only sixteen species of indigenous birds recorded. The low diversity is likely a reflection of the habitat present, which includes large areas of low growing pākihi and less forest habitat, which is more suitable for birds. Based on five-minute bird counts, birds are present in relatively low numbers. Five bird species which are considered 'Threatened' or 'At Risk' have been recorded within MFS Project sub-area. Rōroa/great spotted kiwi are widespread, but sparsely distributed, and call counts indicate rōroa numbers are also relatively low.

The MFS Project sub-area is expected to provide good quality habitats for the lizard fauna present including two 'Threatened' and one 'At Risk' species. The MFS Project sub-area also includes a small amount of habitat suitable for the land snail *Powelliphanta patrickensis*.

The terrestrial invertebrate communities within the MFS Project sub-area are predominantly indigenous and include a good abundance of a high diversity of taxa. The invertebrate communities include widespread species, species endemic to the North Westland area, species adapted to high elevation, wet environments, species which are thought to be local endemics and 'Threatened' and 'At Risk' species.

Table of Contents

Executive Summary **2**
1.0 Introduction **5**
1.1 Background 5
1.2 Scope and Purpose 7
2.0 Methods **7**
2.1 Vegetation Mapping 7
2.2 Identifying Wetland Vegetation Types 9
2.3 Bryophytes and Lichens 9
2.4 Avifauna 10
2.4.1 Background 10
2.4.2 Five-minute bird counts 10
2.4.3 Acoustic recorders 10
2.5 Lizards 10
2.6 Invertebrates 10
2.6.1 Survey methods 10
2.6.2 *Powelliphanta* snails 12
3.0 Field Surveys **14**
3.1 Vegetation 14
3.1.1 Summary 14
3.1.2 Forest vegetation 16
3.1.3 Shrubland vegetation 16
3.1.4 Low vegetation 17
3.1.5 Other landcover types 17
3.1.6 'Threatened' and 'At Risk' plant species 17
3.2 Wetlands 18
3.3 Bryophytes 20
3.4 Lichens 22
3.5 Avifauna 22
3.5.1 Five-minute bird counts 22
3.5.2 Acoustic recorders 23
3.5.3 Rōroa/great spotted kiwi 24
3.6 Terrestrial Invertebrates 24
4.0 Conclusion **25**
5.0 References **26**

Index to Tables

Table 1: Vegetation classification and location of terrestrial invertebrate sampling sites within and near the MFS Project sub-area. 12
Table 2: Vegetation and land cover types within the MFS Project sub-area. 14
Table 3: 'Threatened' and 'At Risk' bryophytes recorded from the MFS Project sub-area. 20
Table 4: Bird species recorded during acoustic recorder surveys at the MFS Project sub-area. 23
Table 5: Rōroa/great spotted kiwi call counts. 24

Index to Figures

Figure 1: Buller Plateaux Continuation Project sub-areas. 6
Figure 2: Extent of the Mapped Area at the Buller Plateaux. 8
Figure 3: Location of five-minute bird counts and acoustic recorders for the MFS Project sub-area. 11
Figure 4: Location of invertebrate survey sites at the MFS Project sub-area. 13
Figure 5: Vegetation and land cover types within the MFS Disturbance area. 15
Figure 6: The extent and location of wetlands within the MFS Project sub-area. 19
Figure 7: Location of bryophytes and lichens of conservation concern within the MFS Project sub-area. 21
Figure 8: Average number of calls per five-minute bird count at the MFS Project sub-area. 22

Appendices

Appendix A – Vegetation plots at the MFS Project sub-area.
Appendix B – Bryophytes recorded at the MFS Project sub-area and surrounds.
Appendix C – Bird species recorded at MFS Project sub-area.

1.0 Introduction

1.1 Background

Bathurst Resources Limited (including its subsidiary companies BT Mining Ltd, Bathurst Coal Ltd, and Buller Coal Ltd) (collectively referred to here as 'Bathurst') are seeking approvals through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('BPCP', or 'the Project'). The purpose of the FTAA is to facilitate the delivery of infrastructure and development projects with significant regional or national benefits.

The purpose of the Project is to reconsent the existing infrastructure and mining operations associated with the Stockton Mine and provide access to additional coal mining areas across the Buller Plateaux. The coal resource in the current Stockton operations is close to depletion, and further coal resources for blending are required.

The Project area includes parts of both the Denniston and Stockton Plateaux, collectively referred to here as 'the Buller Plateaux' located northeast of Westport. The Project is a complex proposal which seeks to enable a mix of ongoing and new mining activities. The land tenure is a mix of Crown, private and Bathurst owned land. The authorisations required for the proposed activities are being bundled into a single application to proceed through the FTAA process.

As shown in Figure 1, the Project has been divided into five project sub-areas for the purpose of the FTAA application:

- Stockton (including the Ngakawau Coal Handling Facility and Aerial Ropeway, 'Stockton').
- Cypress Mining Area ('Cypress').
- Mount Frederick South ('MFS').
- Escarpment Extended (including the Waimangaroa storage area, 'ESE').
- The proposed Upper Waimangaroa Haul Road ('UWHR').

The Project will enable 20 million tonnes of coking coal to be mined, utilising existing infrastructure facilities over a 25-year timeframe to support and extend the mine life of the current Stockton Mine operations. All elements of the Project are essential for the Project to be economically viable and to meet the future coal blend requirements.

The Project provides significant regional economic benefits and contributes to the resilience of the regional economy through:

- Maintaining the current workforce numbers through retention of approximately 390 direct jobs in the Buller district and an additional 50 jobs outside of the Buller district.
- Contributing approximately $40 million annually in wages, much of which is spent locally.

This "Project sub-area report" describes the methods, survey results and ecological values of the Mount Frederick South (MFS) Project sub-area as shown in Figure 1. The effects assessments for each Project sub-area are provided in the Buller Plateaux Continuation Project Ecological Impact Assessment (Ecological Solutions Limited 2026a) and combined in the overall Assessment of Environmental Effects for the Project (Mitchell Daysh Limited 2026).

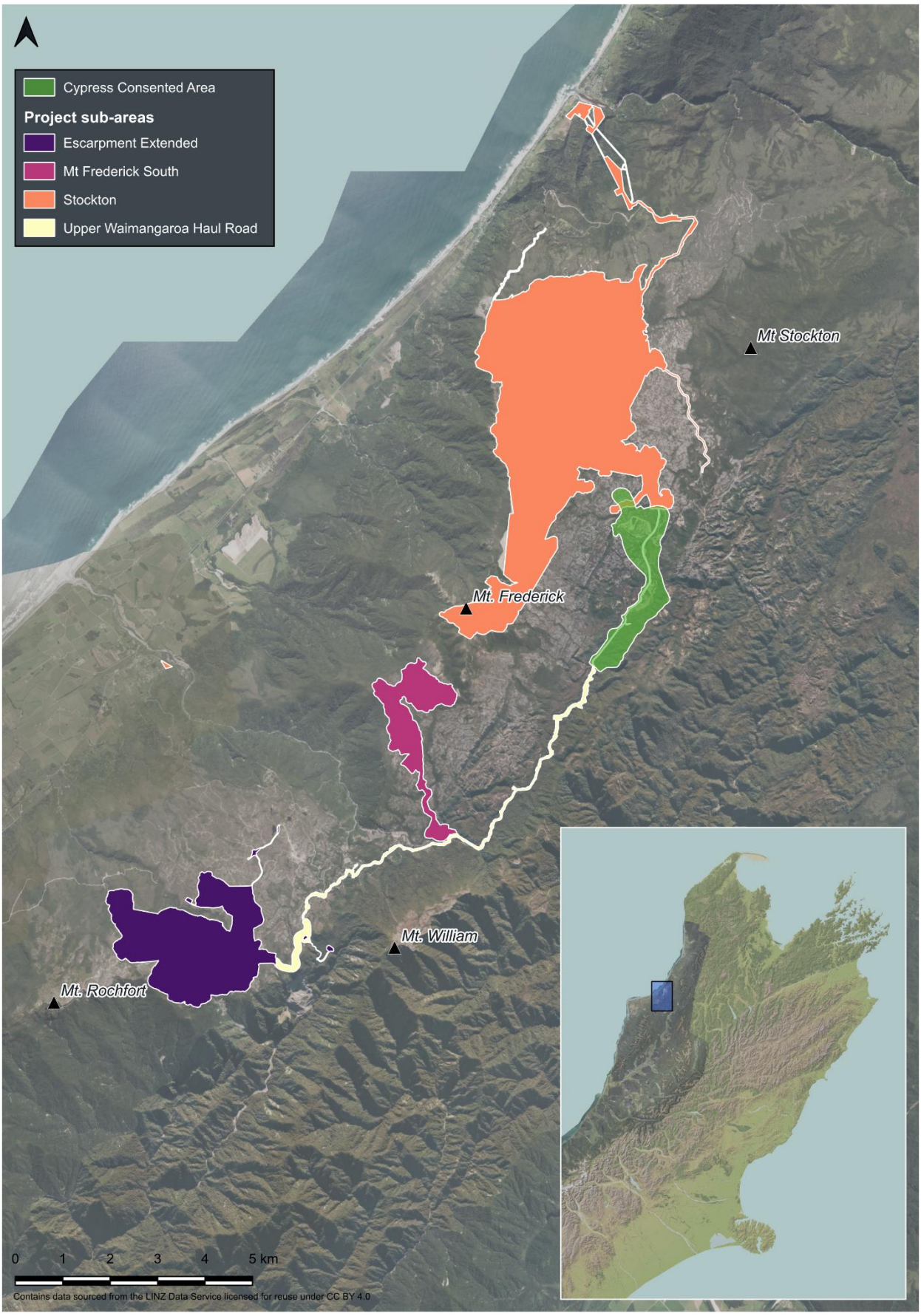


Figure 1: Buller Plateaux Continuation Project sub-areas.

Disturbance areas within each Project sub-area reflect where disturbance will occur (for example, mining, mining infrastructure, roading, buildings). The extent of the MFS Project sub-area is c. 216ha[1] including provision for edge effects, while the MFS Disturbance area is c.175.4ha[2].

1.2 Scope and Purpose

In preparing for the Project, Bathurst has undertaken a range of surveys since 2020, both across the Buller Plateaux generally and at specific relevant locations. Bathurst has also undertaken regular monitoring of a range of species at various locations in order to inform their effects management and compliance reporting. This has produced a large amount of ecological information in a variety of documents. This report summarises the information relevant to the MFS Project sub-area and provides technical detail sufficient to support the Ecological Impact Assessment (Ecological Solutions Limited 2026a) and overall Assessment of Ecological Effects for the Project (Mitchell Daysh Limited 2026) as a standalone document. The purpose is to minimise the information provided in those larger documents, whilst still providing sufficient detail to inform decision makers.

This document includes five sections as follows:

- This introduction (Section 1.0).
- Section 2.0 sets out the methods used to survey vascular and non-vascular vegetation, wetlands, avifauna, lizards, land snails, other terrestrial invertebrates and mammalian pests. Section 2.0 also identifies any relevant key documents to be read in conjunction with this report.
- Section 3.0 sets out the results of the surveys described in Section 2.
- Section 4.0 provides a conclusion with respect to the ecological values present.
- Section 5.0 provides the references used in compiling this report.

2.0 Methods

2.1 Vegetation Mapping

Terrestrial and wetland vegetation within c. 10,129 hectares (ha) of the Buller Plateaux and surrounds (referred to as “the Mapped Area”) was mapped and described using 152 10 x 10 metre (m) vegetation plots collected between 2008 and 2025 across both the Stockton and Denniston Plateaux, combined with ordination and multivariate analysis as well as classification of 45,690 aerial photographs of the Mapped Area collected using a drone between July 2019 and January 2024 (Ecological Solutions Limited 2026b).

The Mapped Area included the MFS Project sub-area and surrounds as shown in Figure 2. The methods used to compile the vegetation map are briefly summarised here. For more detail see Ecological Solutions Limited (2026b).

[1] Based on shapefiles released 4 December 2025.
[2] Based on shapefiles release 15 October 2025.

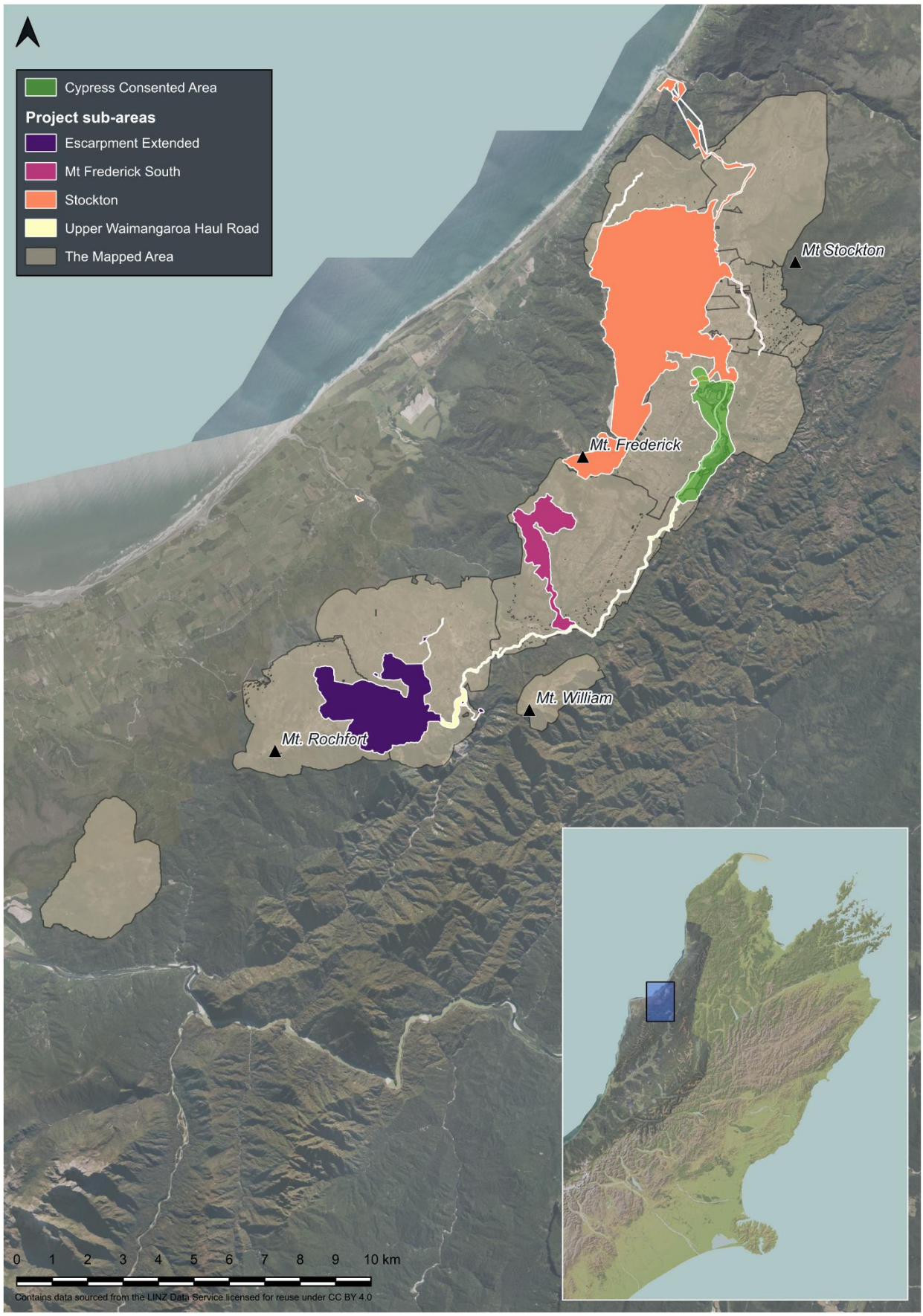


Figure 2: Extent of the Mapped Area at the Buller Plateaux.

Vegetation plot data collected using the RECCE method (Hurst et al. 2022) was ordinated using non-metric multi-dimensional scaling (NMDS) and generalised linear modelling (GLM) and principal components analysis (PCA) were used to discriminate vegetation types and identify underlying ecological drivers. Principal Components Analysis (PCA) indicated that altitude, slope, aspect, and percentage of rock cover were strong ecological drivers of the vegetation type present.

Concurrently, drone imagery was used to create georeferenced orthomaps which were separated into distinct vegetation types using machine learning via two types of algorithms (RF and SVM) informed by training samples which were assigned to one of the vegetation types identified from the ordination by personnel involved in the field surveys. Three additional land cover types were identified during that verification process including bare rock (mostly sandstone erosion pavement), water (often historic or current mine infrastructure) and cleared vegetation.

Of the 152 plots used to inform the vegetation mapping study, 10 were located within the MFS Project sub-area (Ecological Solutions Limited 2026b). A list of these plots is provided in Appendix A.

2.2 Identifying Wetland Vegetation Types

The specific method for identifying wetlands is detailed in Ecological Solutions Limited (2026b). To summarise, the vegetation tests set out in the wetland delineation protocols (Ministry for the Environment 2020) were applied to each of the 152 vegetation plots to determine whether that plot met the definition of 'natural inland wetland' set out in the National Policy Statement for Freshwater Management (2020 and subsequent amendments, "the NPS-FM") or not. For vegetation types where all the plots met the relevant tests, those vegetation types were confirmed as natural inland wetlands. For vegetation types where only some of the plots met the relevant tests, professional judgement was used to determine whether the vegetation was a wetland type or not. Where none of the plots met the relevant tests, those vegetation types were not considered to be wetlands.

2.3 Bryophytes and Lichens

Previous bryophyte and lichen surveys from the Buller Plateaux and Ngakawau Ecological District are summarised in Ecological Solutions Limited (2026c). This included identification of the vegetation type (or habitat) where 'Threatened' and 'At Risk' bryophytes and lichens (de Lange et al. 2018, 2020, Michel et al. 2026) had been recorded previously, so as to inform an assessment of the likely ecological value of parts of the Project Area which could not be surveyed directly.

Within the MFS Project sub-area, ten 5 x 5 metre (m) plots (located within the larger RECCE plots used to assist in mapping vegetation) were surveyed for bryophytes in December 2023 to inform the description of the bryophyte communities within the MFS Project sub-area. An additional three plots adjoining the Project sub-area were also surveyed. The focus was on developing a species list, with particular attention to species of conservation concern, specifically those listed as 'Threatened' or 'At Risk' (de Lange et al. 2020, Michel et al. 2026).

No specific search was undertaken for lichens. The locations of any easily identifiable species considered to be 'Threatened' or 'At Risk' by de Lange et al. (2018) encountered during vegetation surveys were recorded on a handheld Garmin GPS unit.

2.4 Avifauna

2.4.1 Background

Previous avifauna surveys and/or monitoring reports from the Buller Plateaux relating to birds are summarised by Ecological Solutions Limited (2026c).

Surveys for birds within the MFS Project sub-area used five-minute bird counts (5MBC) and acoustic recorder surveys. The locations of these are shown in Figure 3. Acoustic recorders have the advantage of increasing detectability (particularly for cryptic species), avoiding disturbance to birds due to an observer, easily increasing survey area or duration without substantial additional effort and providing permanent recordings (which can be shared with others if required, e.g., to identify rare species).

During the vegetation, bryophyte and terrestrial invertebrate surveys undertaken specifically for the Project, any birds encountered were also recorded.

2.4.2 Five-minute bird counts

Nichol (2020) surveyed avifauna within the MFS Project sub-area and surrounds using 5MBCs at 25 stations on 3 November 2019. Nineteen stations were located within the MFS Project sub-area and six outside as shown in Figure 3.

2.4.3 Acoustic recorders

Stewart (2024) deployed 12 AR4 acoustic recorders (manufactured by the Department of Conservation) between 27 January and 8 February 2024 to survey birds within and surrounding the MFS Project sub-area including four recorders inside and eight outside the Project sub-area. Acoustic recorders were programmed to record from 2200 hours to 0700 hours and therefore recorded nocturnal birds (including rōroa/great spotted kiwi (*Apteryx maxima*)) and diurnal birds calling during the dawn chorus. The locations of acoustic recorders are also shown in Figure 3.

2.5 Lizards

Previous lizard surveys from the Buller Plateaux and Ngakawau Ecological District are summarised in Ecological Solutions Limited (2026c). Lizard surveys were undertaken on the Denniston Plateau and Waimangaroa Valley over five days on 15–16 January and 3–5 March 2020 (refer to Ecological Solutions 2026e and Ecological Solutions 2026f) however these surveys did not include the MFS Project sub-area. An evaluation of habitats within the ESE Project sub-area found that the highest value lizard habitats were those nearest areas of high topographical diversity such as forested gullies surrounded by sandstone pavement and pākihi. These habitats are also present in the MFS Project sub-area.

2.6 Invertebrates

2.6.1 Survey methods

Previous invertebrate surveys from the Buller Plateaux and Ngakawau Ecological District are summarised in Ecological Solutions Limited (2026c). Sampling at each of 18 survey locations within the MFS Project sub-area included three pitfall traps, one malaise trap, sweep netting, beat sampling, and 30 minutes of hand searching (where suitable habitat was available). The sampling sites are described in Table 1 and the locations shown in Figure 4.

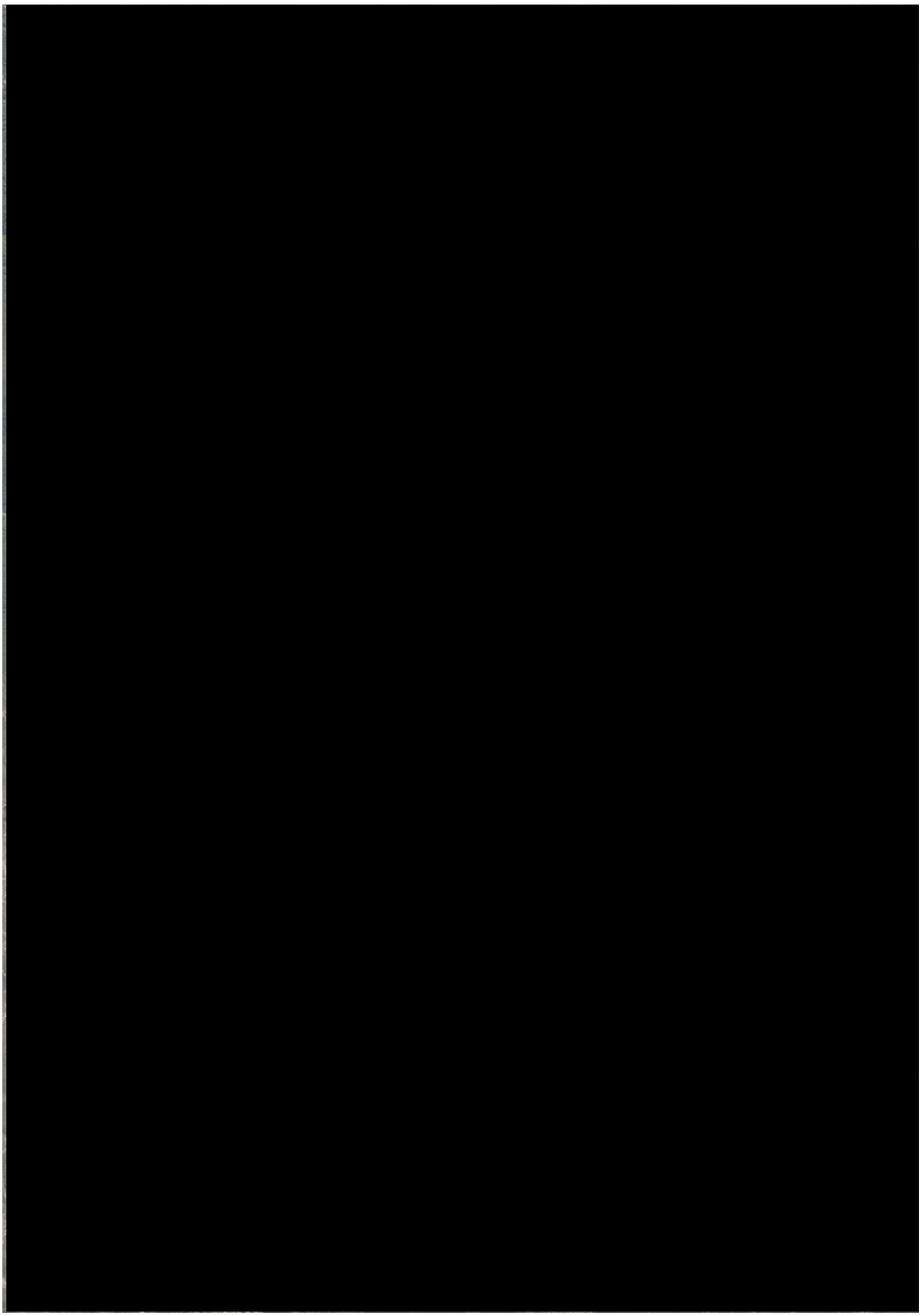


Figure 3: Location of five-minute bird counts and acoustic recorders for the MFS Project sub-area.

Arachnid specimens collected were sorted to order, family, genus, or species depending on available taxonomic resources, sample quality, and on the ability of the particular taxonomic group to provide useful comparative information on distribution. Most arachnids could only be identified to family level.

Table 1: Vegetation classification and location of terrestrial invertebrate sampling sites within and near the MFS Project sub-area.

Site #	Vegetation Classification	NZTM 2000	
		Easting	Northing
MFS1	Low pākihi	[redacted]	[redacted]
MFS2	Mānuka-mountain beech-podocarp shrubland	[redacted]	[redacted]
MFS3	Low pākihi	[redacted]	[redacted]
MFS4	Mānuka-mountain beech-podocarp shrubland	[redacted]	[redacted]
MFS5	Southern rātā-mountain beech-podocarp forest	[redacted]	[redacted]
MFS6	Mānuka-mountain beech-podocarp shrubland	[redacted]	[redacted]
MFS7	Bare Rock	[redacted]	[redacted]
MFS8	Southern rātā-mountain beech-podocarp forest	[redacted]	[redacted]
MFS9	Leatherwood shrubland	[redacted]	[redacted]
MFS10	Silver beech-mountain beech forest	[redacted]	[redacted]
MFS11	Bare Rock	[redacted]	[redacted]
MFS12	Mānuka-flax/wire rush shrubland	[redacted]	[redacted]
MFS13	Low pākihi	[redacted]	[redacted]
MFS14	Low pākihi	[redacted]	[redacted]
MFS15	Low pākihi	[redacted]	[redacted]
MFS16	Bare Rock	[redacted]	[redacted]
MFS17	Low pākihi	[redacted]	[redacted]
MFS18	Southern rātā-mountain beech-podocarp forest	[redacted]	[redacted]

2.6.2 *Powelliphanta* snails

Previous snail surveys and/or monitoring reports relating to land snails on the Buller Plateaux are summarised in Ecological Solutions Limited (2026c).

As part of a *Powelliphanta patrickensis* population study, Lloyd (2012) surveyed 25 plots (10m x 10m) in the upper Deep Creek catchment in the vicinity of the MFS Project sub-area, however no specific snail surveys have been carried out recently within the MFS Project sub-area. Lloyd (2024) developed a species distribution model of *Powelliphanta patrickensis* using density estimates of different vegetation types. Mānuka-flax/wire rush shrubland and tussock-flax shrubland were identified as having the highest estimated snail density. Mānuka/Gahnia-wire rush shrubland and low pākihi are also known to have high snail numbers (Lloyd 2012, Lloyd 2024).

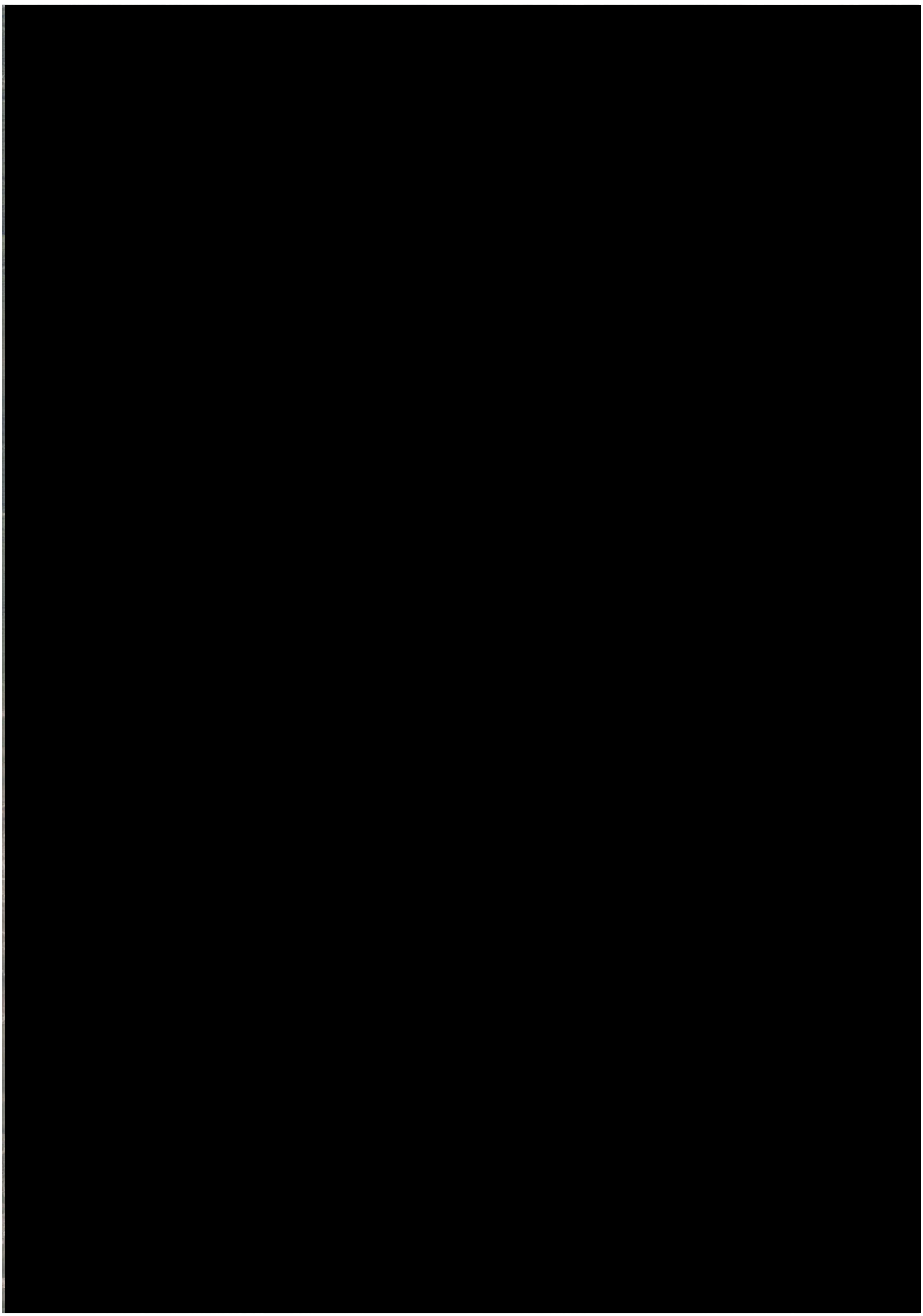


Figure 4: Location of invertebrate survey sites at the MFS Project sub-area.

3.0 Field Surveys

3.1 Vegetation

3.1.1 Summary

The extent of each vegetation and landcover type present within the MFS Disturbance area and associated Indirect Effects Contingency (to provide for edge effects) is set out in Table 2. The distribution and location of each land cover type within the MFS Disturbance area is shown in Figure 5. Each vegetation type is described in more detail in Sections 3.1.2– 3.1.4.

The MFS Project sub-area comprises mostly low pākihi (c. 83.4 ha, 47.6%) with smaller amounts of mānuka-mountain beech forest (c. 34.0ha, 19.4%) and Southern rātā-mountain beech-podocarp forest. (c. 25.5ha, 14.5%). Bare rock (sandstone erosion pavement) makes up approximately 19.3ha (11.0%) of the MFS Project sub-area.

Table 2: Vegetation and land cover types within the MFS Project sub-area.

	Extent (ha)			
	Total (Disturbance + Indirect Effects Contingency)	Disturbance area	Indirect Effects Contingency	Disturbance as a % of MFS Disturbance area
Forest				
Southern rātā-mountain beech-podocarp forest	34.3	25.5	8.8	14.5
Silver beech-mountain beech forest	6.0	5.5	0.5	3.1
Shrubland				
Mānuka-mountain beech-podocarp shrubland	37.9	34.0	3.9	19.4
Moderate height mānuka-tussock-wire rush shrubland	3.7	3.2	0.5	1.8
Mānuka-mountain flax/wire rush shrubland	2.0	2.0	0.1	1.1
Low vegetation				
Low pākihi	89.5	83.4	6.1	47.6
Tussock-mountain flax shrubland	0.9	0.9	0.0	0.5
Non-vegetated land cover				
Bare rock	21.1	19.3	1.8	11.0
Vegetation cleared	1.6	1.6	0.0	0.9
Total	**197.0**	**175.4**	**21.6**	**100.0**

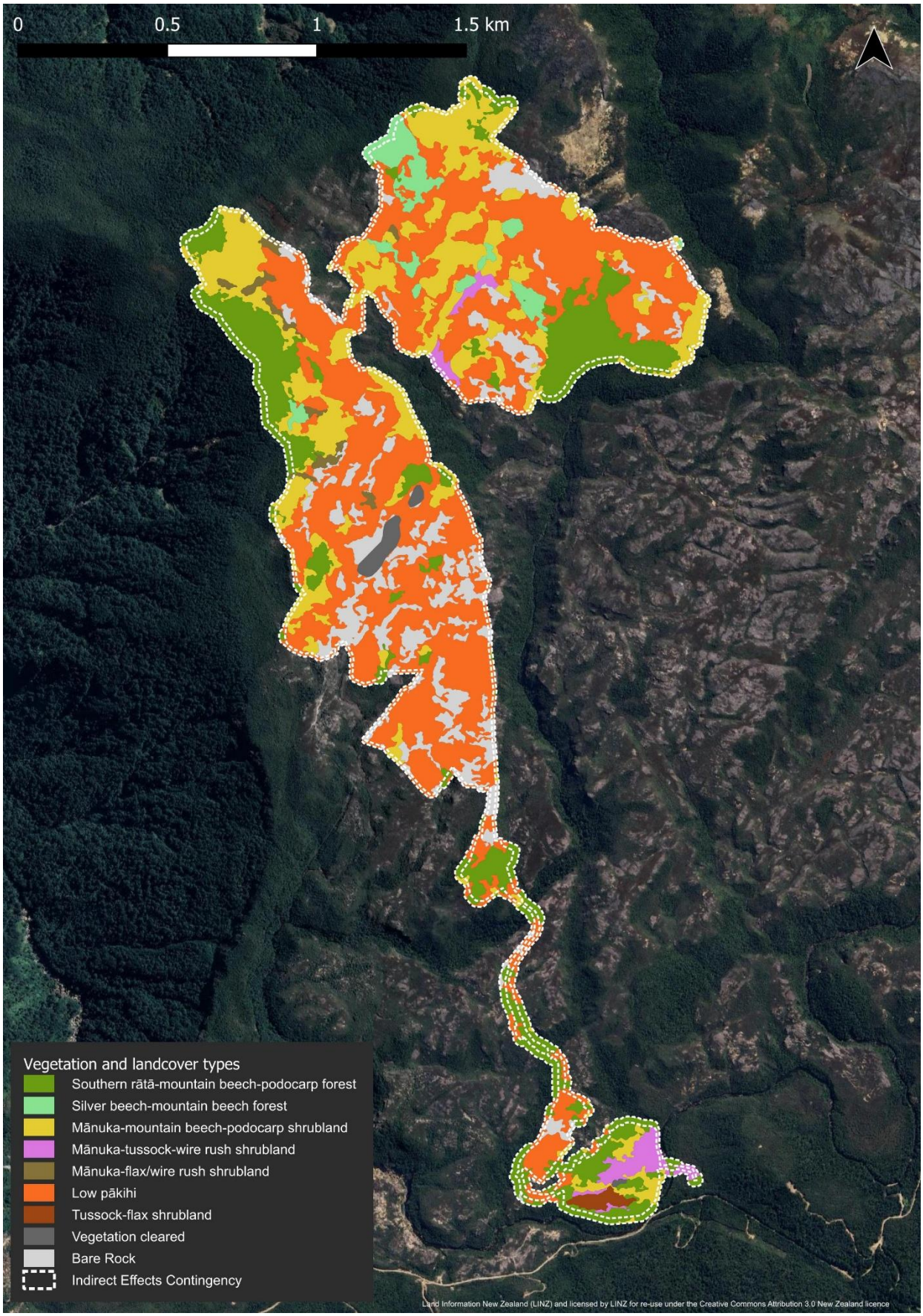


Figure 5: Vegetation and land cover types within the MFS Disturbance area.

3.1.2 Forest vegetation

Two forest types were present within the MFS Disturbance area, together occupying c. 31ha (17.7%). Southern rātā-mountain beech-podocarp forest was the most common (covering c. 25.5ha (14.5%, including edges), occurring mainly in gullies and sheltered sites throughout the disturbance area, particularly in the west and south. This forest had a mean height of c. 7.5m, with a sparse emergent layer dominated by Southern rātā (*Metrosideros umbellata*). Pāhautea (*Libocedrus bidwillii*) formed a sparse but conspicuous component of the canopy in sheltered locations, typically near waterways. The canopy layer was dense, with abundant mountain beech (*Fuscospora cliffortioides*), common yellow-silver pine (*Lepidothamnus intermedius*) and pink pine (*Halocarpus bidwillii*) and occasional silver beech (*Lophozonia menziesii*). The understorey had a high species richness, including species such as weeping māpou (*Myrsine divaricata*), mountain toatoa (*Phyllocladus alpinus*), pseudopanax (*Pseudopanax colensoi* var. *ternata*, *P. linearis*) and various *Coprosma* and *Dracophyllum* species. Ground cover comprised mainly gahnia (*Gahnia procera*), *Astelia nervosa*, ferns and tree/shrub seedlings.

Silver beech-mountain beech forest was present at higher elevations (on the upper slopes of Mt Frederick) and covered c. 5.5ha (3.1%) of the MFS Disturbance area. Stunted silver and mountain beech and *Dracophyllum elegantissimum* dominated the canopy, with occasional Southern rātā. *Archeria traversii*, mountain toatoa and *Pseudopanax linearis* were dominant in the subcanopy. Non-vascular vegetation was a feature of the ground layer, along with *Astelia nervosa*, *Coprosma* species (*C. colensoi, C. foetidissma*, *C. pseudocuneata*), *Luzuriaga parviflora* (lantern berry) and mountain flax (*Phormium cookianum*).

3.1.3 Shrubland vegetation

The most common shrubland type was mānuka-mountain beech-podocarp shrubland, which occupied approximately c. 34ha (19.4%) of the Disturbance area, particularly in the northern (higher altitude) part of the MFS Disturbance area, often forming an ecotone between taller forest on more well-drained slopes and stunted shrubland and pākihi communities in flatter and more poorly drained areas. This shrubland was c. 3.9m tall on average, with the canopy dominated by mānuka and mountain beech, with yellow-silver pine, pink pine and Southern rātā also present in varying proportions. The understorey layer comprised saplings of canopy species, and shrubs such as *Coprosma* spp., prickly mingimingi (*Leucopogon fasciculatus*) and weeping mapou. Gahnia, mountain flax and wire rush (*Empodisma minus*) were abundant in the ground layer.

Mānuka-tussock-wire rush shrubland occupied approximately 3.2ha (1.8%) within the MFS Disturbance area, with most of this vegetation being located near the Waimangaroa River. This short vegetation had a mean height of c. 0.83m, with mānuka dominating the canopy. *Dracophyllum* species (particularly *D. rosmarinifolium*), *Gahnia* spp. and tangle fern (*Gleichenia* spp.) were often present in the lower tiers. Ground cover was primarily prostrate mānuka and wire rush, with coal measures tussock (*Chionochloa juncea*) forming a conspicuous component.

Approximately 2ha (1.1%) of mānuka-mountain flax/wire rush shrubland was distributed sparsely across the MFS Disturbance area. This vegetation was similar in structure to mānuka-tussock-wire rush shrubland, but included mountain flax as a conspicuous sub-dominant species. Ground cover was dominated by prostrate mānuka and wire rush. Red tussock (*Chionochloa rubra*), coal measures tussock, *Dracophyllum* species and podocarps formed a minor component of the upper tiers.

Tussock-flax shrubland (mean height 0.93 m) occupied c. 0.9ha (0.5%) at the southern end of the MFS Disturbance area. This vegetation was dominated by red tussock, along with occasional mountain flax and *Dracophyllum* spp. Wire rush and tangle fern were present in the ground layer.

3.1.4 Low vegetation

Low pākihi was the most common low vegetation type, occupying approximately 83.4ha (47.6%) within the MFS Disturbance area and most common on gently sloping, poorly drained and exposed areas associated with sandstone pavement. This short vegetation (mean height c. 0.27m) was dominated by prostrate mānuka and wire rush, with occasional red tussock, coal measures tussock and carpet grass (*Chionochloa australis*). *Carpha alpina*, cushion plant (*Donatia novae-zelandiae*), tangle fern (*Gleichenia dicarpa*) and sundews (*Drosera* spp.) were common in the ground layer. At more poorly drained locations this vegetation included common pākihi rush (*Machaerina teretifolia*), square sedge (*Lepidosperma australe*) and *Rytidosperma* spp. with occasional *Chionochloa* spp.

3.1.5 Other landcover types

The MFS Project Disturbance area includes approximately 19.3ha (11%) of bare rock. This mostly comprises sandstone erosion pavement with a low proportion of prostrate/low growing vegetation cover including species such as carpet grass, pygmy pine (*Lepidothamnus laxifolius*) prostrate *Dracophyllum* spp. and prostrate mānuka.

Approximately 1.6ha (0.9%) of cleared vegetation was present within the MFS Project Disturbance area resulting from historic mining in the area. Gorse (*Ulex europaeus*) and heath rush (*Juncus squarrosus*) were both present to varying degrees, particularly near areas that had been disturbed.

3.1.6 'Threatened' and 'At Risk' plant species

Ecological Solutions Limited (2026c) identified a total of approximately 542 vascular plant taxa which have been recorded from the Buller Plateaux since 1990. The majority (469 (87%)) of those were indigenous, along with 70 (13%) were exotic species. Thirty-one species (c. 6%) are of conservation concern. The flora of the MFS sub-area includes 'At Risk' vascular plants (de Lange et al. 2024) as well as local endemics and species with disjunct (discontinuous) distributions.

No plants currently regarded as 'Threatened' are known to occur within the MFS Project sub-area, but 11 'At Risk' plants are known or expected to occur there including:

- *Chionochloa juncea* – 'At Risk – Declining';
- *Dracophyllum densum* – 'At Risk – Declining';
- *Euphrasia wettsteiniana* – 'At Risk – Declining';
- Red mistletoe (*Peraxilla tetrapetala*) – 'At Risk – Declining';
- *Astelia subulata* – 'At Risk – Naturally Uncommon';
- *Brachyglottis traversii* – 'At Risk – Naturally Uncommon'.
- *Carex carsei* – 'At Risk – Naturally Uncommon';
- *Carex dallii* – 'At Risk – Naturally Uncommon';
- *Euphrasia disperma* – 'At Risk – Naturally Uncommon';
- *Pseudowintera traversii* – 'At Risk – Naturally Uncommon'; and
- *Schizacme helmsii* – 'At Risk – Naturally Uncommon'.

The 'Threatened – Nationally Vulnerable' bearded orchid *Calochilus paludosus* has been recorded at Mt Frederick on the Stockton Plateau and at Rome Stream to the north of Stockton, and may be seasonally present in pākihi vegetation within the MFS project sub-area.

3.2 Wetlands

Much of the Buller Plateaux exhibits hydrological and soil characteristics typical of wetlands, including soil saturation, surface water, stunted plants, a shallow aquitard (i.e., sandstone basement rock) and highly leached gley soils. The high rainfall contributes to maintaining these wetland features.

Low pākihi, mānuka-tussock-wire rush shrubland, mānuka-mountain beech-podocarp shrubland, mānuka/Gahnia-wire rush shrubland, mānuka-mountain flax/wire rush shrubland, low pākihi with exotic component and tussock-flax shrubland were all considered natural inland wetlands (Ecological Solutions Limited 2026b).

Mixed beech-podocarp-broadleaf forest and Southern rātā-mountain beech-podocarp forest were not considered natural inland wetlands (Ecological Solutions Limited 2026b). Despite, inconclusive outcomes for the wetland tests and small sample sizes, shrubland with exotic component and exotic grassland were not considered to be wetland types, but in these groups may require more site-specific consideration.

The total area of natural inland wetland within the MFS Disturbance area is approximately 123.5ha (70%) as shown in Figure 6. A further c. 10.6ha of natural inland wetlands occur within the Indirect Effects Contingency.

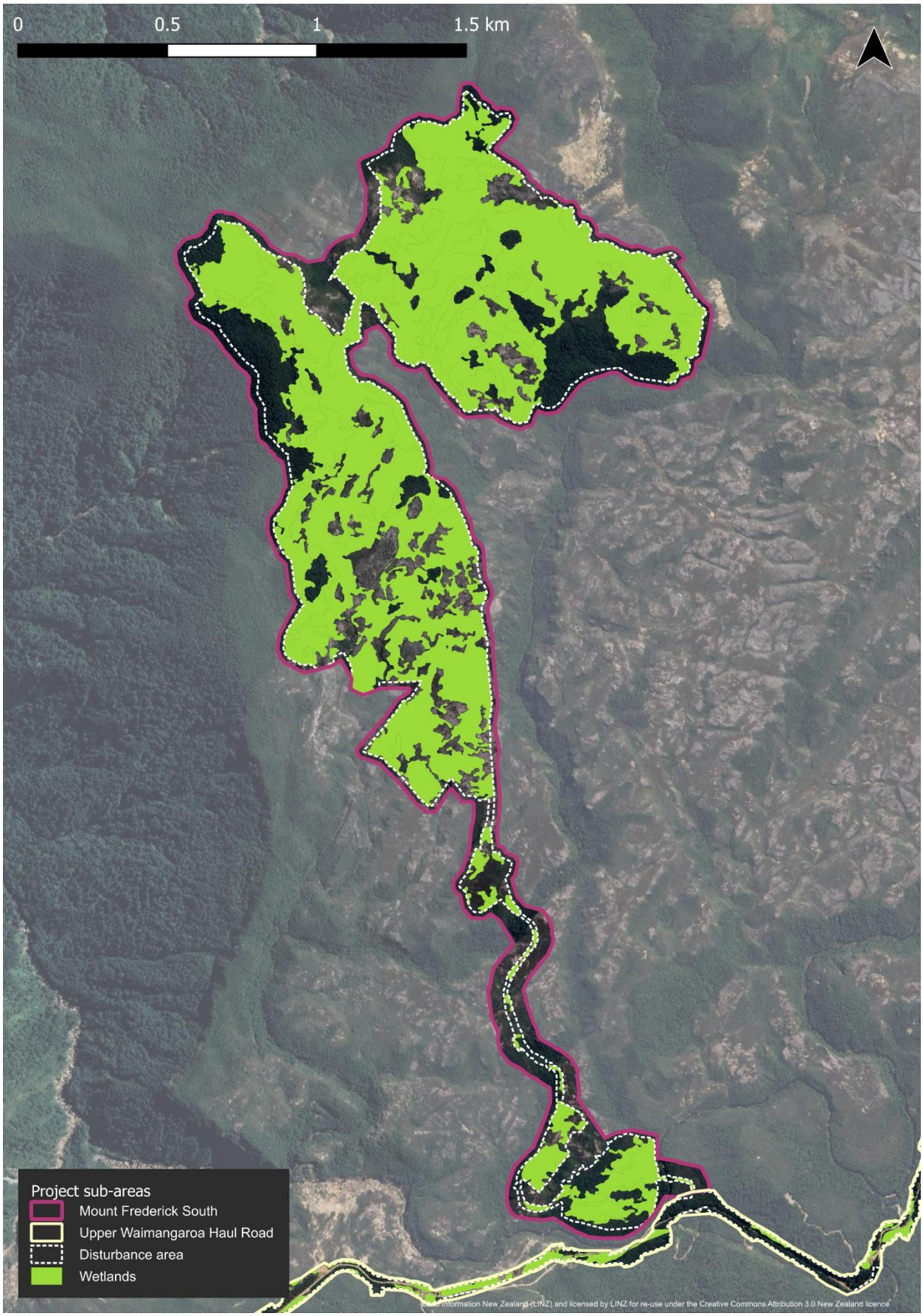


Figure 6: The extent and location of wetlands within the MFS Project sub-area.

3.3 Bryophytes

Five bryophytes considered to be 'Threatened' or 'At Risk' by de Lange et al. (2020) and Michel et al. (2026) are known to occur in the MFS Project sub-area as listed in Table 3. Of those:

- Two are considered 'Threatened – Nationally Vulnerable'; and
- Three are considered 'At Risk – Naturally Uncommon'.

The known location of these species is shown in Figure 7. A list of bryophytes recorded from plots within the MFS Project sub-area and surrounds is provided in Appendix B.

Additional species that may also be present within the MFS Project sub-area based on the presence of suitable habitat or nearby records, but have not been recorded there to date, include: *Isolembidium anomalum* var. *anomalum*, *Neogrollea notabilis*, *Pseudolophocolea denticulata* (all considered 'Threatened – Nationally Critical'), *Saccogynidium decurvum* ('At Risk – Declining'), *Archeophylla schusteri, Bazzania exempta, Cryptolophocolea tuberculata, Heteroscyphus billardierei, Lembidium longifolium*, *Lepidolaena novae-zelandiae, Pachyschistochila virescens, Pallavicinia rubristipa, Trichotemnoma corrugatum, Herzogianthus vaginatus, Zoopsis bicruris* and *Z. ceratophylla* (all 'At Risk – Naturally Uncommon'), and one 'Data Deficient' species *Riccardia exilis*.

Bryophytes of conservation concern are most frequently recorded from the following vegetation and habitat types as set out in Table 3:

- Southern rātā-mountain beech-podocarp forest;
- Silver beech-mountain beech forest;
- Mānuka-mountain beech-podocarp shrubland;
- Mānuka-tussock-wire rush shrubland; and
- Low pākihi.

Table 3: 'Threatened' and 'At Risk' bryophytes recorded from the MFS Project sub-area.

Species	Potential habitat
Threatened – Nationally Vulnerable	
Acromastigum verticale	Riparian and vertical wet walls under silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, and tanglefern shrubland, and low pākihi.
Telaranea inaequalis	Riparian, stream sides and vertical wet walls under forest, Southern rātā-mountain beech-podocarp forest; and shrubland: mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland., and tanglefern shrubland. Also, low pākihi.
At Risk – Naturally Uncommon	
Acromastigum mooreanum	Low pākihi mānuka-mountain beech-podocarp shrubland, silver beech-mountain beech forest. Also epiphytic on beech trees.
Pleurophascum ovalifolium	Silver beech-mountain beech forest, mixed beech-podocarp-broadleaved forest Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, tussock-flax shrubland, mānuka-tussock-wire rush shrubland, mānuka-flax/wire rush shrubland, mānuka/Gahnia-wire rush shrubland, sandstone erosion pavement ('bare rock'), tanglefern shrubland and low pākihi.
Riccardia furtiva	Silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, tussock-flax shrubland, and low pākihi. Also has been recorded from an area historically disturbed ('vegetation cleared').

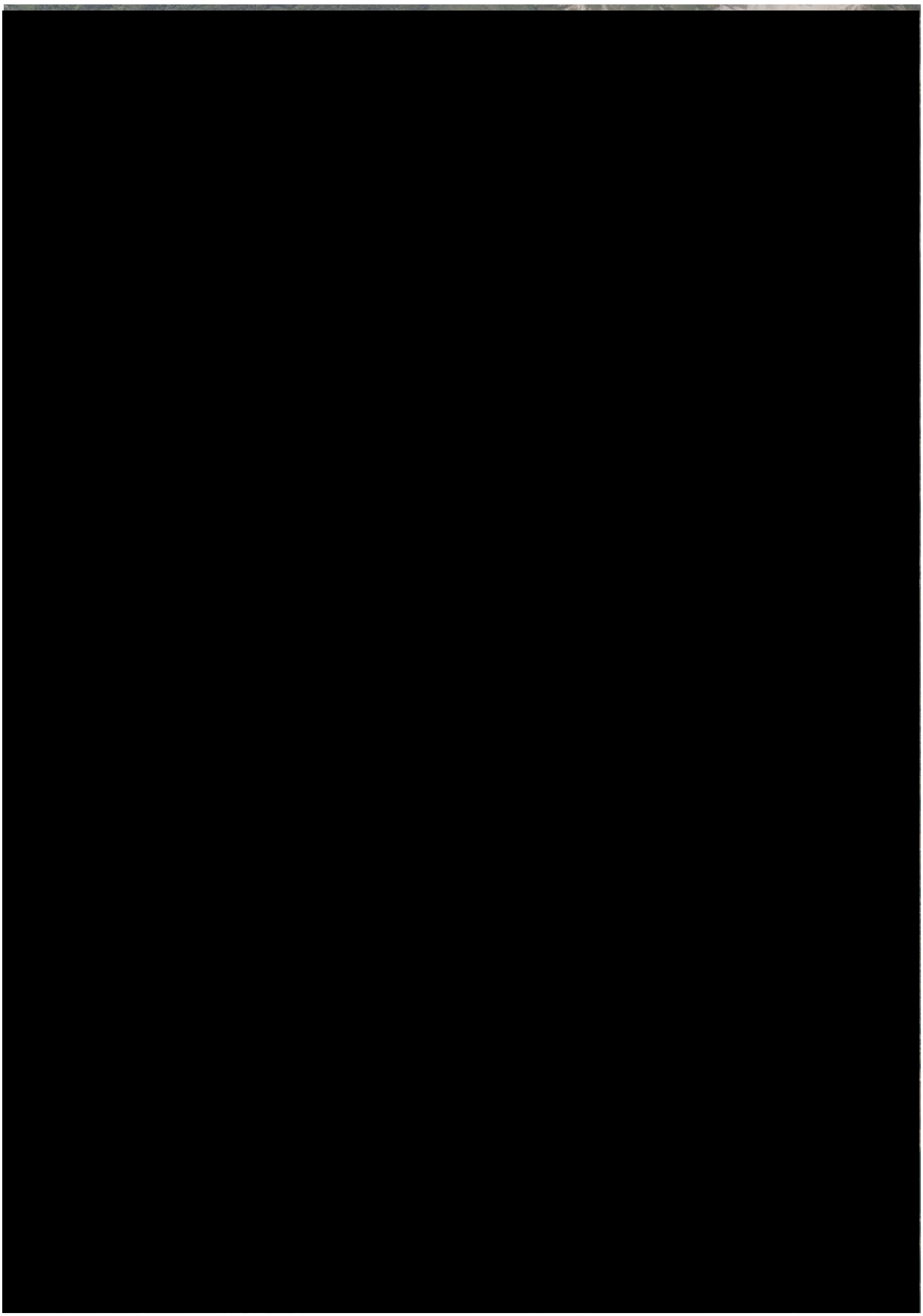


Figure 7: **Location of bryophytes and lichens of conservation concern within the MFS Project sub-area.**

3.4 Lichens

The only lichen considered to be 'Threatened' by de Lange et al. (2018) which is known to occur in the MFS Project sub-area is *Austropeltum glareosum* ('Threatened – Nationally Vulnerable'), which grows on sandstone erosion pavement and inundated quartzite sands ('bare rock') or ecotones between those habitats including mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, and low pākihi. The location of the record is shown in Figure 7.

Other lichens which occupy similar habitats on the Buller Plateaux and may be present include: *Pycnothelia caliginosa* 'Threatened – Nationally Endangered', *Knightiella splachnirima, Cladia fuliginosa* (both 'Threatened – Nationally Vulnerable'), *C. inflata* ('At Risk – Declining'), *Calycidium cuneatum, Degeliella rosulata, Leiorreuma exaltatum, Micarea isabellina, Ochrolechia frigida* and *Pseudocyphellaria lindsayi* (all considered 'At Risk – Naturally Uncommon'. Lichens of conservation concern are most frequently recorded from the habitats where *A. glareosum* also grows.

3.5 Avifauna

3.5.1 Five-minute bird counts

The number of bird species and their abundance during 5MBCs was generally low during the surveys undertaken within the MFS Project sub-area. Nine native bird species and two introduced species were recorded with a total of 2.92 indigenous bird calls per count as shown in Figure 8. This low diversity and abundance probably reflect the large amount of low growing pākihi and bare rock making up the MFS Project sub-area which is not ideal habitat for forest birds.

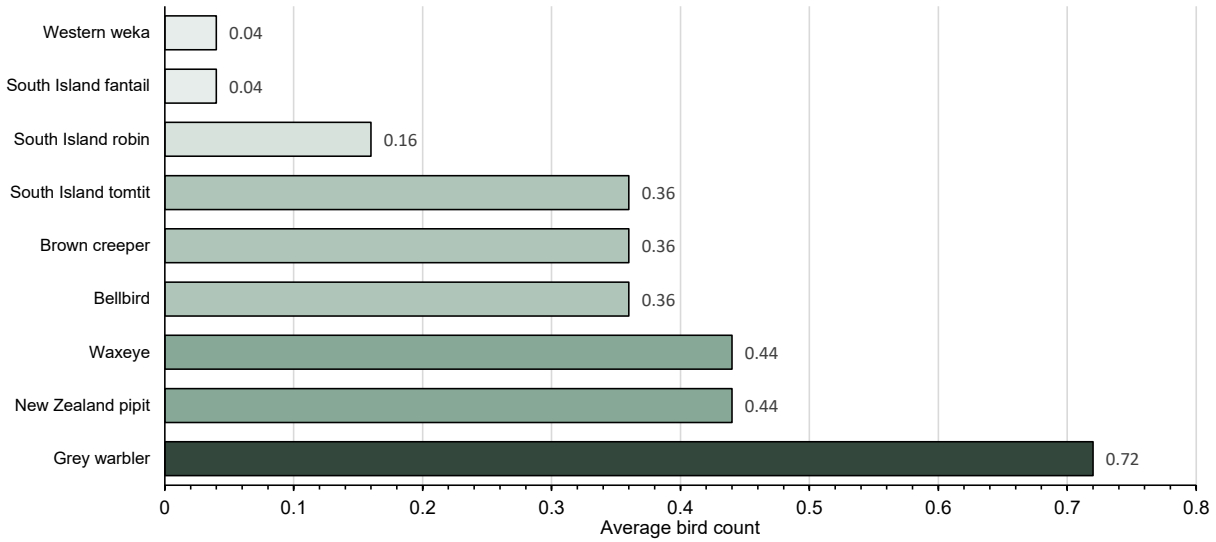


Figure 8: Average number of calls per five-minute bird count at the MFS Project sub-area.

Indigenous species recorded included grey warbler (*Gerygone igata*), South Island tomtit (*Petroica macrocephala macrocephala*), waxeye (*Zosterops lateralis*), bellbird (*Anthornis melanura*), and brown creeper (*Mohoua novaeseelandiae*). Two species regarded as 'At Risk – Declining' by Robertson et al. (2021) were recorded during these surveys including New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae)* and South Island robin (*Petroica*

australis australis). New Zealand pipit are likely to be resident in the low growing vegetation and open areas within the MFS Project sub-area.

Common redpoll (*Acanthis flammea*) was the most common introduced species, followed by chaffinch (*Fringilla coelebs*).

3.5.2 Acoustic recorders

At the MFS Project sub-area seven of the 12 acoustic recorders recorded for ten nights. The remaining five acoustic recorders recorded either 5, 7 or 9 nights. The total sampling effort from the 12 recorders was therefore 102 nights or c. 400 hours.

Sixteen bird species were recorded including 12 native species and four introduced species as set out in Table 4. Four species recorded were of conservation concern including rōroa, which are regarded as 'Threatened – Nationally Vulnerable', kea, which are regarded as 'Threatened – Nationally Endangered' and South Island fernbird and South Island robin, both of which are regarded as 'At Risk – Declining' (Robertson et al. 2021).

Table 4: Bird species recorded during acoustic recorder surveys at the MFS Project sub-area.

Common name	Scientific name	Conservation status (Robertson et al. 2021)
Bellbird	*Anthornis melanura*	Not Threatened
Blackbird	*Turdus merula*	Introduced and naturalised
Brown creeper	*Mohoua novaeseelandiae*	Not Threatened
Common redpoll	*Acanthis flammea*	Introduced and naturalised
European goldfinch	*Carduelis carduelis*	Introduced and naturalised
Great spotted kiwi, rōroa*	*Apteryx maxima*	Threatened – Nationally Vulnerable
Grey warbler	*Gerygona igata*	Not Threatened
Kea*	*Nestor notabilis*	Threatened – Nationally Endangered
Morepork	*Ninox novaeseelandiae*	Not Threatened
Silvereye	*Zosterops lateralis*	Not Threatened
South Island fernbird*	*Poodytes p. punctatus*	At Risk – Declining
South Island robin*	*Petroica australis*	At Risk – Declining
South Island tomtit	*Petroica m. macrocephala*	Not Threatened
Song thrush	*Turdus philomelos*	Introduced and naturalised
Tūi	*Prosthemadera novaeseelandiae*	Not Threatened
Western weka	*Gallirallus a. australis*	Not Threatened

Note: *Species of conservation concern.

Three of the four species of conservation concern recorded (rōroa, South Island fernbird and South Island robin) are likely to be resident in the habitats present. Kea are likely infrequent visitors, as they are to other areas on the Buller Plateaux.

South Island fernbird were recorded on seven acoustic recorders located in a range of habitat types in the MFS Project sub-area. South Island fernbird is relatively common on the Buller Plateaux and are typically seen using low, dense vegetation, often interspersed with emergent shrubs, in swamps, pākihi, rushes and tussock-covered frost flats (Heather and Robertson 2015).

South Island robin were recorded on two acoustic recorders, both located in forest habitat. South Island robin prefer dense forests with an open understorey on fertile soils and are rarely found in areas with widely scattered trees or sparse vegetation (Flack 1979). Robins are common in forested areas on the Buller Plateaux and have been recorded numerous times in

previous surveys (e.g., Buckingham 1998, 2002, Wildlife Surveys 2011).

The bird species recorded are listed in Appendix C.

3.5.3 Rōroa/great spotted kiwi

Rōroa were recorded by all 12 acoustic recorders deployed within the MFS Project sub-area. The total number of calls recorded over the sampling period was 260 (203 male, 56 female), resulting in a mean call/hour for all sampling nights of 0.65. Males were recorded on all 12 acoustic recorders, while females were recorded on 11 acoustic recorders (excluding AR32).

Call rates varied from 0.18 calls/hr at AR48 and 1.22 calls/hr at AR26 as shown in Table 5. This is consistent with the call rates reported by Toy et al. (2021) and the Roroa Practitioner Group (2021) which reported call rates ranging from 0.01 to 1 call/hour on the margins of the Westport sub-population (i.e., including the Buller Plateaux). The core areas (i.e., those with higher call rates from denser populations in more productive habitats) are further east, in the Lyell Range, and have call rates exceeding one call/hour (Roroa Practitioner Group 2021).

The highest call rates/hour were recorded near gully systems (most commonly Deep Creek) which typically had forest or shrubland vegetation. Rōroa were detected on all three recorders near Mt Frederick immediately adjoining Stockton Mine and are known to use rehabilitated areas near the mine boundary (Ecological Solutions Limited 2026d).

Table 5: Rōroa/great spotted kiwi call counts.

Station	26	28	29	30	32	36	41	42	48	49	56
Calls/station	44	44	15	22	14	35	16	33	7	21	9
Hours/station	36	40	40	28	40	36	20	40	40	40	40
Mean call rate/hour	1.22	1.10	0.38	0.79	0.35	0.97	0.80	0.83	0.18	0.53	0.23
Male calls	30	39	13	18	14	21	11	26	6	18	7
Female calls	13	5	2	4	0	14	5	7	1	3	2
Unidentified	1	-	-	-	-	-	-	-	-	-	-

3.6 Terrestrial Invertebrates

The terrestrial invertebrate fauna within the MFS Project sub-area is predominantly native, with very few non-native species. Across all taxonomic groups, only one psyllid (*Acizzia acacia*), and one fly (*Calliphora stygia*) were confirmed to be adventive species. The adventive psyllid is generally associated with acacia and was likely blown onto the MFS Project sub-area. Only one specimen of each was found, despite these being generally very common species in Aotearoa New Zealand. This, combined with the high diversity of native species discussed below, shows the area to hold an invertebrate fauna with a high degree of natural integrity.

Perhaps the most notable species collected was a juvenile specimen of *Pseudaneitea* slug. This is an example from only a handful of observations of this highly elusive, undescribed species. Other molluscs found include a juvenile specimen of *Powelliphanta patrickensis* (Threatened – Nationally Critical (Walker et al. 2024)) and juvenile *Rhytida*, likely from an undescribed species.

Twenty-three spider families were identified across the 18 invertebrate survey sites at the MFS Project sub-area. The most abundant spider families were Araneidae (28 individuals), Thomisidae (24 individuals) and Lycosidae (21 individuals). As well as these common families, there were also examples of less common New Zealand natives, such as Mecysmaucheniidae, *Gradungula sorenseni* and unidentified *Notiodrassus*, and *Huttonia*. The *Huttonia* genus, and indeed the entire Huttonidae family, contains only one formally described species *Huttonia*

palpimanoides, which has a threat status of 'At Risk – Naturally Uncommon' (Sirvid et al. 2021). However, the reclusive nature of these spiders (*Huttonia palpimanoides* lives exclusively inside fern fronds (Paquin et al. 2010)) makes the possibility that is an undescribed species difficult to discount. There were also several specimens of the distinctive, though currently undescribed native Vagrant Spiders known to inhabit the plateaux (*Ulidon* sp.). No invasive spiders, such as *Diplocephalus cristatus*, were detected.

Orthopteran species found include a grasshopper (*Sigaus crassicauda*), two ground wētā (*Anderus maculifrons* and *A. nox*) and a native cricket *(Austronemobius chelates*). The latter was newly described in 2024, and is restricted to the northwestern South Island. 136 individuals of cave wētā (Rhaphidophoridae) were detected, but could only be identified to family level. Possibly this may have included the newly (2025) described white-faced cave wētā (*Occultastella morgana*).

Among the hemipterans, waka bugs (*Paracephaleus curtus*) were common. This species is associated with wire rush. A new detection of a native on the plateaux was the mirid bug (*Tuicoris excelsus*).

There were many large species of beetle found, including *Agathinus tridens* and *Heterotyles argentatus*. Ground beetle (Carabidae) species richness was high, with 13 species recorded. Of note was the rarely encountered *Kiwitrechus karenscottae* which is also endemic to the north-western South Island. Small beetles were also diverse, with at least 3 different *Eupines* species. These included *Eupines minuta*, whose type locality is at Stockton Mine. There were also over 500 specimens of *Saphobius* beetles, which are typical of the Buller Plateaux.

Diptera were consistent with the fauna of the wider Buller Plateaux reported previously, including undescribed species from *Neotrizygia* and *Tetragoneura*. One notable find was a flightless Limoniid cranefly. The specimen was in poor condition hindering identification, but could represent a new species for the Buller Plateaux, or even an undescribed species. Five native ant species were detected, including the cryptic *Discothrea antarctica*.

Overall, sampling showed a highly diverse assemblage of native taxa, including several large species with limited dispersal ability. Many species typical to the Buller Plateaux were collected, and several elusive species were also collected. This assemblage is likely representative of the Buller Plateaux in an unmodified state.

4.0 Conclusion

The MFS Project sub-area covers c.216ha. Vegetation within the MFS Disturbance area (c. 175.4ha) includes approximately 31ha of forest vegetation, 39.2ha of shrubland, 84.4ha of low vegetation, 19.3ha of sandstone erosion pavement and other bare rock and 1.6ha of cleared vegetation. Approximately 70% of the MFS Disturbance area (123.5ha) comprises natural inland wetlands. The vegetation is generally intact, but has been affected by previous mining at some locations, which has cleared areas and introduced weeds to a minor degree.

No 'Threatened' plants are known to be present within the MFS Project sub-area, but 11 species considered to be 'At Risk' are known, or are likely to, occur there. The 'Threatened' bearded orchid *Calochilus paludosus* may also be seasonally present, but has not been recorded recently. The MFS Project sub-area also includes naturally uncommon ecosystems (sandstone erosion pavement, seepages and flushes, boulderfields of acidic rocks, pākihi wetlands and small tarns).

With respect to the non-vascular flora, the MFS Project sub-area is known to provide habitat for five bryophyte and one lichen species listed as 'Threatened' or 'At Risk' by de Lange et al. (2018, 2020) and Michel et al. (2025).

Important vegetation and habitat types where bryophytes and lichens of conservation concern

are most frequently recorded include:

- Sandstone erosion pavement and quartzite sands with ecotone associations;
- Southern rātā-mountain beech-podocarp forest;
- Silver beech-mountain beech forest;
- Mānuka-mountain beech-podocarp shrubland;
- Mānuka-tussock-wire rush shrubland; and
- Low pākihi.

Six of the ten key vegetation and habitat types valuable for bryophytes occur within the MFS Project sub-area. All five key habitat types valuable for lichens occur within the MFS Project sub-area.

Eighteen of the 39 bird species (46%) known to use Buller Plateaux habitats have been recorded from the MFS Project sub-area, either in 5MBCs or using acoustic recorders, including five species which are considered 'Threatened' or 'At Risk' (rōroa, South Island robin, mātātā/South Island fernbird, New Zealand pipit and kea). Rōroa were recorded at all 12 of the acoustic recorders at the MFS Project sub-area, with the highest call rates occurring near gully systems (most commonly Deep Creek) which typically had forest or shrubland vegetation. MFS Project sub-area contains a relatively low density of great spotted kiwi compared to the core of the Westport sub-population located north and east of the Buller Plateaux (Toy et al. 2021). Great spotted kiwi on the Buller Plateaux occupy forested gullies, and will travel across the more open areas of the Buller Plateaux to feed.

Important habitat for *Powelliphanta patrickensis* includes mānuka-mountain flax/wire rush shrubland and tussock-mountain flax shrubland, both of which are present in the MFS Project sub-area. The Buller Plateaux includes the entire known range of this snail and mark-recapture studies show that snail abundance there continues to decline, even in the absence of mining, probably due to increased predation by weka.

The invertebrate community is predominantly indigenous and is likely to include undescribed species, as well as local and regional endemics and seldom collected species.

5.0 References

Buckingham, R.P. 1998. Surveys for endemic bats in the Upper Waimangaroa Exploration Permit Area, and surrounding areas, South Island West Coast, New Zealand. Prepared for Solid Energy International.

Buckingham, R.P. 2002. Cypress Mine Survey for Kiwi and Bats (Report 20). Prepared by Wildlife Surveys for Solid Energy New Zealand Ltd. Reviewed and updated August 2003.

de Lange, P., Blanchon, D., Knight, A., Elix, J., Lucking, R., Frogley, K., Harris, A., Cooper, J., and Rolfe, J. 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27. Department of Conservation, Wellington. 64 pp.

de Lange, P.J., Glenny, D., Frogley, K., Renner, M.A.M., von Konrat, M., Engel, J.J., Reeb, C., and Rolfe, J.R. 2020. Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31. Department of Conservation, Wellington. 30 pp.

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

Ecological Solutions Limited. 2026a. Buller Coal Plateau Continuation Project: Terrestrial Ecological Impact Assessment Report. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. 98 pages + appendices.

Ecological Solutions Limited. 2026b. Buller Plateaux Vegetation Mapping Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. January 2026. 65 pages + appendices.

Ecological Solutions Limited. 2026c. Buller Plateaux Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 101 pages + appendices.

Ecological Solutions Limited. 2026d. Assessment of Rehabilitation Outcomes for Stockton Mine. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. April 2026. 82 pages + appendices.

Ecological Solutions Limited. 2026e. Buller Plateaux Continuation Project: Escarpment Extended Project Sub-Area Baseline Surveys. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 37 pages + appendices.

Ecological Solutions Limited. 2026f. Buller Plateaux Continuation Project: Upper Waimangaroa Haul Road Project Sub-Area Baseline Surveys. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 23 pages + appendices.

Flack, J.A.D. 1979. Biology and ecology of the South Island robin. In Hunt, D.M.; Gill, B.J. (eds). Ecology of Kowhai Bush, Kaikoura. Mauri Ora Special Publication 2: 22-26.

Heather, B.D., Robertson, H.A. 2015. The Field Guide to the Birds of New Zealand. Penguin Random House, Auckland. 464 p.

Hurst, J.M., Allen, R.B. & Fergus, A.J. 2022. The Recce method for describing New Zealand vegetation – expanded manual. Version 5.

Lloyd, B.D. 2012. Analyses of *Powelliphanta* Snail Survey Data for the Escarpment Mine Project. Prepared for Buller Coal Ltd.

Lloyd, B. D. 2024. An Assessment of the Likely Impacts of the Stockton Extension Project on *Powelliphanta patrickensis* snails. Unpublished draft report prepared for Bathurst Resources Limited by Lloyd's Ecological Consulting.

Ministry for the Environment (MfE).2020a. Wetland delineation protocols. Wellington: Ministry for the Environment.

Ministry for the Environment (MfE). 2020b. National Policy Statement for Freshwater Management (NPS-FM) 2020. Amended December 2025.

Michel, P., deRegnier, R., Emmitt, T., Ford, M., Perrie, L., Pritchard, A.S.E. 2026. Conservation status of mosses in Aotearoa New Zealand, 2025. Report 1155. Department of Conservation, Wellington. New Zealand Threat Classification System Series 49.

Mitchell Daysh Limited. 2026. Buller Plateaux Continuation Project Assessment of Environmental Effects.

Nichol, R. 2020. Baseline Bird Survey within Marshalls North, Marshalls South and Deep

Stream, Stockton Plateau. Unpublished report prepared by Richard Nichol Ecology.

Paquin, P., Vink, C.J., Dupérré, N. 2010. Spiders of New Zealand: Annotated Family Key & Species List. Manaaki Whenua Press.

Robertson, H.A., Baird, K.A., Elliott, G.P., Hitchmough, R.A., McArthur, N.J., Makan, T.D., Miskelly, C.M., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A., and Michel, P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 pp.

Roroa Practitioner Group. 2021. Roroa / great spotted kiwi (*Apteryx maxima*) species plan 2019–2029. Collated by Robin Toy and Sandy Toy, Department of Conservation.

Stewart, P. 2024. Deep Creek Autonomous Acoustic Recorder Survey – Summer 2024. Prepared for Ecological Solutions Limited and Bathurst Resources Limited by Sound Counts Limited.

Sirvid, P.J., Vink, C.J., Fitzgerald, B.M., Wakelin, M.D., Rolfe, J., Michel, P., 2021. Conservation status of New Zealand Araneae (spiders), 2020.

Toy, R.J, Toy, S., Mackenzie, D., Simister, K. and Yong, S. 2021. Distribution of great spotted kiwi (*Apteryx maxima*), 2012–2021. Notornis, 2021, 69(1):1–18.

Walker, K., Walton, K., Edwards, E., Hitchmough, R., Payton, I., Barker, G., Michel, P. 2024. Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and snails) Part 3. Rhytididae (carnivorous snails): 2022. Retrieved from DOC, Wellington, NZ.

Wildlife Surveys Limited. 2011. Survey for the Terrestrial Fauna at the proposed Mt William North Mining Area. Prepared for Solid Energy NZ Ltd.

APPENDIX A

Vegetation plots at MFS Project sub-area

Plot reference	Survey	Plot vegetation description
DC01	Ecological Solutions, 2024	Mānuka tussock-shrubland
DC02	Ecological Solutions, 2024	Mānuka-tussock/wire rush shrubland
DC03	Ecological Solutions, 2024	Silver beech-mountain beech forest
DC04	Ecological Solutions, 2024	Southern rātā-mountain beech forest
DC05	Ecological Solutions, 2024	Mānuka-mountain beech-yellow-silver pine forest
DC06	Ecological Solutions, 2024	[Mānuka-*Chionochloa juncea*]/wire rush shrubland
DC07	Ecological Solutions, 2024	[Southern rātā]-mānuka-mountain beech forest
DC08	Ecological Solutions, 2024	Southern rātā-mountain beech forest
DC09	Ecological Solutions, 2024	Southern rātā-podocarp-broadleaved forest
DC10	Ecological Solutions, 2024	[Silver beech]/leatherwood tussock-shrubland
DC11	Ecological Solutions, 2024	Silver beech-mountain beech forest
DC12	Ecological Solutions, 2024	Leatherwood/mountain flax-Gahnia-*Chionochloa juncea* shrubland
DC13	Ecological Solutions, 2024	Mountain beech-pāhautea forest

APPENDIX B

Bryophytes recorded in the MFS Project sub-area and surrounds

Species of conservation concern are marked in bold (de Lange et al. 2020, Michel et al. 2026).
Species of conservation interest are marked by an asterisk (*).

Location: Mount Frederick South Project sub-area
Plot ID: **DK-01**
Cultural: Natural
Grid reference ([redacted]
Date measured: 5/12/23
Altitude: 857 m asl
Area: 5 x 5 m
Plot description: Low pākihi with exotic component

Acrocladium sp.
Solenostoma sp.
Adelanthus occlusus
Ceratodon purpureus
Cheilolejeunea campbelliensis
Cryptochila sp.
Ditrichum sp.
Kurzia helophila
Lepidozia sp.
Neolepidozia patentissima
?Polytrichum sp.
Radula sp.
Rhacocarpus purpurascens
Riccardia crassa
Riccardia sp.
Tricholepidozia lindenbergii

Location: Mount Frederick South Project sub-area
Plot ID: DK-02
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 5/12/23
Altitude: 869 m asl
Area: 5 x 5 m
Plot description: Moderate height Mānuka-tussock-wire rush shrubland

[Liverworts incomplete]
Acromastigum mooreanum – ***'At Risk – Naturally Uncommon'***
Campylopus clavatus
Campylopus introflexus
Cyathophorum bulbosum
Leucobryum javense
*Pulchrinodus inflatus**
Ptychomnion aciculare
Ptychomnion sp.

Location: Mount Frederick South Project sub-area
Plot ID: **DK-03**
Cultural: Natural
Grid reference ([redacted]
Date measured: 5/12/23
Altitude: 849 m asl
Area: 5 x 5 m
Plot description: Silver-mountain beech forest

[Liverworts incomplete]
Acromastigum mooreanum – ***'At Risk – Naturally Uncommon'***
Dicranoloma sp.
Hedwigia sp.

Pyrrhobryum bifarium
Rhacocarpus sp.
Riccardia furtiva – ***'At Risk – Naturally Uncommon'***
Weymouthia cochlearifolia
Wijkia extenuata

Location: Mount Frederick South Project sub-area
Plot ID: DK-04
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 5/12/23
Altitude: 806 m asl
Area: 5 x 5 m
Plot description: Southern rātā-mountain beech-podocarp forest

[Liverworts incomplete]
Campylopus clavatus
Campylopus sp.
Dicranoloma billardierei
Dicranoloma sp.
Ditrichum sp.
Grimmia pulvinata
Hedwigia sp.
Mniodendron comosum var. *comosum*
Ptychomnion aciculare

Location: Mount Frederick South Project sub-area
Plot ID: DK-05
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 6/12/23
Altitude: 816 m asl
Area: 5 x 5 m
Plot description: Mānuka-mountain beech-podocarp shrubland

Acrochila biserialis
Acromastigum anisostomum
Acromastigum cavifolium
Acromastigum mooreanum – ***'At Risk – Naturally Uncommon'***
Adelanthus falcatus
Bazzania novae-zelandiae
Camptochaete sp.
Cuspidatula monodon
Dicranoloma sp.
Frullania rostrata
Goebeliella cornigera
Gottschea tuloides
Hedwigia sp.
Herbertus oldfieldianus
Heteroscyphus billardierei ?
Heteroscyphus menziesii
Heteroscyphus mononuculus var. *mononuculus*
Kurzia compacta
Kurzia hippuroides
Kurzia quinquespina
Lejeunea sp.
Lepicolea scolopendra
Lepidozia ulothrix
Leptoscyphus excipulatus
Megalembidium insulanum
Neolepidozia praenitens

Plagiochila sp.
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
*Pulchrinodus inflatus**
Rhacocarpus sp.
Radula uvifera
Riccardia crassa
Riccardia cochleata
Riccardia furtiva – ***'At Risk – Naturally Uncommon'***
Riccardia sp.
Schistochila ciliata
Schistochila pseudociliata
Telaranea herzogii
Tetracymbaliella decipiens
Tricholepidozia lindenbergii
Wijkia extenuata

Location: Mount Frederick South Project sub-area
Plot ID: DK-06
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 6/12/23
Altitude: 815 m asl
Area: 5 x 5 m
Plot description: Low pākihi

Acromastigum anisostomum
Acromastigum sp.
Brachythecium sp.
Campylopus introflexus
Clasmatocolea notophylla ?
Goebeliella cornigera
Jamesoniella colorata
Kurzia hippuroides
Neolepidozia patentissima
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
*Pulchrinodus inflatus**
Radula sp.
Riccardia crassa
Riccardia sp.
Schistochila pseudociliata
Telaranea herzogii
Zoopsis setulosa
Wijkia extenuata

Location: Mount Frederick South Project sub-area
Plot ID: DK-07
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 6/12/23
Altitude: 826 m asl
Area: 5 x 5 m
Plot description: Mānuka-mountain beech-podocarp shrubland

Acrochila biserialis
Acromastigum anisostomum
Bazzania adnexa
Bazzania involuta
Bazzania novae-zelandiae
Cuspidatula monodon
Dicranoloma billardierei
Frullania rostrata
Goebeliella cornigera

Gottschea tuloides
Herbertus oldfieldianus
Heteroscyphus sp.
Hypnum cupressiforme
Kurzia compacta
Kurzia hippuroides
Lepicolea attenuata
Lepicolea scolopendra
Lepidozia ulothrix
Macromitrium longipes
Neolepidozia patentissima
Paracromastigum sp.
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Pseudomarsupidium piliferum
Ptychomnion aciculare
Radula uvifera
Rhaphidorrhynchium amoenum
Riccardia cochleata
Riccardia crassa
Riccardia sp.
Symphyogyna / Pallavicinia
Telaranea herzogii
Tetracymbaliella cymbalifera
Tetracymbaliella decipiens
Tricholepidozia remotifolia
Zoopsis setulosa

Location: Mount Frederick South Project sub-area
Plot ID: DK-08
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 6/12/23
Altitude: 821 m asl
Area: 5 x 5 m
Plot description: Southern rātā-mountain beech-podocarp forest

[Liverworts incomplete]
Acromastigum cavifolium
Campylopus sp.
Dicranoloma sp.
Hedwigia sp.
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
*Pulchrinodus inflatus**
Ptychomnion aciculare
Rhacocarpus sp.
Trachyloma planifolium
Wijkia extenuata

Location: Mount Frederick South Project sub-area
Plot ID: DK-09
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 7/12/23
Altitude: 736 m asl
Area: 5 x 5 m
Plot description: Southern rātā-mountain beech-podocarp forest

[Liverworts incomplete]
Acrocladium chlamydophyllum
Calyptrochaeta sp.
Campylopus clavatus
Catharomnion ciliatum

Ditrichum sp.
Lembophyllum sp.
Mniodendron comosum var. *comosum*
Pohlia sp.
Ptychomnion aciculare
*Pulchrinodus inflatus**
Riccardia filicina
Wijkia extenuata

Location: Outside Mount Frederick South Project sub-area
Plot ID: DK-10
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 8/12/23
Altitude: 1007 m asl
Area: 5 x 5 m
Plot description: Leatherwood shrubland

[Liverworts incomplete]
Brachythecium sp.
Cryptolophocolea tuberculata – ***'At Risk – Naturally Uncommon'***
Dicranoloma sp.
Ditrichum sp.
Herzogianthus vaginatus – ***'At Risk – Naturally Uncommon'***
Rhacocarpus purpurascens
Wijkia extenuata

Location: Outside Mount Frederick South Project sub-area
Plot ID: DK-11
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 8/12/23
Altitude: 1016 m asl
Area: 5 x 5 m
Plot description: Silver-mountain beech forest

Acromastigum anisostomum
Adelanthus occlusus
Bazzania novae-zelandiae
Cryptolophocolea spinifera
Dicranoloma sp.
Cuspidatula kirkii
Cuspidatula monodon
Goebeliella cornigera
Gottschea pinnatifolia
Gottschea tuloides
Heteroscyphus fissistipus
Heteroscyphus cuneistipulus
Lepidolaena novae-zelandiae – ***'At Risk – Naturally Uncommon'***
Lepidozia sp.
Lepidozia ?kirkii
Lepidozia setigera
Lepicolea attenuata
Leptoscyphus excipulatus
Lobatiriccardia alterniloba
Leucobryum sp.
Metzgeria leptoneura
Plagiochila annotina / strombifolia
Plagiochila circumdentata

Plagiochila circinalis
Plagiochila fuscella
Plagiochilion conjugatum
Ptychomnion aciculare
Radula sp.
Riccardia sp.
Schistochila chlorophylla
Schistochila nobilis
Trichocolea mollissima
Tricholepidozia lindenbergii
Weymouthia cochlearifolia
Wijkia extenuata

Location: Outside Mount Frederick South Project sub-area
Plot ID: DK-12
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 8/12/23
Altitude: 921 m asl
Area: 5 x 5 m
Plot description: Mānuka-flax/wire rush shrubland

Acrobolbus saccatus
Acromastigum anisostomum
Adelanthus occlusus
Brachythecium sp.
Campylopus clavatus
Clasmatocolea notophylla
Dicranoloma billardierei
Kurzia compacta
Kurzia helophila
Lepicolea scolopendra
Lepidozia kirkii
Lepidolaena novae-zelandiae – ***'At Risk – Naturally Uncommon'***
Neolepidozia praenitens
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Ptychomnion aciculare
Riccardia crassa
Riccardia aequicellularis
Riccardia bipinnatifida
Sphagnum falcatulum
Tetracymbaliella decipiens

Location: Mount Frederick South Project sub-area
Plot ID: DK-13
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 14/12/23
Altitude: 512 m asl
Area: 5 x 5 m
Plot description: Southern rātā-mountain beech-podocarp forest

[Liverworts incomplete]
Camptochaete arbuscula
Campylopus sp.
Catharomnion ciliatum
Dicranoloma sp.
Glyphothecium sciuroides

Hypnodendron arcuatum
Ptychomnion aciculare
Rhacocarpus purpurascens
Sphagnum sp.
Wijkia extenuata

APPENDIX C

Bird species recorded at MFS Project sub-area

Common name	Scientific name	Survey type	Conservation status (Robertson et al. 2021)
Bellbird	*Anthornis melanura*	AR, 5MBC	Not Threatened
Blackbird	*Turdus merula*	AR	–
Brown creeper	*Mohoua novaeseelandiae*	AR, 5MBC	Not Threatened
Chaffinch	*Fringilla coelebs*	5MBC	–
Common redpoll	*Acanthis flammea*	AR, 5MBC	–
European goldfinch	*Carduelis carduelis*	AR	–
Fantail	*Rhipidura fuliginosa*	5MBC	Not Threatened
Great spotted kiwi, rōroa*	*Apteryx maxima*	AR	Threatened – Nationally Vulnerable
Grey warbler	*Gerygona igata*	AR, 5MBC	Not Threatened
Kea*	*Nestor notabilis*	AR	Threatened – Nationally Endangered
Morepork	*Ninox novaeseelandiae*	AR	Not Threatened
New Zealand Pipit	*Anthus novaeseelandiae*	5MBC	At Risk – Naturally Uncommon
Silvereye	*Zosterops lateralis*	AR, 5MBC	Not Threatened
South Island fernbird*	*Poodytes p. punctatus*	AR	At Risk – Declining
South Island robin*	*Petroica australis*	AR, 5MBC	At Risk – Declining
South Island tomtit	*Petroica m. macrocephala*	AR	Not Threatened
Song thrush	*Turdus philomelos*	AR	–
Tūi	*Prosthemadera novaeseelandiae*	AR	Not Threatened
Western weka	*Gallirallus a. australis*	AR	Not Threatened

APPENDIX E

Buller Plateaux Continuation Project Baseline Ecological surveys for the Stockton Project sub-area (Ecological Solutions Limited 2026e)

ecoLogical Solutions
Environmental Consultants







August 2026

Buller Plateaux Continuation Project
Stockton Project Sub-Area Baseline Surveys

Prepared for Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by:	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
Reviewed by:	[redacted] Terrestrial Ecology Team Leader	[redacted]

Status: Final **Issued:** 7 August 2026

ecoLogical solutions

tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 4/195 main highway,
ellerslie, Auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

nelson office
p: 021 172 2091

www.ecoLogicalsolutions.co.nz

Executive Summary

This report describes the specific ecological surveys, including methods and survey results, used to inform an assessment of ecological values of the Stockton (Stockton) Project sub-area which forms part of the larger Buller Plateaux Continuation Project ("the Project" or "the BPCP"). This report does not include the values assessment or consider the effects of the Project, which are both provided in the Buller Plateaux Continuation Project Ecological Impact Assessment (Ecological Solutions Limited 2026a).

The Stockton Project sub-area is the largest of the BPCP Project sub-areas, but only includes 31.4ha of 'new' disturbance. The vegetation within the Stockton Disturbance area comprises mostly shrubland (c. 15.5ha, 49.4%) and forest (c. 10.3ha, 32.8%) with low vegetation covering 2.4ha (7.6%). Bare rock, mostly comprising sandstone erosion pavement covers c. 2.1ha, (6.6%) with cleared vegetation making up the remaining c. 1.1ha (3.5%).

No vascular plants currently regarded as 'Threatened' are known to occur within the Stockton Project sub-area, but up to 14 'At Risk' plants may occur there. Based on the vegetation types and habitats present up to 19 'Threatened' and 'At Risk' bryophytes and up to five 'Threatened' and 'At Risk' lichens could be present.

With respect to avifauna, a similar suite of species to other parts of the Buller Plateaux is expected to be present, which includes 'Threatened' and 'At Risk' species. The shrubland habitats are ideal for South Island fernbird, which have been recorded as sparsely distributed pairs. New Zealand pipit is also known to be present.

There are records of snails and/or shells immediately north of the Project sub-area and the area is within the known range of *Powelliphanta patrickensis*.

Pest mammal abundance within the Stockton Project sub-area varies both seasonally and annually, as well as in response to mast years. Surveys show that mammalian pests are often present at densities which exceed levels required for biodiversity protection.

Table of Contents

Executive Summary ..... **ii**
1.0 Introduction **1**
1.1 Background 1
1.2 Stockton Mine 3
1.3 Scope and Purpose 3
2.0 Methods **4**
2.1 Vegetation 4
2.1.1 Mapping Vegetation Types 4
2.1.2 Identifying Wetland Vegetation Types 4
2.2 Bryophytes and Lichens 6
2.3 Avifauna 6
2.4 Lizards 6
2.5 Terrestrial Invertebrates 6
2.6 Land Snails 6
2.7 Mammalian Pests 6
3.0 Results **8**
3.1 Vegetation 8
3.1.1 Summary 8
3.1.2 Forest Vegetation 10
3.1.3 Shrubland Vegetation 10
3.1.4 Low vegetation 11
3.1.5 Other landcover types 11
3.1.6 'Threatened' and 'At Risk' plant species 11
3.1.7 Wetlands 12
3.2 Bryophytes 14
3.3 Lichens 17
3.4 Avifauna 17
3.5 Mammalian Pests 17
4.0 Conclusion **17**
5.0 References **18**

Index to Tables

Table 1: Extent of vegetation and land cover types within the Stockton 'new' Disturbance Area. 8
Table 2: 'Threatened' and 'At Risk' bryophytes recorded within the Stockton Project sub-area. 15

Index to Figures

Figure 1: Buller Plateaux Continuation Project sub-areas. 2
Figure 2: Extent and location of the Mapped Area at the Buller Plateaux. 5
Figure 3: Pest monitoring device locations on the Stockton Plateau (From Alliance Ecology 2025). 7
Figure 4: Vegetation and land cover within the Stockton 'new' Disturbance Area and Indirect Effects Contingency. 9
Figure 5: Wetlands within the Stockton 'new Disturbance area. 13
Figure 6: Location of bryophytes and lichens of conservation concern within the Stockton Project sub-area. 16

Appendices

Appendix A – Vegetation plots used to inform the Stockton Project sub-area.

1.0 Introduction

1.1 Background

Bathurst Resources Limited (including its subsidiary companies Bathurst Coal Ltd, and Buller Coal Ltd, and joint venture company BT Mining Ltd) (collectively referred to here as 'Bathurst') are seeking approvals through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('BPCP', or 'the Project'). The purpose of the FTAA is to facilitate the delivery of infrastructure and development projects with significant regional or national benefits.

The purpose of the Project is to reconsent the existing infrastructure and mining operations associated with the Stockton Mine and provide access to additional coal mining areas across the Buller Plateaux. The coal resource in the current Stockton operations is close to depletion, and additional coal resource for blending is required.

The Project area includes parts of both the Denniston and Stockton Plateaux, collectively referred to here as 'the Buller Plateaux' located northeast of Westport. The Project is a complex proposal which seeks to enable a mix of ongoing and new mining activities. The land tenure is a mix of Crown, private and Bathurst owned land. The authorisations required for the proposed activities are being bundled into a single application to proceed through the FTAA process.

As shown in Figure 1, the Project has been divided into five project sub-areas for the purpose of the FTAA application:

- Stockton (including the Ngakawau Coal Handling Facility and Aerial Ropeway, 'Stockton').
- Cypress Mining Area ('Cypress').
- Mount Frederick South ('MFS').
- Escarpment Extended (including the Waimangaroa storage area, 'ESE').
- Transport Corridor known as the Upper Waimangaroa Haul Road ('UWHR').

The Project will enable 20 million tonnes of coking coal to be mined, utilising existing infrastructure facilities over a 25-year timeframe to support and extend the mine life of the current Stockton Mine operations. All elements of the Project are essential for the Project to be economically viable and to meet the future coal blend requirements.

This "Project sub-area report" focuses on the methods, survey results and ecological values of the Stockton Project sub area. The effects assessments for each Project sub-area are provided in the Buller Plateaux Continuation Project Ecological Impact Assessment (Ecological Solutions Limited 2026a) and combined in the overall Assessment of Environmental Effects for the Project (Mitchell Daysh Limited 2026).

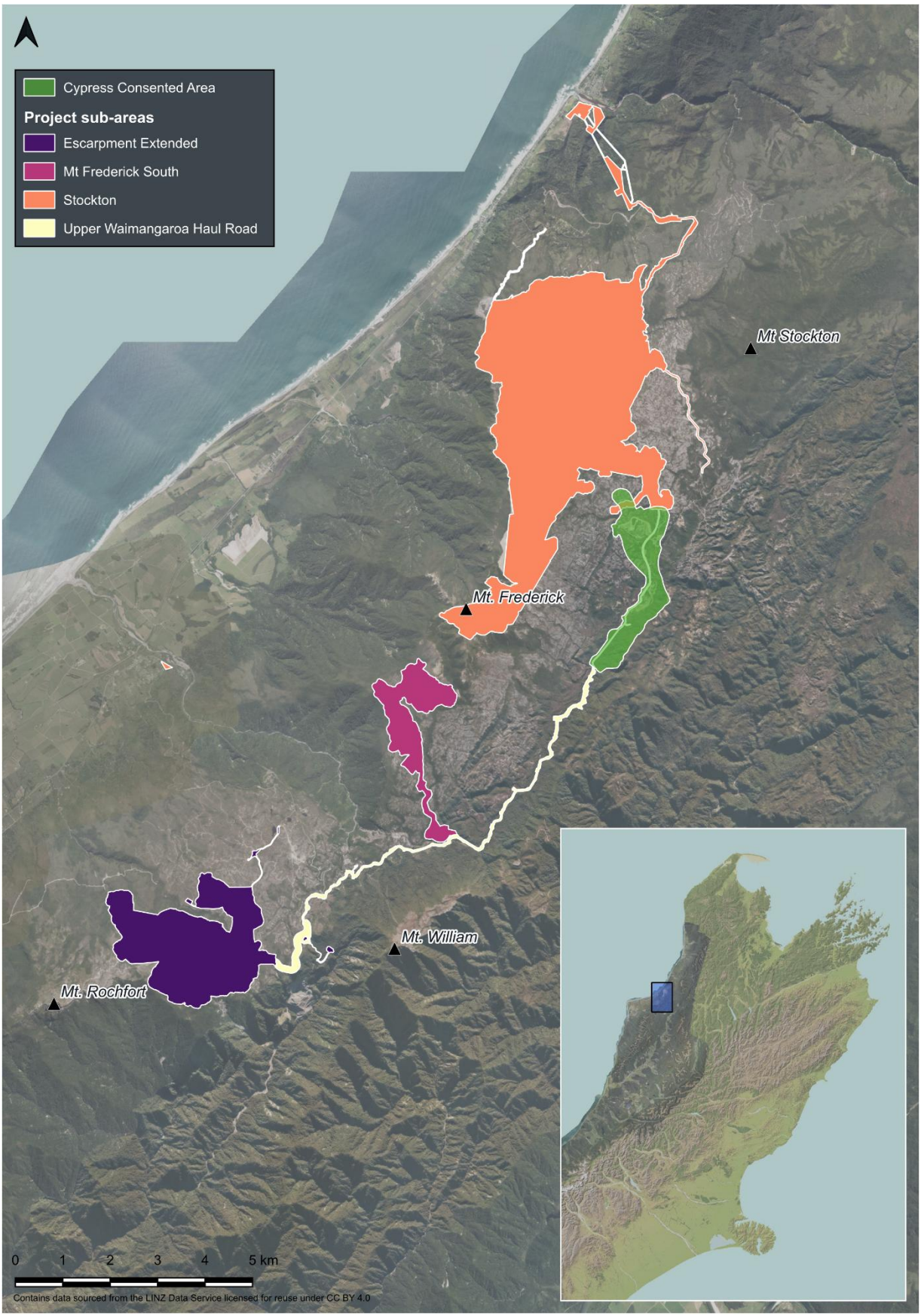


Figure 1: Buller Plateaux Continuation Project sub-areas.

Disturbance areas with respect to the Stockton Project sub-area reflect where 'new' (post 2027) disturbance will occur. The extent of the Stockton Project sub-area is c. 1,825ha[1] including provision for edge effects, while the Stockton 'new' Disturbance area is c.31.3ha[2].

1.2 Stockton Mine

The Stockton Project sub-area includes the existing Stockton Mine and associated infrastructure including access roads, administration area, workshop and maintenance areas, the Coal Handling and Processing Plant (CHPP), A Drive Quarry, Coal Fines Storage Facilities, Water Treatment Plants, various sumps, fuel storage, [redacted] as well as the aerial ropeway and the Ngakawau Rail Loadout area as described in Mitchell Daysh Limited 2026. The Stockton Mine administration area includes buildings housing offices, bath house and stores, alongside car parking for employees, delivery trucks and visitors. There are several storage sheds, laydown areas and a helicopter landing pad and Emergency Response Team facility. Workshop and maintenance areas include large workshops and service bays, tyre changing and stores facilities catering to the larger-sized mobile equipment typical of a mine site. There are bunded storage areas containing hazardous materials including oils, chemicals and bulk fuel storage, with self-bunded tanks and advanced fuel management systems. The area also includes sediment sumps and oily water separators at the vehicle wash bay facilities and workshops.

[redacted]

In the Stockton Project sub-area, Bathurst proposes to mine small additional areas, primarily in the north of the Stockton Mine, continue using the existing infrastructure and facilities, carry out further quarrying activities in the A Drive Quarry, and develop three additional Coal Fines Storage Facilities (CFSF).

1.3 Scope and Purpose

In preparing for the Project, Bathurst has undertaken a range of surveys, both across the Buller Plateaux generally and at specific locations since 2019. Bathurst has also undertaken regular monitoring of a range of species at various locations in order to inform their effects management and compliance reporting. This has produced a large amount of ecological information in a variety of unpublished documents. This report summarises the information relevant to the Stockton Project sub-area and provides technical detail sufficient to support the Ecological Impact Assessment (Ecological Solutions Limited 2026a) and overall Assessment of Ecological Effects for the Project (Mitchell Daysh Limited 2026) as a standalone document. The purpose is to minimise the information provided in those larger documents, whilst still providing sufficient detail to inform decision makers.

This document includes five sections as follows:

- This introduction (Section 1.0).
- Section 2.0 sets out the methods used to survey vascular and non-vascular vegetation, wetlands, avifauna, lizards, land snails, other terrestrial invertebrates and mammalian pests. Section 2.0 also identifies any relevant key documents to be read in conjunction with this report.

[1] Based on GIS layers released 4 December 2025.
[2] Based on GIS layers released 25 October 2025.

- Section 3.0 sets out the results of the surveys described in Section 2.
- Section 4.0 provides a conclusion with respect to the ecological values present.
- Section 5.0 provides the references used in compiling this report.

2.0 Methods

2.1 Vegetation

2.1.1 Mapping Vegetation Types

Terrestrial and wetland vegetation within c. 10,129ha of the Buller Plateaux and surrounds (referred to as "the Mapped Area") was mapped and described using 152 10 x 10 metre (m) vegetation plots collected between 2008 and 2025 across both the Stockton and Denniston Plateaux, combined with ordination and multivariate analysis as well as classification of 45,690 aerial photographs of the Mapped Area collected between July 2019 and January 2024 (Ecological Solutions Limited 2026b).

The Mapped Area included the Stockton Project sub-area and surrounds as shown in Figure 2. The methods used to compile the vegetation map are briefly summarised here. For more detail see Ecological Solutions Limited (2026b).

Vegetation plot data collected using the RECCE method (Hurst et al. 2022) was ordinated using non-metric multi-dimensional scaling (NMDS) combined with generalised linear modelling (GLM) and principal components analysis (PCA) to discriminate vegetation types and identify underlying ecological drivers. The PCA indicated that altitude, slope, aspect and percentage of rock cover were strong ecological drivers of the vegetation type present.

Concurrently, drone imagery was used to create georeferenced orthomaps which were separated into distinct vegetation types using machine learning via two types of algorithms (RF and SVM) informed by training samples which were assigned to one of the vegetation types identified from the ordination by those personnel involved in the field surveys. Three additional land cover types were identified during that verification process including bare rock (mostly sandstone erosion pavement), water (often historic and current mine infrastructure) and cleared vegetation associated with roads, historic mining and other disturbance. Manual checking and editing of polygons was carried out to ensure accuracy between the mapped vegetation or land cover and high-resolution imagery.

None of the plots used to inform the vegetation mapping were within the Stockton Project sub-area, but five were located north of Stockton Mine in low pākihi vegetation. The location of these plots are listed in Appendix A. In addition, Nichol (2021) and Ecological Solutions Limited (2023) carried out walkthrough surveys of the northern part of the Stockton Project sub-area associated with an earlier proposal for a water treatment solution that was not progressed.

2.1.2 Identifying Wetland Vegetation Types

The specific method for identifying wetlands is detailed in Ecological Solutions Limited (2026b). To summarise, the vegetation tests set out in the wetland delineation protocols (Ministry for the Environment 2020a) were applied to each of the 152 vegetation plots to determine whether that plot met the definition of 'natural inland wetland' set out in the National Policy Statement for Freshwater Management (2020 and subsequent amendments, "the NPS-FM") or not.

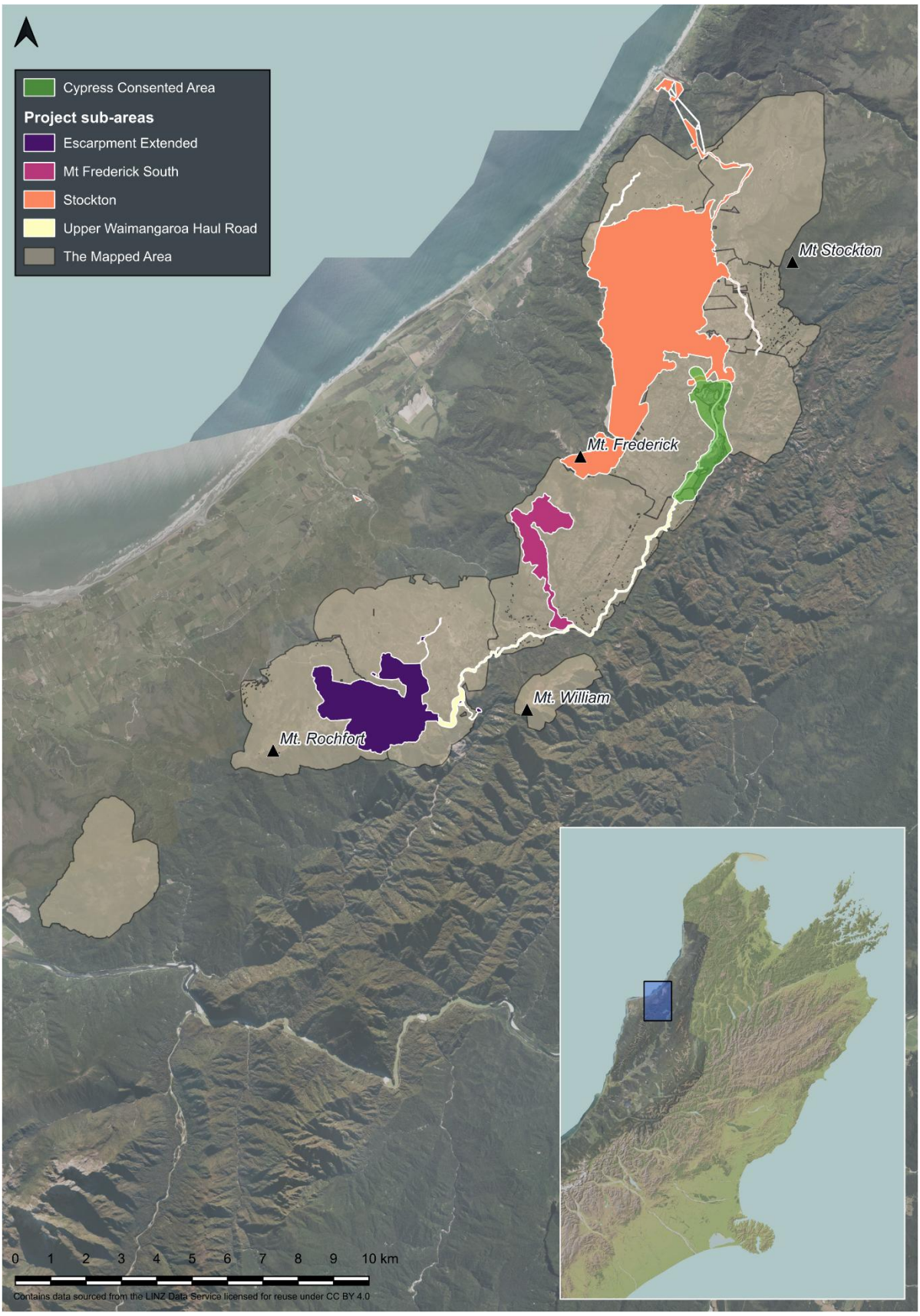


Figure 2: Extent and location of the Mapped Area at the Buller Plateaux.

For vegetation types where all the plots met the relevant tests, those vegetation types were confirmed as natural inland wetlands. For vegetation types where only some of the plots met the relevant tests, professional judgement was used to determine whether the vegetation was a wetland type or not. Where none of the plots met the relevant tests, those vegetation types were not identified as wetlands.

2.2 Bryophytes and Lichens

Previous bryophyte and lichen survey data from the Buller Plateaux and Ngakawau Ecological District is summarised in Ecological Solutions Limited (2026c). No specific search for bryophytes or lichens has been undertaken within the Stockton Project sub-area. Instead, the vegetation classes (i.e., habitat types) where bryophytes and lichens of conservation concern (de Lange et al. 2018, 2020, Michel et al. 2026) have been recorded were used to inform an assessment of the likely values of the Stockton Project sub-area for bryophytes and lichens.

2.3 Avifauna

Previous surveys and/or monitoring reports from the Buller Plateaux and Ngakawau Ecological District relating to birds are summarised in Ecological Solutions Limited (2026c).

Nichol (2021) undertook bird surveys within an area to the north of the Stockton Project sub-area disturbance area on the 15th and 17th December, 2020. Birds observed during site visits were recorded as point observations and note was made of the general abundance of species.

2.4 Lizards

Previous surveys and/or monitoring reports from the Buller Plateaux and Ngakawau Ecological District relating to lizards are summarised in Ecological Solutions Limited (2026c).

2.5 Terrestrial Invertebrates

Previous surveys and/or monitoring reports from the Buller Plateaux and Ngakawau Ecological District relating to terrestrial invertebrates are summarised in Ecological Solutions Limited (2026c).

2.6 Land Snails

Previous surveys and/or monitoring reports from the Buller Plateaux and Ngakawau Ecological District relating to *Powelliphanta* snails are summarised in Ecological Solutions Limited (2026c). Live *Powelliphanta patrickensis* snails have been detected both north and south of the Stockton Project sub-area, and since it is within their known range, the area is conservatively expected to provide habitat for this land snail.

2.7 Mammalian Pests

Across the Buller Plateaux, rodents and stoats have been monitored quarterly in most years using tracking tunnels. Tracking tunnels are an effective, relatively sensitive tool for establishing indices of rodent densities, with the advantage that the method is nationally standardised (Gillies and Williams 2013). In contrast, tracking tunnels have a low sensitivity for detection of stoats, so should be regarded as an indication of presence only (Smith and Weston 2017). Tracking tunnels were placed on transects in both sandstone pavement and in forest, with results summarised in Parkes (2020) and Williams (2024). Possums were monitored using wax-tags before and after aerial baiting with 1080 (sodium

monofluoroacetate) in 2015, 2017, 2019, 2020 and 2023 (Williams 2024). Recent pest monitoring used three lines of tracking tunnels (targeting rodents), and five lines each of chew cards (targeting rodents and possums) and motion-detecting trail cameras (targeting mustelids, feral cats and ungulate species, Alliance Ecology 2025) set according to the national protocols or, in the case of cameras, broadly accepted methods. The location layout of these monitoring devices on the Stockton Plateau is shown in Figure 3.

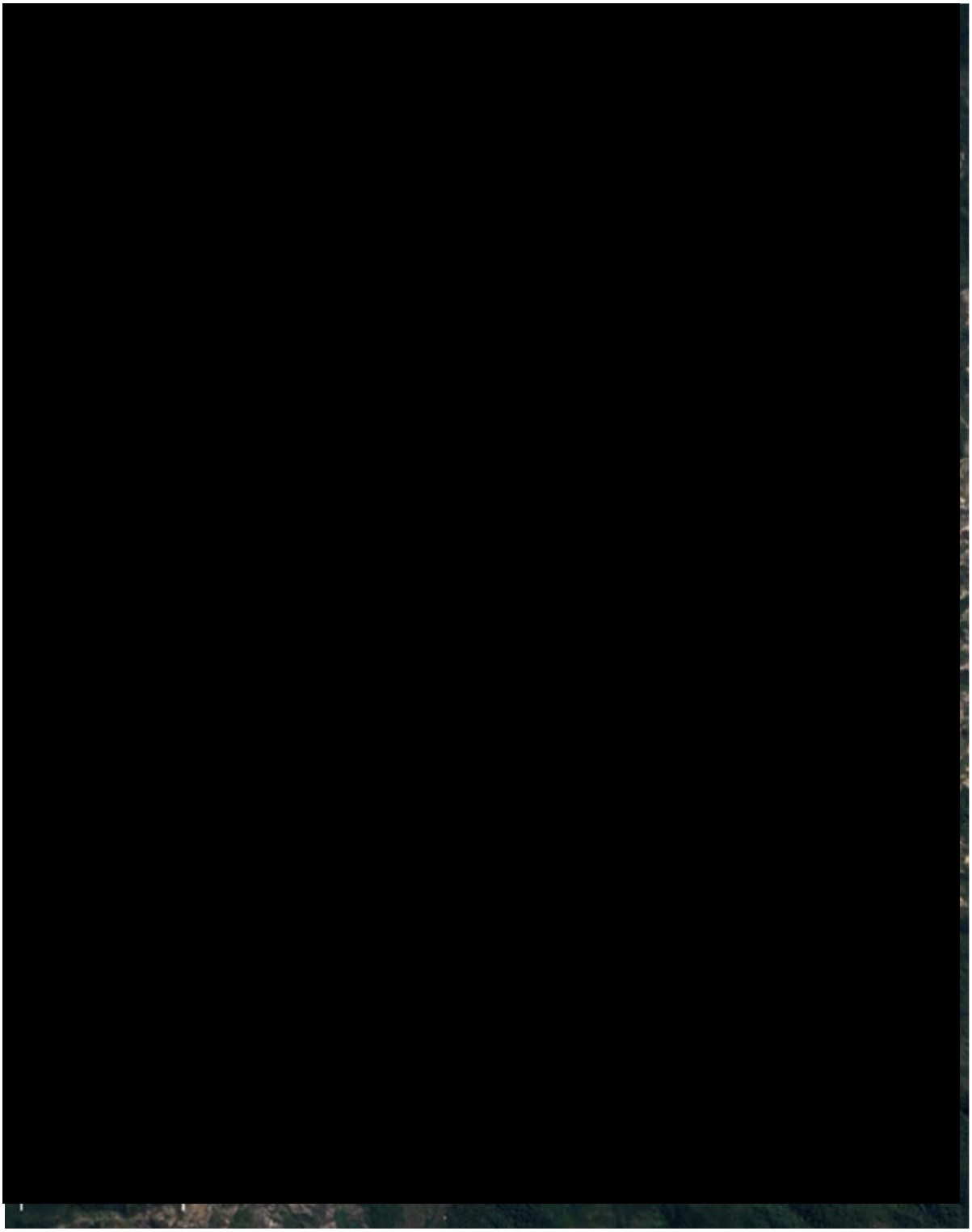


Figure 3: Pest monitoring device locations on the Stockton Plateau (From Alliance Ecology 2025).

3.0 Results

3.1 Vegetation

3.1.1 Summary

The extent of each vegetation and landcover type present within the Stockton 'new' Disturbance Area and associated Indirect Effects Contingency (to provide for edge effects) is set out in Table 1. The distribution and location of each cover type is shown in Figure 4. Each vegetation type is described in more detail in Sections 3.1.2– 3.1.4. The Stockton new Disturbance Area comprises mostly shrubland vegetation (c. 15.5ha, 49.4% of the new Disturbance Area), most of which (c. 7.8ha, 24.9%) is mānuka-mountain beech-podocarp shrubland. Forest comprises approximately (10.3ha, 32.8%), with the remainder of the vegetation cover comprising low pākihi (c. 2.4ha, 7.6%).

Bare rock, mostly comprising sandstone erosion pavement, comprises 2.1ha (c. 6.6%) with cleared vegetation making up the remaining c.1.1ha (3.5%).

Edge related effects within the Indirect Effects Contingency would influence an additional 16ha of vegetated habitats and 0.5ha of sandstone erosion pavement.

Table 1: Extent of vegetation and land cover types within the Stockton 'new' Disturbance Area.

	Extent (ha)			% of Stockton Disturbance Area
	Total	Disturbance Area	Indirect Effects Contingency	
Forest				
Southern rātā-mountain beech-podocarp forest	17.3	10.3	7.1	32.8
Shrubland				
Mānuka-mountain beech-podocarp shrubland	10.4	7.8	2.6	24.9
Mānuka/Gahnia-wire rush shrubland	0.9	0.5	0.4	1.5
Weedy shrubland	1.2	1.1	0.1	3.4
Mānuka-tussock-wire rush shrubland	9.7	6.0	3.8	19.1
Mānuka-mountain flax/wire rush shrubland	0.3	0.2	0.1	0.6
Low vegetation				
Low pākihi	4.3	2.4	1.9	7.6
Non-vegetated land cover				
Bare Rock	2.6	2.1	0.5	6.6
Vegetation cleared	5.7	1.1	4.6	3.5
Total	**52.4**	**31.3**	**21.1**	**100.0%**

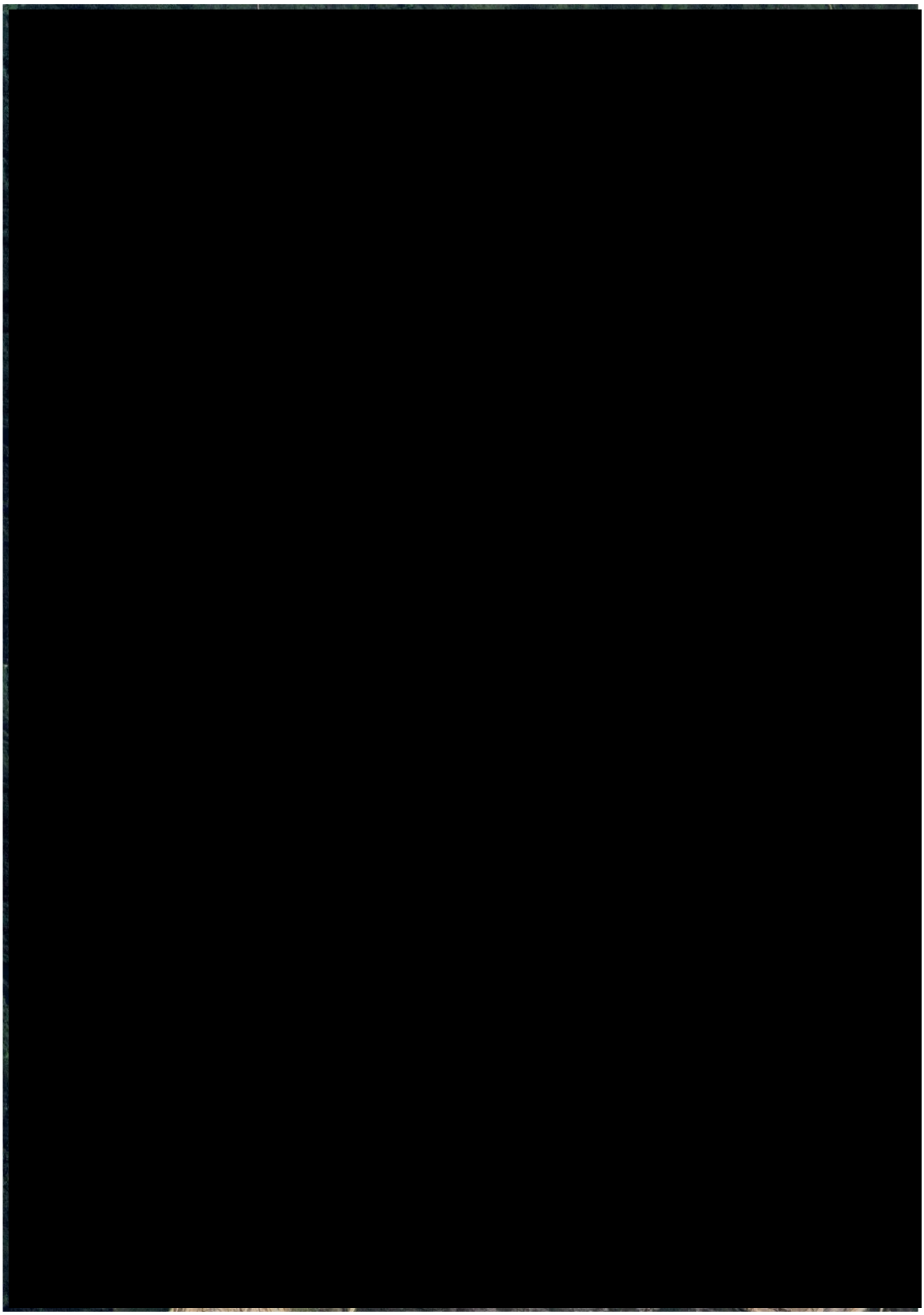


Figure 4: Vegetation and land cover within the Stockton 'new' Disturbance Area and Indirect Effects Contingency.[3]

[3] Image shows 'new' Disturbance Area based on GIS shapefiles released 15 December 2025.

3.1.2 Forest Vegetation

One forest type was present within the Stockton Disturbance Area, Southern rātā-mountain beech-podocarp forest (c. 10.3ha, 32.8%) which occurred mainly in gullies and sheltered sites particularly in the east of the Project sub-area. This forest had a mean height of c. 7.5m, with a sparse emergent layer dominated by Southern rātā (*Metrosideros umbellata*). Pāhautea (*Libocedrus bidwillii*) formed a sparse but conspicuous component of the canopy in sheltered areas, typically near waterways. The canopy layer was dense, with abundant mountain beech (*Fuscospora cliffortioides*), common podocarps yellow-silver pine (*Lepidothamnus intermedius*) and pink pine (*Halocarpus bidwillii*) and occasional silver beech (*Lophozonia menziesii*). The understorey had a high species richness, including species such as weeping māpou (*Myrsine divaricata*), mountain toatoa (*Phyllocladus alpinus*), pseudopanax (*Pseudopanax colensoi* var. *ternata*, *P. linearis*) and various *Coprosma* and *Dracophyllum* species. Ground cover comprised mainly gahnia (*Gahnia procera*), *Astelia nervosa*, ferns and tree/shrub seedlings.

3.1.3 Shrubland Vegetation

Shrubland covered almost half (49.4%) of the Stockton Disturbance Area with mānuka-mountain beech-podocarp shrubland most widespread occupying c. 7.8ha (24.9%). This vegetation was c. 3.9m tall on average, with the canopy dominated by mānuka and mountain beech, with yellow-silver pine, pink pine and Southern rātā also present in varying proportions. The understorey layer comprised saplings of canopy species, and shrubs such as *Coprosma* spp., prickly mingimingi (*Leucopogon fasciculatus*) and weeping māpou. Gahnia, mountain flax (*Phormium cookianum*) and wire rush (*Empodisma minus*) were abundant in the ground layer. This vegetation was widely distributed across the Stockton Disturbance Area often forming an ecotone between taller forest on more well-drained slopes and in gullies and the stunted shrubland and pākihi communities on flatter, more poorly drained sites.

Mānuka-tussock-wire rush shrubland occupied 6.0ha (19.1%). This short vegetation had a mean height of c. 0.83m, with mānuka dominating the canopy. *Dracophyllum* species (particularly *D. rosmarinifolium*), *Gahnia* spp. and tangle fern (*Gleichenia* spp.) were often present in the lower tiers. Ground cover was primarily prostrate mānuka and wire rush, with coal measures tussock (*Chionochloa juncea*) forming a conspicuous component.

Weedy shrubland covered c. 1.1ha and was often located near cleared vegetation. This mixed species shrubland was of medium stature (mean height 2m) and comprised a range of indigenous and exotic species, including mānuka, kāmahi, pink pine, gorse (*Ulex europaeus*), *Juncus* species (soft rush (*Juncus effusus*), tailed seeded rush (*J. canadensis*) and heath rush (*J. squarrosus*)) and exotic grasses such as browntop (*Agrostis capillaris*) and Yorkshire fog (*Holcus lanatus*).

Mānuka/Gahnia-wire rush shrubland occupied approximately 0.5ha and had a mean height of 2.8m, with the canopy dominated by dense mānuka and to a lesser extent, mountain beech, yellow-silver pine and mountain toatoa. Ground cover was predominantly wire rush and *Gahnia procera*, with occasional low growing *Dracophyllum* species, prickly mingimingi and mountain flax. This vegetation was sparsely distributed across the Stockton Disturbance area occupying 10.8ha in total.

Approximately 0.2ha of mānuka-mountain flax/wire rush shrubland was present. This vegetation was similar in structure to mānuka-tussock-wire rush shrubland, but included mountain flax as a conspicuous sub-dominant species. Ground cover was dominated by mānuka and wire rush. Red tussock (*Chionochloa rubra*), coal measures tussock, *Dracophyllum* species and podocarps formed a minor component of the upper tiers. This vegetation was sparsely distributed across the Stockton Disturbance Area.

3.1.4 Low vegetation

Low pākihi was sparsely distributed across the Disturbance Area occupying approximately 2.4ha, usually occurring on gently sloping, exposed areas associated with sandstone pavement. This short vegetation (mean height c. 0.27m) was dominated by prostrate mānuka and wire rush, with occasional red tussock, coal measures tussock and carpet grass (*Chionochloa australis*). *Carpha alpina*, cushion plant (*Donatia novae-zelandiae*), tangle fern (*Gleichenia dicarpa*) and sundews (*Drosera* spp.) were common in the ground layer. At more poorly drained locations this vegetation included common pākihi rush (*Machaerina teretifolia*), square sedge (*Lepidosperma australe*) and *Rytidosperma* spp. with occasional *Chionochloa* spp.

3.1.5 Other landcover types

The Stockton Disturbance Area includes approximately 2.1ha (6.7%) of bare rock. This mostly comprises sandstone erosion pavement with a low proportion of prostrate/low growing vegetation cover including species such as carpet grass, pygmy pine (*Lepidothamnus laxifolius*) prostrate *Dracophyllum* spp. and prostrate mānuka.

As well as the vegetation, there was approximately 1.1ha (3.5%) of cleared areas.

3.1.6 'Threatened' and 'At Risk' plant species

Ecological Solutions Limited (2026c) identified a total of approximately 542 vascular plant taxa which have been recorded from the Buller Plateaux since 1990. The majority (469 (87%)) of those were indigenous, with 70 (13%) exotic species. Thirty-one species (c. 6%) were of conservation concern. The flora of the Stockton Project sub-area includes 'At Risk' vascular plants (de Lange et al. 2024) as well as local endemics and species with disjunct (discontinuous) distributions.

No plants currently regarded as 'Threatened' are known to occur within the Stockton Project sub-area, but 14 'At Risk' plants may occur there including:

- *Bulbinella modesta* – 'At Risk – Declining';
- *Chionochloa juncea* – 'At Risk – Declining';
- *Dracophyllum densum* – 'At Risk – Declining';
- *Euphrasia wettsteiniana* – 'At Risk – Declining';
- Red mistletoe (*Peraxilla tetrapetala*) – 'At Risk – Declining';
- *Astelia subulata* – 'At Risk – Naturally Uncommon';
- *Brachyglottis traversii* – 'At Risk – Naturally Uncommon';
- *Carex carsei* – 'At Risk – Naturally Uncommon';
- *Carex dallii* – 'At Risk – Naturally Uncommon';
- *Euphrasia disperma* – 'At Risk – Naturally Uncommon';
- *Pseudowintera traversii* – 'At Risk – Naturally Uncommon';
- *Schizacme helmsii* – 'At Risk – Naturally Uncommon';
- *Sticherus tener* – 'At Risk – Naturally Uncommon'; and
- *Sticherus urceolatus* – 'At Risk – Naturally Uncommon'.

The 'Threatened – Nationally Vulnerable' bearded orchid *Calochilus paludosus* has been recorded from the Buller Plateaux, and may be present in pākihi vegetation within the Stockton Project sub-area.

3.1.7 Wetlands

Much of the Buller Plateaux exhibits hydrological and soil characteristics typical of wetlands, including soil saturation, surface water, stunted plants, a shallow aquitard (i.e., sandstone basement rock) and highly leached gley soils. The high rainfall contributes to maintaining these wetland features.

Low pākihi, mānuka-tussock-wire rush shrubland, mānuka-mountain beech-podocarp shrubland, mānuka/Gahnia-wire rush shrubland and mānuka-mountain flax/wire rush shrubland were all considered natural inland wetlands (Ecological Solutions Limited 2026b).

Mixed beech-podocarp-broadleaf forest and Southern rātā-mountain beech-podocarp forest were not considered natural inland wetlands (Ecological Solutions Limited 2026b). Weedy shrubland was not considered to be a wetland type, but in general this group may require more site-specific consideration.

The total extent of natural inland wetland within the Stockton Disturbance Area is approximately 16.8ha (54%) as shown in Figure 5. An additional 8.8ha of wetlands are included in the Indirect Effects Contingency and would be subject to edge effects.

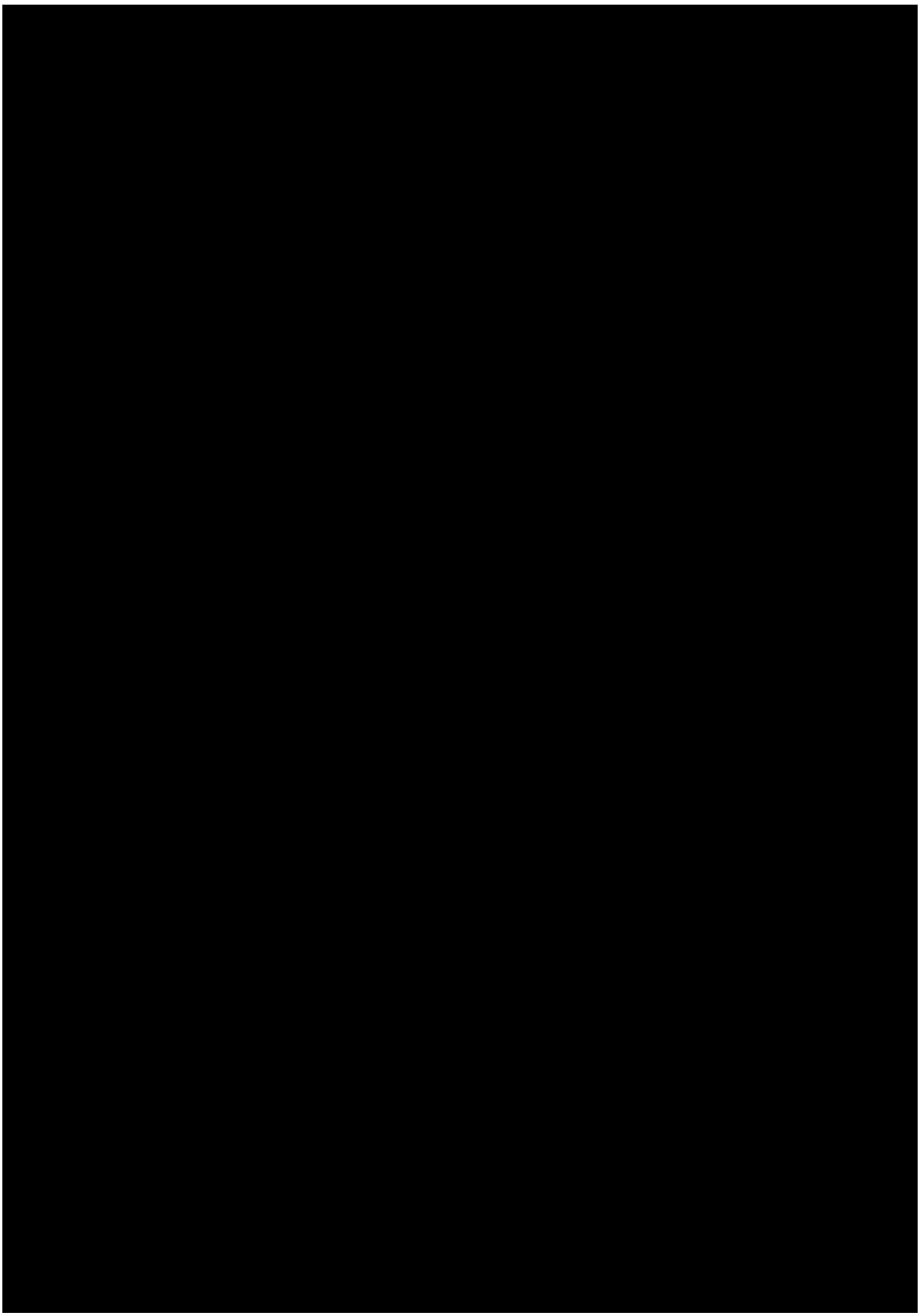


Figure 5: Wetlands within the Stockton 'new Disturbance area.[4]

[4] Image shown reflects 'new' Disturbance area based on GIS shapefiles released 15 December 2025.

3.2 Bryophytes

No specific search for bryophytes has been undertaken within the Stockton Project sub-area to inform the Project. However, based on existing location records, 19 bryophytes considered to be 'Threatened' or 'At Risk' by de Lange et al. (2020) and Michel et al. (2026) are known to occur in the Project sub-area, as listed in Table 2. Of those:

- One is considered 'Threatened – Nationally Critical';
- Two are considered 'Threatened – Nationally Vulnerable';
- Two are considered 'At Risk – Declining'; and
- 14 are considered 'At Risk – Naturally Uncommon'.

The known locations of these species recorded in previous surveys at Stockton Mine and surrounds are shown in Figure 6.

Additional species that may also be present within the Stockton Project sub-area based on the presence of suitable habitat or nearby records include: *Isolembidium anomalum* var. *anomalum* ('Threatened – Nationally Critical'), *Andreaea acuminata, Andreaea subulata, Blindia immersa, Herzogianthus vaginatus and Riccardia multicorpora* (all listed as 'At Risk – Naturally Uncommon').

Bryophytes of conservation concern are most frequently recorded within the Stockton Project sub-area from the following vegetation and habitat types as shown in Figure 4:

- Southern rātā-mountain beech-podocarp forest;
- Mānuka-tussock-wire rush shrubland;
- Mānuka-mountain beech-podocarp shrubland; and
- Low pākihi.

Table 2: 'Threatened' and 'At Risk' bryophytes recorded within the Stockton Project sub-area.

Species	Potential habitat
Threatened – Nationally Critical	
Neogrollea notabilis	Mānuka/ Gahnia-wire rush shrubland, mānuka-tussock-wire rush shrubland, low pākihi and tussock-flax shrubland, including vegetation within open sandstone pavement.
Threatened – Nationally Vulnerable	
Acromastigum verticale	Riparian and vertical wet walls under silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, tanglefern shrubland, and low pākihi.
Telaranea inaequalis	Riparian, stream sides and vertical wet walls under forest, Southern rātā-mountain beech-podocarp forest; and shrubland: mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, tanglefern shrubland and low pākihi.
At Risk – Declining	
Saccogynidium decurvum	Mixed beech-podocarp-broadleaved forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, low pākihi, tussock-flax shrubland. Also riparian, vertical wet walls and epiphytic on beech trees.
Acromastigum interstisiale	Riparian and vertical wet walls under mixed beech-podocarp-broadleaved forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, and mānuka-tussock-wire rush shrubland.
At Risk – Naturally Uncommon	
Acromastigum mooreanum	Low pākihi, mānuka-mountain beech-podocarp shrubland, silver beech-mountain beech forest. Also epiphytic on beech trees.
Campylopus kirkii	Mixed beech-podocarp-broadleaved forest, Southern rātā-mountain beech-podocarp forest, tussock-flax shrubland, and low pākihi.
Cryptolophocolea tuberculata	Mixed beech-podocarp-broadleaved forest, Southern rātā-mountain beech-podocarp forest, silver beech-mountain beech forest, and leatherwood shrubland.
Heteroscyphus billardierei	Silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, and low pākihi.
Isotachis westlandica	Riparian: sandy banks and stream edges under mixed beech-podocarp-broadleaved forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, and mānuka-tussock-wire rush shrubland.
Kurzia nivicola	Low pākihi.
Lembidium longifolium	Densely shaded sites e.g. deep dark recesses, under Southern rātā-mountain beech-podocarp forest, and mānuka-tussock-wire rush shrubland.
Lepidolaena novae-zelandiae	Typically epiphytic on myrtaceous species, frequently on mānuka, also present on Dracophyllum and beech. Silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka/Gahnia-wire rush shrubland, mānuka-tussock-wire rush shrubland, tussock-flax shrubland, and low pākihi.
Pachyschistochila virescens	Riparian, silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, and low pākihi.
Pallavicinia rubristipa	Riparian, Southern rātā-mountain beech-podocarp forest, tussock-flax shrubland, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, tanglefern shrubland, and low pākihi.
Pleurophascum ovalifolium	Silver beech-mountain beech forest, mixed beech-podocarp-broadleaved forest Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, tussock-flax shrubland, mānuka-tussock-wire rush shrubland, mānuka-flax/wire rush shrubland, mānuka/Gahnia-wire rush shrubland, sandstone erosion pavement ('bare rock'), tanglefern shrubland and low pākihi.
Riccardia furtiva	Epiphytic and terricolous in silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, tussock-flax shrubland, and low pākihi.
Trichotemnoma corrugatum	Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland, low pākihi and tanglefern shrubland.
Zoopsis bicruris	Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland.

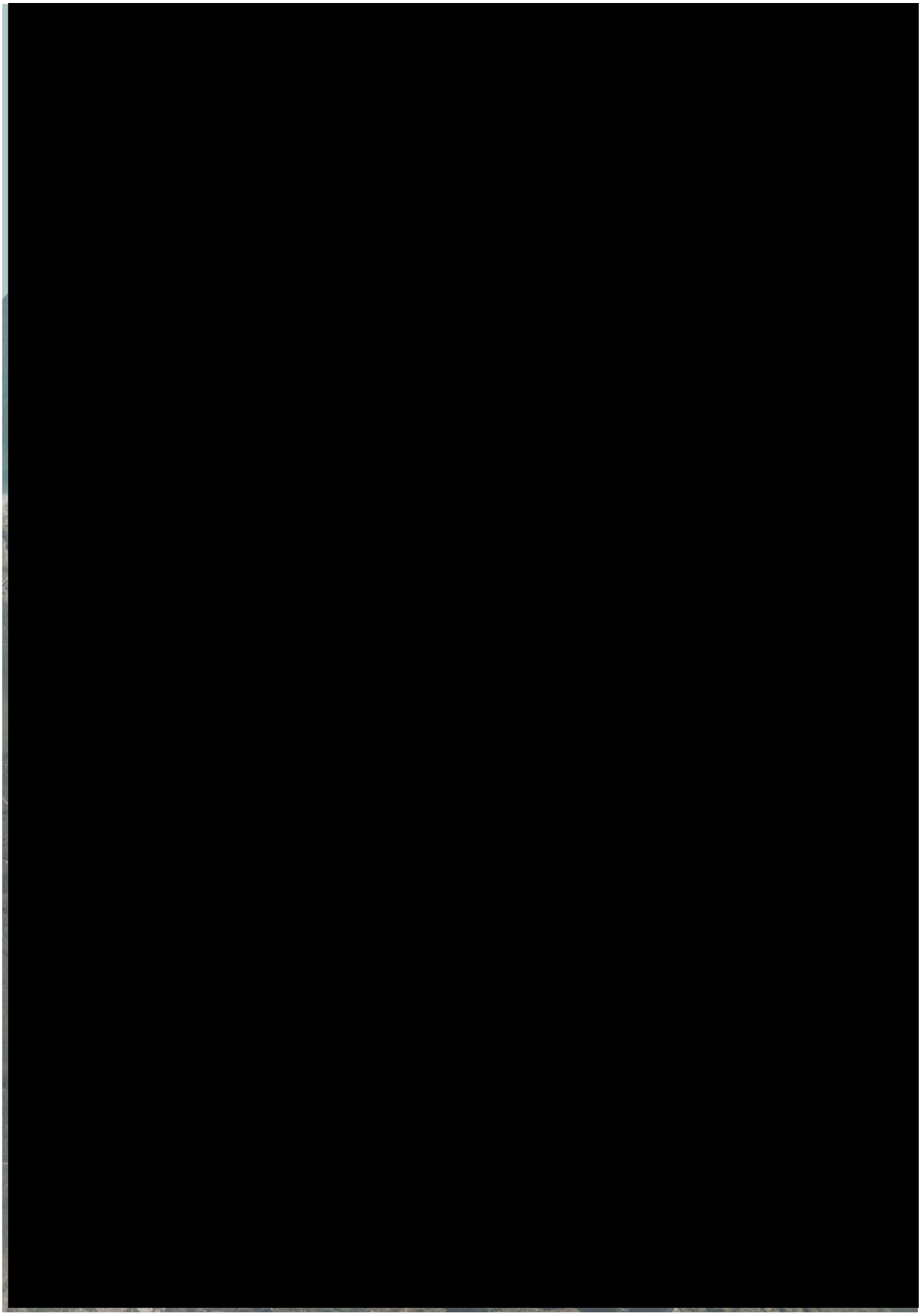


Figure 6: Location of bryophytes and lichens of conservation concern within the Stockton Project sub-area.

3.3 Lichens

No specific surveys for lichens have been undertaken within the Stockton Project sub-area to inform the Project. Based on the vegetation classes (i.e., habitat types) present, up to five 'Threatened' and 'At Risk' lichens may be present including:

- *Pycnothelia caliginosa* ('Threatened – Nationally Endangered')
- *Austropeltum glareosum* ('Threatened – Nationally Vulnerable')
- *Cladia fuliginosa* ('Threatened – Nationally Vulnerable')
- *Knightiella splachnirima* ('Threatened – Nationally Vulnerable')
- *Cladia inflata* ('At Risk – Declining')

The locations of previous records of 'Threatened' and 'At Risk' lichens at Stockton Mine are shown in Figure 6.

3.4 Avifauna

Previous surveys and reports relating to avifauna at the Buller Plateaux and within the Ngakawau Ecological District were summarised by Ecological Solutions Limited (2026c). Nichol (2021) recorded mātātā/South Island fernbird (*Bowdleria punctata punctata*) at all sites he surveyed immediately north of the Stockton Project sub-area in similar habitats. Mātātā are regarded as 'At Risk – Declining' (Robertson et al. 2021) and were usually present as sparsely distributed pairs. Suitable habitat for mātātā was abundant, including mixed shrubland-sedgeland associations with *Gahnia rigida*, mountain flax, tamingi (*Epacris pauciflora*), tanglefern (*Gleichenia dicarpa*) and mānuka. Pīhoihoi/New Zealand pipit ('At Risk – Declining', Robertson et al. 2021) were also recorded.

3.5 Mammalian Pests

Mammalian pests known to occur on the Stockton Plateau include ship rats (*Rattus rattus*), mice (*Mus musculus*), possums (*Trichosurus vulpecula*), hares (*Lepus europaeus occidentalis*), deer (*Cervus elaphus*), weasels (*Mustela nivalis*) and stoats (*Mustela erminea*) while feral cats (*Felis catus*), pigs (*Sus scrofa*), goat (*Capra hircus*) and chamois (*Rupicapra rupicapra*) may occur, but have not been detected.

Recent surveys found that rodents occur at densities which exceed levels required for biodiversity protection (Parkes 2020), including during the summer of 2024/2025 even in absence of masting that year (Alliance Ecology 2025). Stoats (*Mustela erminea*) were also commonly detected. This provides strong evidence that pest mammals are likely to be negatively affecting vulnerable native fauna at the Buller Plateaux.

4.0 Conclusion

Vegetation within the Stockton new Disturbance Area (c 31.3ha) includes mostly shrubland vegetation and forest vegetation with approximately 7.6% of the area comprising low vegetation. Bare rock, mostly comprising sandstone erosion pavement, makes up c. 2.1ha (6.6%) with cleared vegetation making up the remaining c.1.1ha (3.5%). Edge related effects would influence an additional 16.0ha of vegetated habitats and 0.5ha of sandstone erosion pavement.

The ecological values of the Stockton Project sub-area are representative of the Buller Plateaux more generally, with slightly more than half the Stockton Disturbance area (54%) comprising wetland vegetation. The vegetation types present include 'At Risk' vascular plants.

With respect to the non-vascular flora, the Stockton Project sub-area is known to provide habitat for 19 bryophyte and five lichen species listed as 'Threatened' or 'At Risk' by de Lange et al. (2018, 2020) and Michel et al. (2026).

The vegetation provides habitats for a unique lizard assemblage and 'Threatened' and 'At Risk' bird species, including rōroa, fernbirds and New Zealand pipit. The vegetation also provides habitat for land snails and a predominantly intact terrestrial invertebrate fauna.

The habitats are generally predominantly natural, intact and well connected, although the connection to the south is substantially reduced by the existing Stockton Mine.

Pest numbers are such that, in the absence of active management (including that undertaken by Bathurst), indigenous biodiversity would be adversely affected.

5.0 References

Alliance Ecology Limited. 2025. Pest Mammal Survey: Buller Plateau Pest Monitoring. Unpublished report prepared for Bathurst Resources Limited.

Hurst, J.M., Allen, R.B. & Fergus, A.J. 2022. The Recce method for describing New Zealand vegetation – expanded manual. Version 5.

de Lange, P., Blanchon, D., Knight, A., Elix, J., Lucking, R., Frogley, K., Harris, A., Cooper, J., and Rolfe, J. 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27. Department of Conservation, Wellington. 64 pp.

de Lange, P.J., Glenny, D., Frogley, K., Renner, M.A.M., von Konrat, M., Engel, J.J., Reeb, C., and Rolfe, J.R. 2020. Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31. Department of Conservation, Wellington. 30 pp.

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

Ecological Solutions Limited. 2023. Proposed Millerton North Water Infrastructure Ecological Assessment. Unpublished report prepared for BT Mining Limited by Ecological Solutions Limited, Kāeo, Northland. 23 pp + appendices.

Ecological Solutions Limited. 2026a. Buller Coal Plateau Continuation Project: Terrestrial Ecological Impact Assessment Report. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. 98 pages + appendices.

Ecological Solutions Limited. 2026b. Buller Plateaux Vegetation Mapping. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. January 2026. 65 pages + appendices.

Ecological Solutions Limited. 2026c. Buller Plateaux Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 101 pages + appendices.

Gillies, C. A., & Williams, D. 2013. DOC tracking tunnel guide v2. 5.2: Using tracking tunnels to monitor rodents and mustelids. *Hamilton, Department of Conservation*.

Nichol, R. 2021. Mine Creek Sump Proposal – Stockton Ecological Impact Assessment. Unpublished report prepared by Richard Nichol Ecology Ltd.

Michel, P., deRegnier, R., Emmitt, T., Ford, M., Perrie, L., Pritchard, A.S.E. 2026. Conservation status of mosses in Aotearoa New Zealand, 2025. Report 1155. Department of Conservation, Wellington. New Zealand Threat Classification System Series 49.

Ministry for the Environment (MfE).2020a. Wetland delineation protocols. Wellington: Ministry for the Environment.

Ministry for the Environment (MfE). 2020b. National Policy Statement for Freshwater Management (NPS-FM) 2020. Amended December 2025.

Mitchell Daysh Limited. 2026. Buller Plateaux Continuation Project Assessment of Environmental Effects.

Parkes, J. 2020. Review of Pest Management on the Buller Plateau. Unpublished report 2020/021 by Kurahaupo Consulting for Bathurst Resources Limited. 28pp + appendices. Kurahaupo Consulting, Christchurch.

Robertson, H.A., Baird, K.A., Elliott, G.P., Hitchmough, R.A., McArthur, N.J., Makan, T.D., Miskelly, C.M., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A., and Michel, P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 pp.

Smith, D. H., & Weston, K. A. 2017. Capturing the cryptic: a comparison of detection methods for stoats (Mustela erminea) in alpine habitats. *Wildlife Research*, *44*(5), 418-426.

Williams, J. 2024. Heaphy and Denniston Biodiversity Projects Annual Report 1 July 2023 – 30 June 2024. Unpublished report prepared by the Department of Conservation, Westport. 63 pp + appendices.

APPENDIX A

Vegetation plots used to inform the Stockton Project sub-area

Plot reference	NZTM_East	NZTM_North	Vegetation group
NSTO1	[redacted]		Low pākihi
NSTO2			Low pākihi
NSTO3			Low pākihi
NSTO4			Low pākihi
NSTO5			Low pākihi

APPENDIX F

Buller Plateaux Continuation Project Upper Waimangaroa Haul Road Project Sub-Area Baseline Surveys (Ecological Solutions Limited 2026f)

ecoLogical Solutions
Environmental Consultants







August 2026

Buller Plateaux Continuation Project

Upper Waimangaroa Haul Road Project Sub-Area Baseline Surveys

Prepared for Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by:	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted]) Herpetologist (Lizard sections only)	[redacted]
Reviewed by:	[redacted] Terrestrial Ecology Team Leader	[redacted]

Status: Final **Issued:** 7 August 2026

ecoLogical solutions
tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 4/195 main highway,
ellerslie, Auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

nelson office
p: 021 172 2091
www.ecoLogicalsolutions.co.nz

Executive Summary

This report describes the specific ecological surveys, including methods and results, used to inform an assessment of ecological values of the Upper Waimangaroa Haul Road Project sub-area ('UWHR') which forms part of the larger Buller Plateaux Continuation Project ('BPCP'). This report does not include the values assessment or consider the effects of the Project, which are both provided in the Buller Plateaux Continuation Project Ecological Impact Assessment (Ecological Solutions Limited 2026a).

The UWHR is approximately 19km long, with the road formation typically 16.7m wide, connecting the Denniston and Stockton Plateaux. Vegetation cover within the UWHR Disturbance area comprises mostly forest and shrubland with small areas of low vegetation, bare rock, cleared vegetation and water. Approximately 16.5ha (37%) of the UWHR Disturbance area is comprised of wetlands which meet the definition of 'natural inland wetland' set out in the National Policy Statement for Freshwater Management ('the NPS-FM' 2020). These wetlands are scattered across the UWHR Project sub-area.

Vegetation within the UWHR Project sub-area includes up to 12 'At Risk' vascular plant species and is known to provide habitat for 11 bryophyte species (non-vascular) listed as 'At Risk'. Four new records of bryophytes were obtained from the UWHR Project sub-area, extending the known range of those species within New Zealand.

Fifteen bird species were recorded along the route of the UWHR Project sub-area. Birds were recorded in moderate numbers, and fewer birds were recorded in 2020 than 2019. Three 'At Risk – Declining' bird species were recorded. Rōroa/great spotted kiwi (which are considered 'Threatened – Nationally Vulnerable') are also present at low densities within and surrounding the UWHR Project sub-area.

Two species of gecko were recorded including one regarded as 'Threatened – Nationally Vulnerable' and one 'At Risk – Declining'.

Terrestrial invertebrate communities within the UWHR Project sub-area retain a high degree of natural integrity despite long-term human activities. The majority (94%) of invertebrates collected in surveys were native. The UWHR Project sub-area is within the known range of the land snail *Powelliphanta patrickensis* and snails have been recorded from within the footprint and further east.

The vegetation and fauna within the UWHR Project sub-area is generally affected by previous disturbance and activities to a relatively low degree and the communities have remained predominantly indigenous.

Table of Contents

Executive Summary ..... **ii**
1.0 Introduction **1**
1.1 Background 1
1.2 Upper Waimangaroa Haul Road 3
1.3 Scope and Purpose 3
2.0 Methods **3**
2.1 Vegetation 3
2.1.1 Mapping Vegetation Types 3
2.1.2 Identifying Wetland Vegetation Types 4
2.1.3 Bryophytes and Lichens 4
2.2 Avifauna 6
2.2.1 Background 6
2.2.2 Five-Minute Bird Counts 6
2.2.3 Roroa Surveys 6
2.3 Lizards 8
2.4 Land Snails 8
2.5 Other Terrestrial Invertebrates 9
3.0 Field Surveys **11**
3.1 Vegetation 11
3.1.1 Summary 11
3.1.2 Forest Vegetation 13
3.1.3 Shrubland Vegetation 13
3.1.4 Low vegetation 14
3.1.5 Other landcover types 14
3.1.6 Naturally Uncommon Ecosystems 14
3.1.7 'Threatened' and 'At Risk' plant species 14
3.2 Wetlands 15
3.3 Bryophytes 17
3.4 Lichens 18
3.5 Avifauna 20
3.5.1 Five-minute bird counts 20
3.6 Lizards 20
3.7 Terrestrial Invertebrates 21
4.0 Conclusion **21**
5.0 References **22**

Index to Tables

Table 1: Site descriptions and locations for terrestrial invertebrate traps in the Waimangaroa Valley. 9
Table 2: Extent of vegetation and land cover types within the UWHR Project sub-area. 11
Table 3: Bryophytes of conservation concern recorded from the UWHR Project sub-area. 18
Table 4: Results of five-minute bird counts within the UWHR Project sub-area. 20

Index to Figures

Figure 1: Buller Plateaux Continuation Project sub-areas. 2
Figure 2: Extent of the Mapped Area at the Buller Plateaux. 5
Figure 3: Location of five-minute bird counts in relation to the UWHR Project sub-area. 7
Figure 4: Terrestrial invertebrate sampling locations within the UWHR Project sub-area. 10
Figure 5: Vegetation and land cover types within the UWHR Project sub-area. 12
Figure 6: Natural inland wetlands within the UWHR Project sub-area. 16
Figure 7: Location of bryophytes and lichens of conservation concern within the UWHR Project sub-area. 19
Figure 8: Species richness at each invertebrate sampling site within the UWHR Project sub-area. 21

Appendices

Appendix A – Vegetation plots within the UWHR Project sub-area.
Appendix B – Bryophytes recorded within the UWHR Project sub-area.
Appendix C – Terrestrial invertebrates collected within the UWHR Project sub-area.

1.0 Introduction

1.1 Background

Bathurst Resources Limited (including its subsidiary companies Bathurst Coal Ltd and Buller Coal Ltd, and joint venture company BT Mining Ltd) (collectively referred to here as 'Bathurst') are seeking approvals through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('BPCP' or 'the Project').

The purpose of the Project is to reconsent the existing infrastructure and mining operations associated with the Stockton Mine and provide access to additional coal mining areas across parts of both the Denniston and Stockton Plateaux, collectively referred to here as 'the Buller Plateaux' located northeast of Westport. The coal resource in the current Stockton operations is close to depletion, and further coal resources for blending are required.

The Project is a complex proposal which seeks to enable a mix of ongoing and new mining activities. The land tenure is a mix of Crown, private and Bathurst owned land. The authorisations required for the proposed activities are being bundled into a single application to proceed through the FTAA process.

As shown in Figure 1, the Project has been divided into five project sub-areas for the purpose of the FTAA application:

- Stockton (including the Ngakawau Coal Handling Facility and Aerial Ropeway, 'Stockton').
- Cypress Mining Area ('Cypress').
- Mount Frederick South ('MFS').
- Escarpment Extended (including the Waimangaroa storage area) ('ESE').
- Upper Waimangaroa Haul Road ('UWHR').

The Project will enable 20 million tonnes of coking coal to be mined, utilising existing infrastructure facilities over a 25-year timeframe to support and extend the mine life of the current Stockton Mine operations. All elements of the Project are essential for the Project to be economically viable and to meet the future coal blend requirements.

The Project provides significant regional economic benefits and contributes to the resilience of the regional economy through:

- Maintaining the current workforce numbers through retention of approximately 390 direct jobs in the Buller district and an additional 50 jobs outside of the Buller district.
- Contributing approximately $40 million annually in wages, much of which is spent locally.

Disturbance areas within each Project sub-area reflect where disturbance will occur (for example, mining, mining infrastructure, roading, buildings). The UWHR Disturbance area includes both 'new' disturbance and what Bathurst defines as 'existing' disturbance. This is because existing disturbed areas may still contain vegetation and habitats suitable for species, when considering the actual and potential effects of the Project. The extent of the proposed Upper Waimangaroa Haul Road ('UWHR') Project sub-area is 82ha[1], while the UWHR Disturbance Area is c. 44.8ha[2].

[1] Based on shapefiles released 4 December 2025.
[2] Based on shapefiles released 15 October 2025.

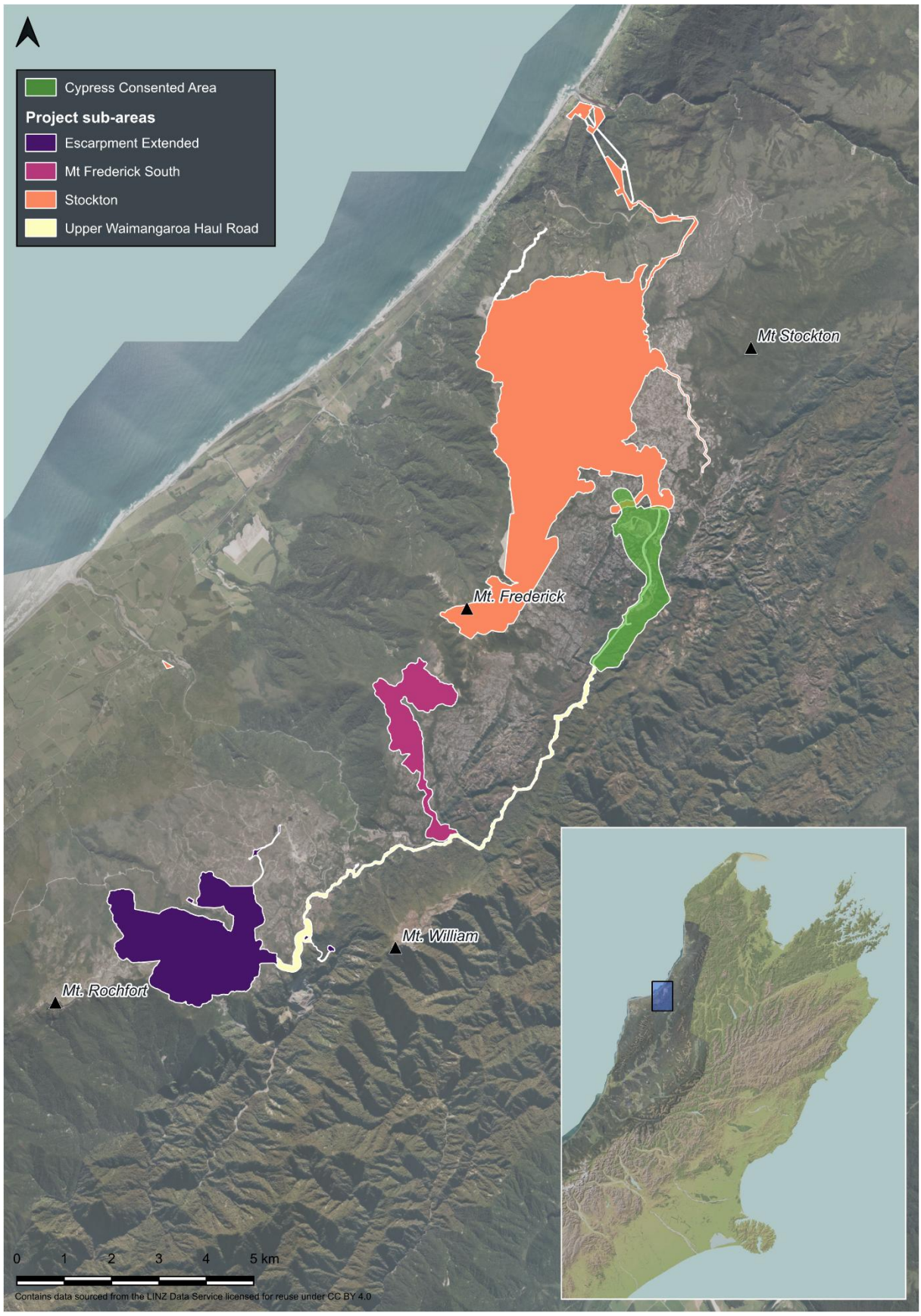


Figure 1: Buller Plateaux Continuation Project sub-areas.

1.2 Upper Waimangaroa Haul Road

The UWHR is a "transport corridor" that will connect the mining areas at ESE and MFS to the coal handling and processing infrastructure at Stockton Mine via the Cypress Mining area as shown in Figure 1. The UWHR would be approximately 19km long, with the road formation approximately 16.7m wide. Construction would involve upgrading and extending existing low-use tracks in the Upper Waimangaroa Valley as well as approximately 4km of new length (comparatively undisturbed). Vegetation within the new length of road includes a mix of tall forest, shrubland, low pākihi, and bare rock. The majority of the UWHR sub-area footprint is Crown owned land administered by Land Information New Zealand, with the remainder being public conservation land administered by the Department of Conservation.

1.3 Scope and Purpose

In preparing for the Project, Bathurst has undertaken a range of surveys since 2019, both across the Buller Plateaux generally and within the particular Project sub-areas. Bathurst has also undertaken regular monitoring of a range of species at a variety of locations in order to inform their effects management and compliance reporting. This has produced a large amount of ecological information distributed in a variety of unpublished reports. This report summarises the available information relevant to the UWHR Project sub-area and provides technical detail sufficient to support the Ecological Impact Assessment (Ecological Solutions Limited 2026a) and overall Assessment of Ecological Effects for the Project (Mitchell Daysh Limited 2026) as a standalone document. The purpose is to minimise the information provided in those larger documents, whilst still providing sufficient detail to inform decision makers.

This document includes five sections as follows:

- This introduction (Section 1.0).
- Section 2.0 sets out the methods used to survey vascular and non-vascular vegetation, wetlands, avifauna, lizards, land snails, other terrestrial invertebrates and mammalian pests. Section 2.0 also identifies any relevant key documents to be read in conjunction with this report.
- Section 3.0 sets out the results of the surveys described in Section 2.
- Section 4.0 provides a conclusion with respect to the ecological values present.
- Section 5.0 provides the references used in compiling this report.

2.0 Methods

2.1 Vegetation

2.1.1 Mapping Vegetation Types

Terrestrial and wetland vegetation within c. 10,129ha of the Buller Plateaux and surrounds (referred to as "the Mapped Area") was mapped and described using 152 10 x 10m vegetation plots collected between 2008 and 2025 across both the Stockton and Denniston Plateaux, combined with ordination and multivariate analysis as well as classification of 45,690 aerial photographs collected between July 2019 and January 2024 (Ecological Solutions Limited 2026b).

The Mapped Area included the UWHR Project Sub-area and surrounds as shown in Figure

2. The methods used to compile the vegetation map are briefly summarised here. For more detail see Ecological Solutions Limited (2026b).

Vegetation plot data collected using the RECCE method (Hurst et al. 2022) was ordinated using non-metric multi-dimensional scaling (NMDS) combined with generalised linear modelling (GLM) and principal components analysis (PCA) to discriminate vegetation types and identify underlying ecological drivers. The PCA indicated that altitude, slope, aspect and percentage of rock cover were strong ecological drivers of the vegetation type present.

Concurrently, drone imagery was used to create georeferenced orthomaps which were separated into distinct vegetation types using machine learning via two types of algorithms (RF and SVM) informed by training samples which were assigned to one of the vegetation types identified from the ordination by those personnel involved in the field surveys. Three additional land cover types were identified during that verification process including bare rock (mostly sandstone erosion pavement), water (often current or historic mine infrastructure) and cleared vegetation. Manual checking and editing of polygons were carried out to ensure accuracy between the mapped vegetation or land cover and the high-resolution imagery beneath.

The UWHR Project sub-area contained four of the vegetation plots used by Ecological Solutions Limited (2026b) to inform the vegetation mapping, including two mānuka-tussock-wire rush shrubland plots, one low pākihi plot and one weedy shrubland plot as set out in Appendix A. In addition, a walk-through survey of the UWHR route was undertaken in 2019 with Dr David Meagher and others and the vegetation along the route was described and photographed.

2.1.2 Identifying Wetland Vegetation Types

The specific method for identifying wetland vegetation is detailed in Ecological Solutions Limited (2026b). To summarise, the vegetation tests set out in the wetland delineation protocols (Ministry for the Environment 2020a) were applied to each of the 152 vegetation plots to determine whether that plot met the definition of ‘natural inland wetland’ set out in the National Policy Statement for Freshwater Management (2020 and subsequent amendments, “the NPS-FM”) or not. For vegetation types where all the plots met the relevant tests, those vegetation types were confirmed as ‘natural inland wetlands’. For vegetation types where only some of the plots met the relevant tests, professional judgement was used to determine whether the vegetation was a wetland type or not. Where none of the plots met the relevant tests, those vegetation types were not identified as wetlands.

2.1.3 Bryophytes and Lichens

Previous bryophyte and lichen surveys from the Buller Plateaux and Ngakawau Ecological District are summarised in Ecological Solutions Limited (2026c). This included identification of the vegetation type (or habitat) where ‘Threatened’ and ‘At Risk’ bryophytes and lichens (de Lange et al. 2018, 2020, Michel et al. 2026) had been recorded previously so as to inform an assessment of the likely ecological value of parts of the Project Area which could not be surveyed directly.

The bryophyte species and communities within the UWHR Project sub-area were described by Meagher (2020) using a walk-through survey, along the true-left of the Waimangaroa River. No specific search was undertaken for lichens.

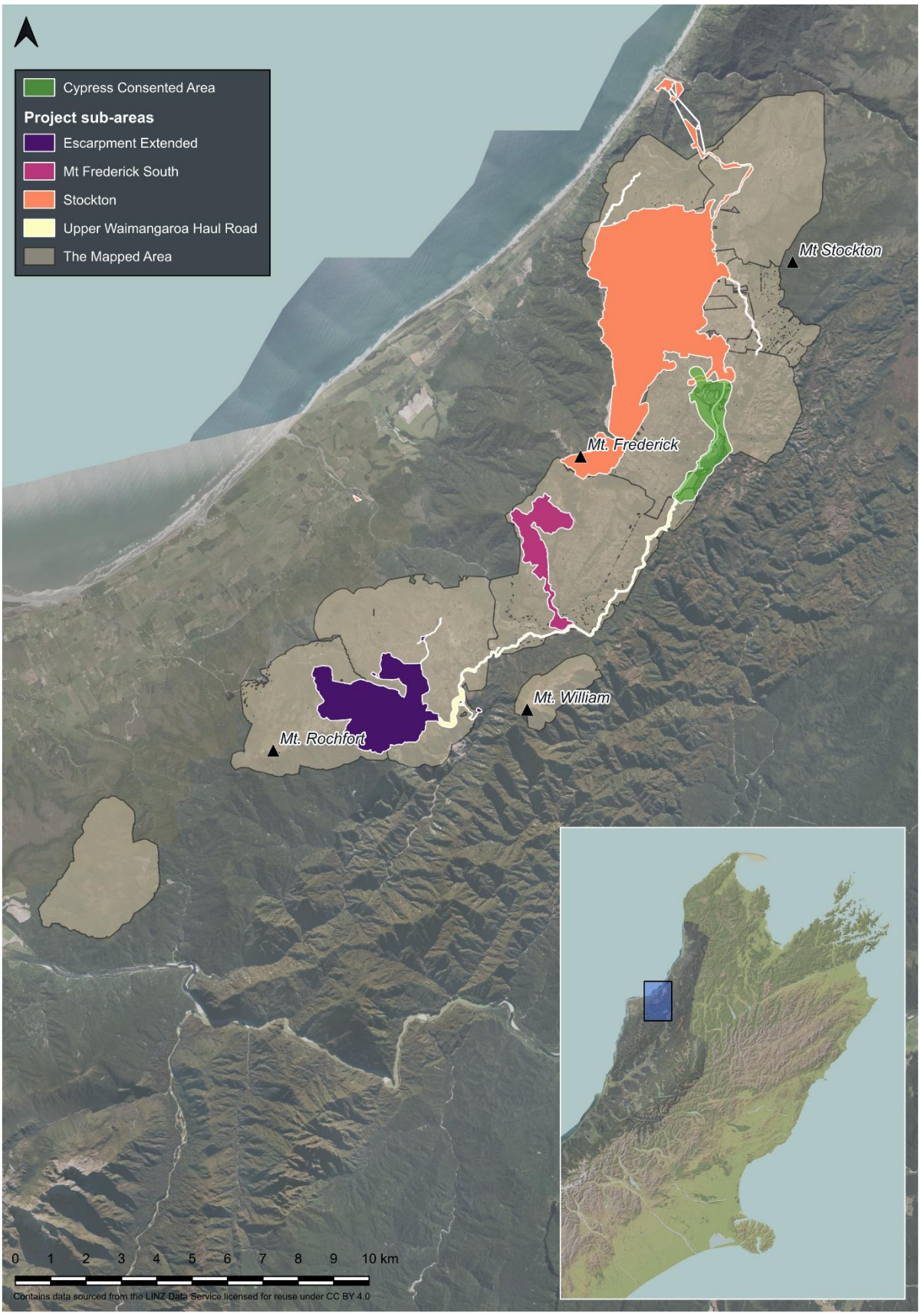


Figure 2: Extent of the Mapped Area at the Buller Plateaux.

In addition, an opportunistic survey for bryophytes was conducted by Ecological Solutions Limited in March 2025 at one location along Cedar Creek Road, near an unnamed tributary of Burnett Stream within the UWHR Project sub-area. A list of bryophytes recorded from within the UWHR Project sub-area, plot survey and surrounds is provided in Appendix B.

2.2 Avifauna

2.2.1 Background

Previous surveys and/or monitoring reports from the Buller Plateaux and Ngakawau Ecological District relating to birds are summarised in Ecological Solutions Limited (2026c).

Bird surveys within the Upper Waimangaroa Valley and surrounds have used a variety of methods including five-minute bird counts (5MBC), acoustic recorder surveys for diurnal birds, standard call count surveys (e.g., for roroa/great spotted kiwi (*Apteryx maxima*)) and acoustic recorder surveys for nocturnal birds. Acoustic recorders have the advantage of increasing detectability (particularly for cryptic species), avoiding disturbance to birds due to an observer, easily increasing survey area or duration without substantial additional effort and providing permanent recordings (which can be shared with others if required, e.g., to identify rare species).

During the vegetation, bryophyte and terrestrial invertebrate surveys undertaken specifically for the Project, any birds encountered were also recorded.

2.2.2 Five-Minute Bird Counts

Five-minute bird counts were undertaken at 34 locations along the UWHR and surrounds on 25 and 28 February 2019 and 2 March 2020 (Nichol 2020). Two observers carried out the bird counts, meaning each 5MBC site was surveyed once by two different observers. The locations of these 5MBCs are shown in Figure 3.

2.2.3 Roroa Surveys

Previous surveys and/or monitoring reports from the Buller Plateaux and Ngakawau Ecological District relating to roroa/great spotted kiwi are summarised in Ecological Solutions Limited (2026c).

No recent (i.e., within the last 10 years) surveys for roroa have been undertaken within the UWHR Project sub-area, except at the western extent of the UWHR, where the Denniston Plateau roroa call count surveys have been conducted (Nichol 2022). Based on the habitat present, we expect roroa to be present throughout the UWHR Project sub-area. The results of Nichol's (2022 and earlier) surveys are detailed in the ESE Project sub-area report (Ecological Solutions Limited 2026d). These surveys have demonstrated that many roroa frequent the edges of the plateaux, including the Cascade Creek catchment and forested areas near Burnett's Face and the lower slopes of Mt William, which are all in relatively close proximity to the UWHR and have similar forested vegetation. On that basis, roroa are expected to be present throughout the UWHR Project sub-area in low – moderate densities.

.



Figure 3: Location of five-minute bird counts in relation to the UWHR Project sub-area.

2.3 Lizards

Previous lizard surveys from the Buller Plateaux and Ngakawau Ecological District are summarised in Ecological Solutions Limited (2026c).

Dr Matt Baber (Alliance Ecology Limited) undertook lizard surveys on the Denniston Plateau and Waimangaroa Valley over five days on 15–16 January and 3–5 March 2020 when the weather was warm (> 12°C) and geckos were most likely to be active. Methods used to locate lizards included manual day searching and nocturnal spotlighting.

Manual searching included the use of binoculars and/or the naked eye to target species including West Coast green gecko (*Naultinus tuberculatus*) and basking Westland speckled skink (*Oligosoma* aff. *newmani* "Westland"). Visual searching targeted lizards within all habitat types in the survey area that provided suitable habitat and that were conducive to detecting lizards. Manual searching also included hand-searching for the presence of inactive forest gecko (*Mokopirirakau granulatus*) and speckled skink. Hand-searching entailed crevice inspections (by torchlight) and careful lifting of rock slabs and other surface debris, taking care to return disturbed items to their original positions.

Searching was undertaken in forest margins, low prostrate vegetation, shrubland, rock outcrops and pavement. Despite providing suitable habitat, searching was not undertaken in tall shrubland or native forest habitat or on steep slopes due to the reduced likelihood of detecting lizards (e.g., geckos located in tall trees) and/or health and safety concerns.

Nocturnal searches were undertaken to detect active forest or West Coast green geckos using powerful torches (minimum 800 lumens) and binoculars to 'spotlight' and capture lizards. Searching was undertaken on foot and also while driving (1–5 km/hr along selected drivable tracks that were readily accessible and surrounded by suitable and readily searchable habitat.

Irrespective of method, searches were timed to provide a measure of catch per unit effort, i.e., catches per person hour. All captured lizards were released at their capture site. Capture locations were recorded using a Garmin GPS and recorded on Data Collector.

For each lizard captured during surveys, the following information was recorded:

- Date and time of capture and weather conditions;
- Capture methodology;
- Capture location (GPS coordinates), capture methodology, habitat type; and
- Species; sex (reproductive status for females); age class; snout to vent length (SVL); tail status (regenerating versus original tail); and overall health and condition.

At least one photograph of each captured lizard was taken, including at least one photograph showing the dorsal surface clearly.

2.4 Land Snails

Previous snail surveys and/or monitoring reports from the Buller Plateaux are summarised in Ecological Solutions Limited (2026c). No specific snail surveys have been undertaken to inform the UWHR Project sub-area assessment, but there are a large number of records of both snails and shells from various locations within the UWHR Project sub-area. The area is within the known range of *Powelliphanta patrickensis*, and there are also records of snails and/or snail shells from areas further east (Ecological Solutions Limited 2026c). On that basis, it is conservative to assume land snails are present.

2.5 Other Terrestrial Invertebrates

Previous surveys and reports from the Buller Plateaux and Ngakawau Ecological District relating to terrestrial invertebrates are summarised in Ecological Solutions Limited (2026c).

The terrestrial invertebrate community of the UWHR Project sub-area was specifically surveyed in March and April 2023. Many terrestrial invertebrates have high habitat specificity and the survey approach adopted a broad sampling effort focused on covering the range of vegetation types present rather than providing a high intensity survey at specific locations or habitats. The aim was to sample as wide a range of habitat and vegetation types as practicable, in order to capture the underlying variation in invertebrate communities.

Sampling at each of 10 locations in the vicinity of the UWHR Project sub-area included three pitfall traps, one malaise trap, sweep netting, beat sampling, and hand searching (where suitable habitat was available). The sampling sites are described in Table 1 and shown in Figure 4.

Table 1: Site descriptions and locations for terrestrial invertebrate traps in the Waimangaroa Valley.

Site #	Location	Site Description	NZTM 2000	
			Easting	Northing
1	South Cypress	Small patch of exotic grasses (c. <0.3m), surrounded by mānuka (*Leptospermum* spp) shrub, flax, hebes (e.g. *Veronica*) and yellow-silver pine (*Lepidothamnus intermedius*).	[redacted]	
2	South Cypress	Red tussock (*Chionochloa rubra*) (c. <0.5m), adjacent to mixed shrubland with mānuka, flax, tanglefern (*Gleichenia dicarpa*) and occasional bog pine (*Halocarpus bidwillii*).	[redacted]	
3	South Cypress	Tall forest (c. >15m) with kāmahi (*Pterophylla racemosa*), Southern rātā (*Metrosideros umbellata*), beech, *Dracophyllum.*	[redacted]	
4	Upper Waimangaroa	Short forest (c. 8m) mountain beech (*Fuscospora cliffortioides*), mānuka and podocarp forest.	[redacted]	
5	Upper Waimangaroa	Tall forest (c. >15m) with beech-podocarp, Southern rātā and broadleaf.	[redacted]	
6	Upper Waimangaroa	Bare sandstone erosion pavement with short (c. <0.5m) prostrate mānuka and wire rush (*Empodisma minus*).	[redacted]	
7	Upper Waimangaroa	Short mānuka (c. <0.5m) with wire rush, tussock, and tanglefern.	[redacted]	
8	Denniston	Tall forest (c. 15m) with kāmahi, *Dracophyllum townsonii,* pāhautea (*Libocedrus bidwillii*) and mountain beech.	[redacted]	
9	Denniston	Mānuka scrub (c. 1.5m) with wire rush and tanglefern.	[redacted]	
10	Denniston	Wire rush (c. <0.3 m) with inaka (*Dracophyllum rosmarinifolium*), pygmy pine (*Lepidothamnus laxifolius*) and square sedge (*Lepidosperma australe*).	[redacted]	



Figure 4: Terrestrial invertebrate sampling locations within the UWHR Project sub-area.

3.0 Field Surveys

3.1 Vegetation

3.1.1 Summary

The extent of each vegetation and landcover type present within the UWHR Disturbance Area and associated Indirect Effects Contingency (to provide for edge effects) is set out in Table 2. The distribution and location of each cover type is shown in Figure 5. Each vegetation type is described in more detail in Sections 3.1.2–3.1.4.

Vegetation within the UWHR Disturbance Area comprises mostly forest (17.7ha, 39.4%). There were two types of forest present including Southern rātā-mountain beech-podocarp forest (c. 12.6ha, 28.1%) and mixed beech-podocarp-broadleaved forest (c. 5.1ha, 11.4%). An additional c. 26ha of forest is located within the Indirect Effects Contingency and would be affected by edge effects.

Shrubland vegetation of various types makes up approximately 11.1ha (24.7%) of the UWHR Disturbance Area. The majority of the shrubland was mānuka-tussock-wire rush shrubland (c. 6.7ha, 14.9%), with smaller amounts of mānuka-mountain beech-podocarp shrubland (c. 3.4ha, 7.6%) and weedy shrubland (c. 1.0ha, 2.2%). An additional c. 9.3ha of shrubland is within the Indirect Effects Contingency and would be subject to edge effects.

Bare rock comprised c. 0.4ha (1.0%) of the UWHR Disturbance Area, noting that the route was chosen in part to avoid disturbance to the sandstone erosion pavement to the greatest extent practicable since it is a naturally uncommon ecosystem which cannot not be re-created. Cleared vegetation and water, generally associated with current or historic mining or roading activities, comprised 9.2ha (20.4%).

Table 2: Extent of vegetation and land cover types within the UWHR Project sub-area.

	Extent (ha)			Percentage of Disturbance Area
	Total	Disturbance Area	Indirect Effects Contingency	
Forest				
Mixed beech-podocarp-broadleaved forest	13.1	5.1	8.1	11.4
Southern rātā-mountain beech-podocarp forest	30.5	12.6	18.0	28.1
Shrubland				
Mānuka-mountain beech-podocarp shrubland	6.9	3.4	3.5	7.6
Weedy shrubland	1.5	1.0	0.5	2.2
Mānuka-tussock-wire rush shrubland	12.1	6.7	5.4	14.9
Low vegetation				
Low pākihi	10.6	5.9	4.6	13.2
Tussock-mountain flax shrubland	1.1	0.5	0.6	1.2
Non-vegetated land cover				
Bare Rock	1.1	0.4	0.7	1.0
Vegetation cleared	10.5	9.2	1.3	20.4
Water	0.2	0.0	0.2	0.0
Total	**87.6**	**44.8**	**42.8**	**100.0%**

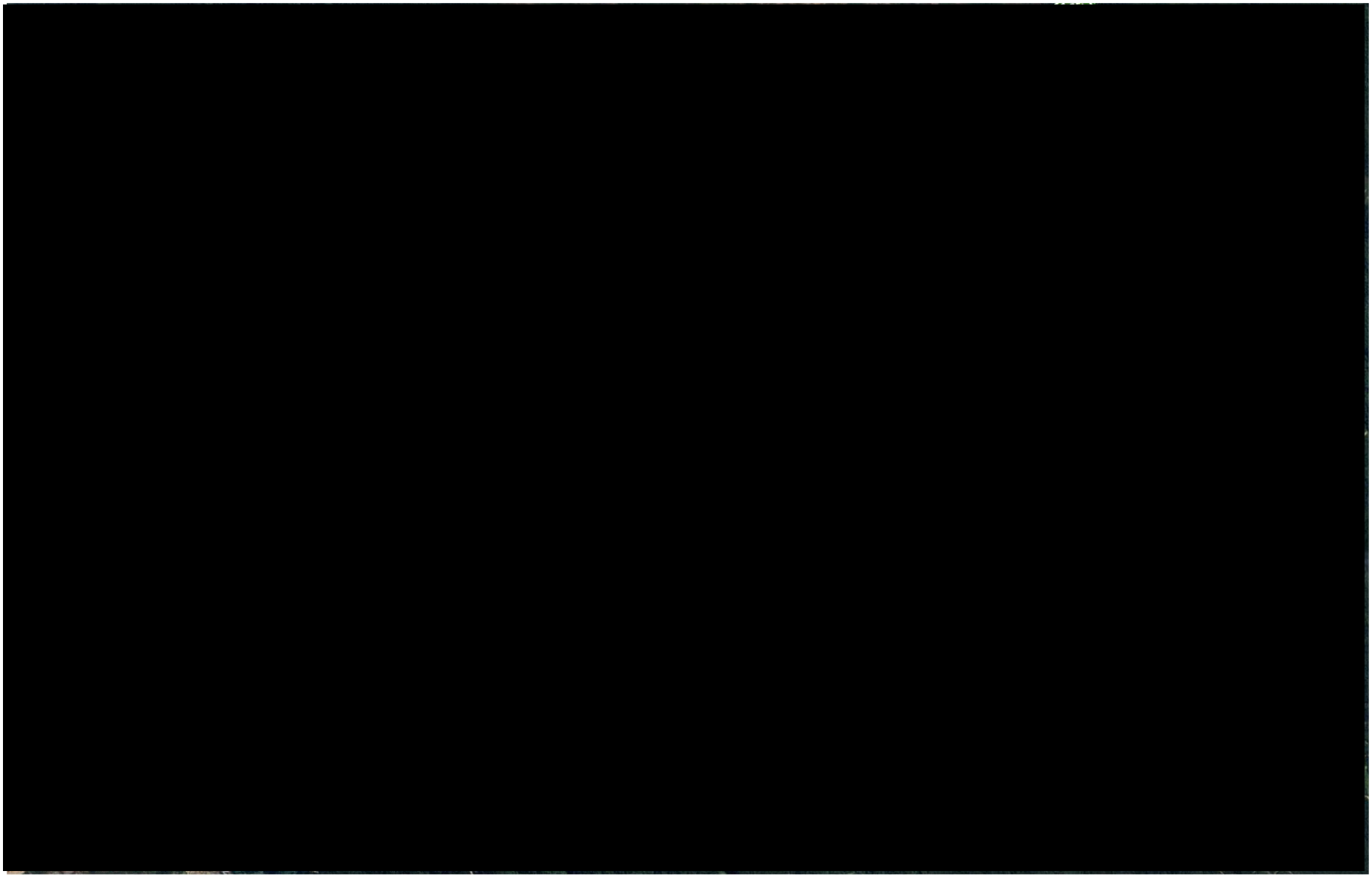


Figure 5: Vegetation and land cover types within the UWHR Project sub-area.

3.1.2 Forest Vegetation

Two forest types were present within the UWHR Disturbance Area. Southern rātā-mountain beech-podocarp forest was the most common (covering c. 12.6ha, 28.1%), and was common along the riparian margins of the Waimangaroa River, tributary gullies and sheltered areas throughout. This forest had a mean height of c. 7.5m, with a sparse emergent layer dominated by Southern rātā (*Metrosideros umbellata*). Pāhautea (*Libocedrus bidwillii*) formed a sparse but conspicuous component of the canopy in sheltered areas, typically near waterways. The canopy layer was dense, with abundant mountain beech (*Fuscospora cliffortioides*), common podocarps yellow-silver pine (*Lepidothamnus intermedius*) and pink pine (*Halocarpus bidwillii*) and occasional silver beech (*Lophozonia menziesii*). The understorey had a high species richness, including species such as weeping māpou (*Myrsine divaricata*), mountain toatoa (*Phyllocladus alpinus*), pseudopanax (*Pseudopanax colensoi* var. *ternata*, *P. linearis*) and various *Coprosma* and *Dracophyllum* species. Ground cover comprised mainly gahnia (*Gahnia procera*), *Astelia nervosa*, ferns and tree/shrub seedlings.

Mixed beech-podocarp-broadleaved forest occupied a smaller area (c. 5.1ha, 11.4%) and was present in the northern part of the UWHR Disturbance Area, near Cypress Mining Area. This vegetation was commonly associated with riparian margins and fertile colluvial material. It was characterised by tall (mean height c.12.4 m), dense, old growth forest, dominated by large forest trees such as red beech (*Fuscospora fusca*), silver beech, Hall's tōtara (*Podocarpus laetus*) and Southern rātā, with rimu (*Dacrydium cupressinum*) and red beech dominating the emergent layer. Other common species in the canopy and sub-canopy included kāmahi (*Pterophylla racemosa*), quintinia (*Quintinia serrata*) and dracophyllum (*Dracophyllum elegantissimum, D. traversii*). Ground cover was mainly dominated by ferns (small kiokio (*Parablechnum procerum*), crown fern (*Lomaria discolor*), *Hymenophyllum* species) and bush rice grass (*Microlaena avenacea*).

3.1.3 Shrubland Vegetation

The most common shrubland type present was mānuka-tussock-wire rush shrubland, which occupied approximately 6.7ha (c.15%) within the UWHR Disturbance area. This short vegetation had a mean height of c. 0.83m, with mānuka (*Leptospermum scoparium* agg.) dominating the canopy. *Dracophyllum* species (particularly *D. rosmarinifolium*), *Gahnia* spp. and tangle fern (*Gleichenia* spp.) were often present in the lower tiers. Ground cover was primarily mānuka and wire rush, with coal measures tussock (*Chionochloa juncea*) forming a conspicuous component.

Mānuka-mountain beech-podocarp shrubland occupied c. 3.4ha (7.6%). This shrubland was c. 3.9m tall on average, with the canopy dominated by mānuka and mountain beech, with yellow-silver pine, pink pine and Southern rātā also present in varying proportions. The understorey layer comprised saplings of canopy species, and shrubs such as *Coprosma* spp., prickly mingimingi (*Leucopogon fasciculatus*) and weeping māpou. Gahnia, mountain flax (*Phormium cookianum*) and wire rush (*Empodisma minus*) were abundant in the ground layer. This vegetation was sparsely distributed across the UWHR Disturbance area, often forming an ecotone between taller forest on more well-drained slopes and stunted shrubland and pākihi communities.

Weedy shrubland covered c. 1.0ha (2.2%) and was located near disturbed areas, such as along the existing vehicle track and near historic mining areas. This mixed species shrubland was of medium stature (mean height 2m) and comprised a range of indigenous and exotic species, including mānuka, kāmahi, pink pine, gorse (*Ulex europaeus*), *Juncus* species (soft rush (*Juncus effusus*), tailed seeded rush (*J. canadensis*) and heath rush (*J. squarrosus*)) and exotic grasses such as browntop (*Agrostis capillaris*) and Yorkshire fog (*Holcus lanatus*).

3.1.4 Low vegetation

Low pākihi occupied approximately 5.9ha (13.2%) of the UWHR Disturbance Area, usually on gently sloping, exposed areas associated with sandstone erosion pavement, particularly in the south-western part of the UWHR Disturbance A/rea (at Denniston). This short vegetation (mean height c. 0.27m) was dominated by prostrate mānuka and wire rush, with occasional red tussock (*Chionochloa rubra*), coal measures tussock and carpet grass (*Chionochloa australis*). *Carpha alpina*, cushion plant (*Donatia novae-zelandiae*), tangle fern (*Gleichenia dicarpa*) and sundews (*Drosera* spp.) were common in the ground layer. At more poorly drained locations this vegetation included common pākihi rush (*Machaerina teretifolia*), square sedge (*Lepidosperma australe*) and *Rytidosperma* spp. with occasional *Chionochloa* spp.

Small, localised patches of tussock-flax shrubland (mean height 0.93m) were sparsely distributed throughout the UWHR Disturbance area, together occupying an area of c. 0.5ha (1.1%). This vegetation was dominated by red tussock, along with occasional mountain flax and *Dracophyllum* spp. Wire rush and tangle fern were present in the ground layer. In the UWHR Project sub-area, this vegetation was associated with river terraces and poorly-drained sites.

3.1.5 Other landcover types

The UWHR Project sub-area included approximately 0.4ha (1.0%) of bare rock. This mostly comprised sandstone erosion pavement and is discussed in more detail below.

As well as the vegetation, there was approximately 9.2ha (20.4%) of cleared areas, and barely detectable areas of water. Within the UWHR Project sub-area water comprised natural river systems, rather than mine infrastructure.

3.1.6 Naturally Uncommon Ecosystems

The UWHR Disturbance Area included approximately 0.4ha of bare rock. This mostly comprised sandstone erosion pavement with a low proportion of prostrate/low growing vegetation cover including species such as carpet grass (*Chionochloa australis*), pygmy pine (*Lepidothamnus laxifolius*) prostrate *Dracophyllum* spp. and prostrate mānuka.

The UWHR Disturbance Area does not include boulderfields of acidic rock, but does include pākihi wetlands and small tarns and seepages and flushes. These are discussed further in Section 3.2.

3.1.7 ‘Threatened’ and ‘At Risk’ plant species

Ecological Solutions Limited (2026b) identified a total of approximately 542 vascular plant taxa which have been recorded from the Buller Plateaux since 1990. The majority (469 (87%)) of those were indigenous, with 70 (13%) exotic species. Thirty-one species (c. 6%) were of conservation concern. The flora of the UWHR Project sub-area includes ‘At Risk’ vascular plants (de Lange et al. 2024) as well as local endemics and species with disjunct (discontinuous) distributions.

No plants currently regarded as ‘Threatened’ are known to occur within the UWHR Project sub-area, but 12 ‘At Risk’ plants are known or expected to occur there including:

- *Bulbinella modesta* – ‘At Risk – Declining’;
- *Chionochloa juncea* – ‘At Risk – Declining’;
- *Dracophyllum densum* – ‘At Risk – Declining’;
- *Euphrasia wettsteiniana* – ‘At Risk – Declining’;

- Red mistletoe (*Peraxilla tetrapetala*) – 'At Risk – Declining';
- *Astelia subulata* – 'At Risk – Naturally Uncommon';
- *Brachyglottis traversii* – 'At Risk – Naturally Uncommon'.
- *Carex carsei* – 'At Risk – Naturally Uncommon';
- *Carex dallii* – 'At Risk – Naturally Uncommon';
- *Euphrasia disperma* – 'At Risk – Naturally Uncommon';
- *Pseudowintera traversii* – 'At Risk – Naturally Uncommon'; and
- *Schizacme helmsii* – 'At Risk – Naturally Uncommon'.

The 'Threatened – Nationally Vulnerable' bearded orchid *Calochilus paludosus* has been recorded on the Buller Plateaux, and may be seasonally present in pākihi vegetation within the UWHR Project sub-area.

3.2 Wetlands

Much of the Buller Plateaux exhibits hydrological and soil characteristics typical of wetlands, including soil saturation, surface water, stunted plants, a shallow aquitard (i.e., sandstone basement rock) and highly leached gley soils. The high rainfall contributes to maintaining these wetland features.

Low pākihi, mānuka-tussock-wire rush shrubland, mānuka-mountain beech-podocarp shrubland, and tussock-flax shrubland were all considered natural inland wetlands (Ecological Solutions Limited 2026b).

Mixed beech-podocarp-broadleaf forest and Southern rātā-mountain beech-podocarp forest were not considered natural inland wetlands (Ecological Solutions Limited 2026b). Weedy shrubland was not considered to be wetland, but in general, this group may require more site-specific consideration.

The extent of natural inland wetland within the UWHR Disturbance Area was approximately 16.5ha (37% of the UWHR Disturbance Area) as shown in Figure 6. These wetlands were scattered throughout the route. An additional 14.1ha of wetland, is located within the Indirect Effects Contingency area and would be subject to edge effects.

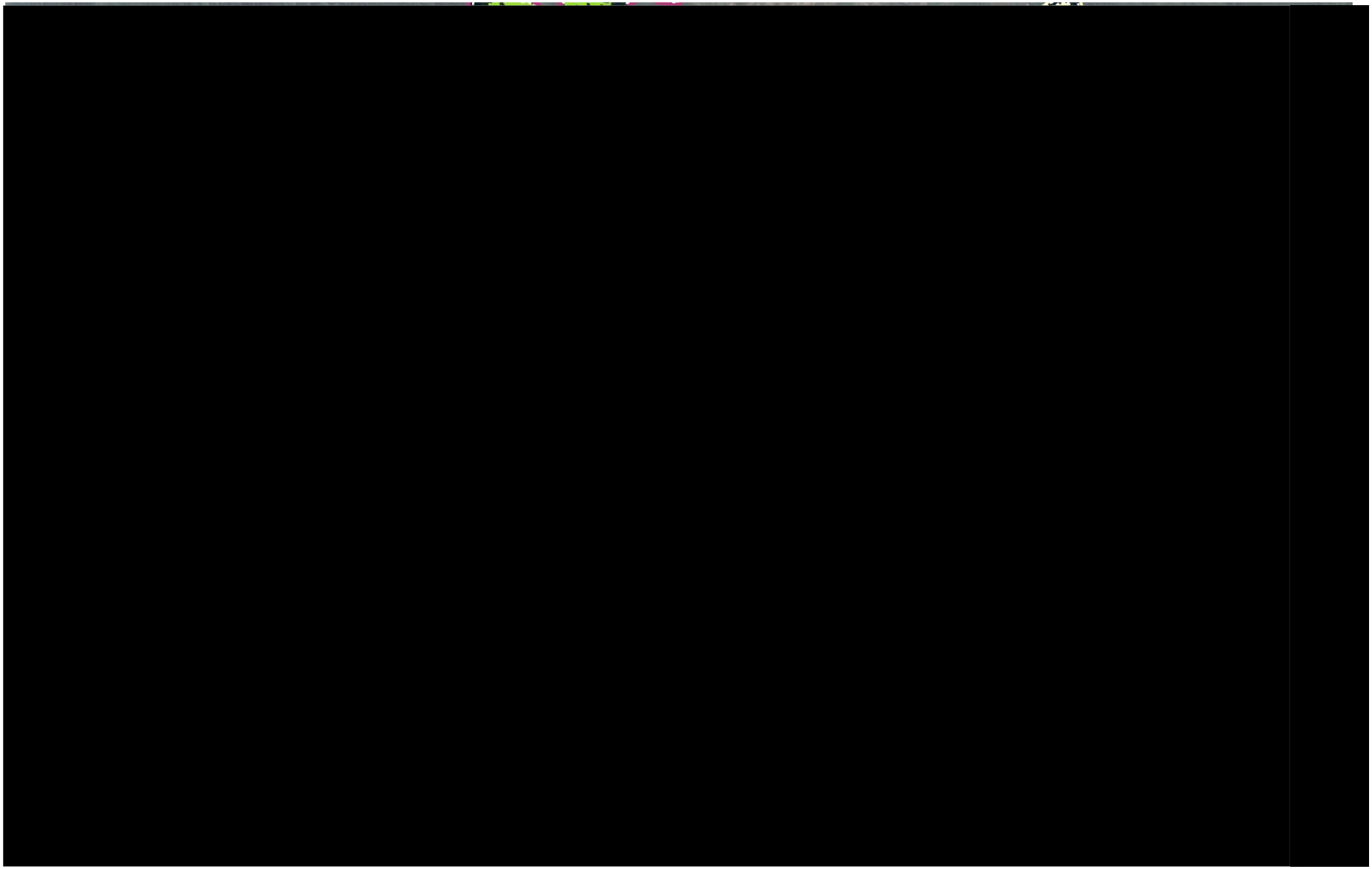


Figure 6: Natural inland wetlands within the UWHR Project sub-area.

3.3 Bryophytes

Eleven bryophytes considered to be 'At Risk' by de Lange et al. (2020) and Michel et al. (2026) are known to occur in the UWHR Project sub-area as listed in Table 3. Of those:

- One is considered 'At Risk – Declining'; and
- 10 are considered 'At Risk – Naturally Uncommon'.

The known locations of these species are shown in Figure 7. A list of bryophytes recorded from the plot survey within the UWHR Project sub-area and surrounds is provided in Appendix B.

The known New Zealand range of four bryophytes was extended by the surveys undertaken within the UWHR Project sub-area (i.e., there were new records of species outside their known range) including:

- *Chiloscyphus gippslandicus* (the only record in New Zealand is within the UWHR Project sub-area);
- *Porella cranfordii* (regarded as an Australian endemic);
- *Pyrrhobryum paramattense* (the first record from the South Island); and
- *Zoopsis matawaia* (new northern limit).

These records are discussed in more detail in Ecological Solutions Limited (2026c). Two species considered 'Data Deficient' were also recorded: *Ceramanus tuberifera* and *Cryptolophocolea leucophylla*.

Other species that may be present within the UWHR Project sub-area, because there is suitable habitat present, include *Isolembidium anomalum* var. *anomalum* and *Neogrollea notabilis* (both considered 'Threatened – Nationally Critical'), *Acromastigum verticale* and *Telaranea inaequalis* (both considered 'Threatened – Nationally Vulnerable'), *Saccogynidium decurvum* (At Risk – Declining), *Cryptolophocolea tuberculata, Herzogianthus vaginatus, Trichotemnoma corrugatum,* and *Riccardia furtiva* (all 'At Risk – Naturally Uncommon'). An additional species, *Riccardia exilis* (considered 'Data Deficient') has also been recorded from Deep Creek, Waimangaroa River and Cypress Stream and is therefore likely to be present.

Bryophytes of conservation concern are most frequently recorded from the following vegetation and habitat types within the UWHR Project sub-area as set out in Table 3:

- Southern rātā-mountain beech-podocarp forest;
- Silver beech-mountain beech forest;
- Mānuka-mountain beech-podocarp shrubland;
- Mānuka-tussock-wire rush shrubland; and
- Low pākihi.

Table 3: Bryophytes of conservation concern recorded from the UWHR Project sub-area.

Species of Conservation Concern	Potential Habitat
At Risk – Declining	
Acromastigum interstisiale	Riparian and vertical wet walls under mixed beech-podocarp-broadleaved forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, and mānuka-tussock-wire rush shrubland.
At Risk – Naturally Uncommon	
Blindia immersa	Instream through tussock-flax shrubland and Southern rātā-mountain beech-podocarp forest.
Campylopus kirkii	Mixed beech-podocarp-broadleaved forest, Southern rātā-mountain beech-podocarp forest, tussock-flax shrubland, and low pākihi.
Heteroscyphus billardierei	Silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, and low pākihi.
Lembidium longifolium	Densely shaded sites e.g. deep dark recesses, under Southern rātā-mountain beech-podocarp forest, and mānuka-tussock-wire rush shrubland.
Lepidolaena novae-zelandiae	Typically epiphytic on myrtaceous species, frequently on mānuka, also present on beech. Silver beech-mountain beech forest, Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka/Gahnia-wire rush shrubland, mānuka-tussock-wire rush shrubland, tussock-flax shrubland, and low pākihi.
Pleurophascum ovalifolium	Silver beech-mountain beech forest, mixed beech-podocarp-broadleaved forest Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, tussock-flax shrubland, mānuka-tussock-wire rush shrubland, mānuka-flax/wire rush shrubland, mānuka/Gahnia-wire rush shrubland, sandstone erosion pavement ('bare rock'), tanglefern shrubland and low pākihi.
Pyrrhobryum paramattense	Deep ravine under mixed beech-podocarp-broadleaved forest.
Zoopsis bicruris	Southern rātā-mountain beech-podocarp forest, mānuka-mountain beech-podocarp shrubland, mānuka-tussock-wire rush shrubland
Zoopsis ceratophylla	Southern rātā-mountain beech-podocarp forest, mānuka-tussock-wire rush shrubland.
Zoopsis matawaia	Deep ravine under mixed beech-podocarp-broadleaved forest, also Southern rātā-mountain beech-podocarp forest, and mānuka-mountain beech-podocarp shrubland.

3.4 Lichens

No specific search for lichens has been undertaken within the UWHR Project sub-area, but the habitats present include small amounts of sandstone erosion pavement and quartzite sands associated with ecotones between open areas and low pākihi, mānuka-mountain beech-podocarp shrubland, Southern rātā-mountain beech-podocarp forest and mānuka-tussock-wire rush shrubland which provide suitable habitat for 'Threatened' and 'At Risk' lichen species including: *Austropeltum glareosum*, *Pycnothelia caliginosa* (both 'Threatened – Nationally Endangered'), *Knightiella splachnirima, Cladia fuliginosa* (both 'Threatened – Nationally Vulnerable'), *C. inflata* ('At Risk – Declining'), *Calycidium cuneatum, Degeliella rosulata, Leiorreuma exaltatum, Micarea isabellina, Ochrolechia frigida,* and *Pseudocyphellaria lindsayi* (all considered 'At Risk – Naturally Uncommon' de Lange et al. 2018). This brings the total number of 'Threatened' and 'At Risk' lichens that may be present to 11, although the small amount of habitat available means that only very few individuals would likely be affected.

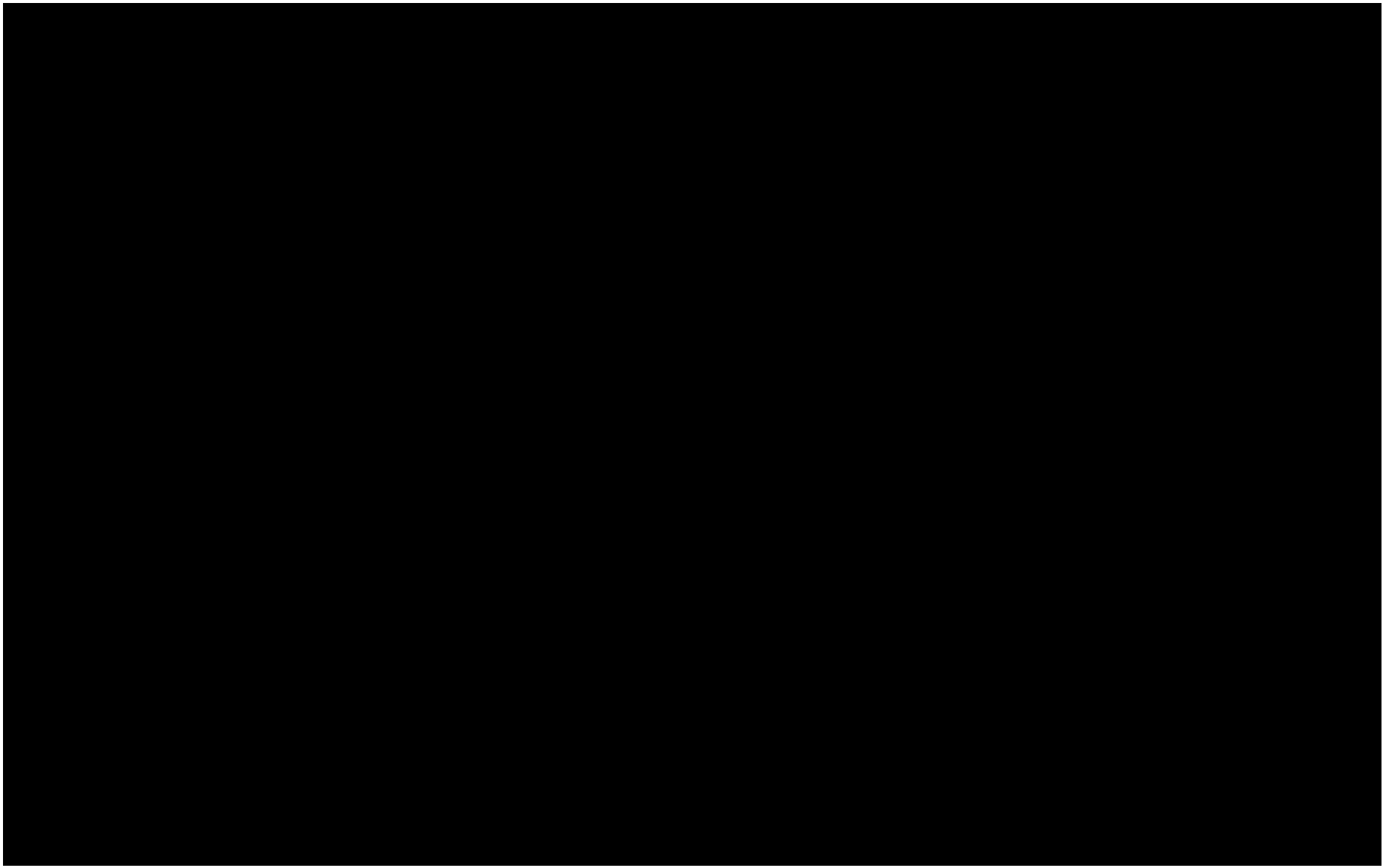


Figure 7: Location of bryophytes and lichens of conservation concern within the UWHR Project sub-area.

3.5 Avifauna

3.5.1 Five-minute bird counts

Ecological Solutions Limited (2026c) recorded the presence of 29 species of bird across the Buller Plateaux including nine 'Threatened' or 'At-Risk' species. Fifteen species (38%) were recorded during five-minute bird counts along the UWHR Project sub-area route including 13 indigenous species and two introduced and naturalised species as shown in Table 4. Call counts were moderate (>3.5 calls per count), perhaps indicative of the preponderance of forest habitats along the route suitable for birds.

Three species of conservation concern were recorded within the UWHR Project sub-area including pihoihoi/New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*), mātātā/South Island fernbird (*Poodytes punctatus*) and kakaruwai/South Island robin (*Petroica australis*), all of which are regarded as 'At Risk – Declining' (Robertson et al. 2021).

Table 4: Results of five-minute bird counts within the UWHR Project sub-area.

	Species	Year	
		2019	2020
Endemic	Bellbird (*Anthornis melanura*)	1.575	0.935
	Brown creeper (*Mohoua novaeseelandiae*)	0.270	0.105
	Grey warbler (*Gerygone igata*)	0.780	0.735
	New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*)	0.055	0.025
	Rifleman (*Acanthisitta chloris*)	0.120	0.000
	South Island fantail (*Rhipidura fuliginosa*)	0.400	0.490
	South Island fernbird (*Poodytes punctatus*)	0.090	0.135
	South Island robin (*Petroica australis australis*)	0.240	0.155
	South Island tomtit (*Petroica macrocephala macrocephala*)	0.600	0.375
	Tui (*Prosthemadera novaeseelandiae*)	0.430	0.055
	Western weka (*Gallirallus australis australis*)	0.090	0.005
Native	Silvereye (*Zosterops lateralis*)	0.215	0.485
	Welcome swallow (*Hirundo neoxena*)	0.025	0.000
	Total indigenous	**4.890**	**3.500**
Introduced	Chaffinch (*Fringilla coelebs*)	0.105	0.025
	Common redpoll (*Acanthis flammea*)	0.450	0.035
	Total introduced	**0.555**	**0.060**
	Overall total	**5.445**	**3.560**

3.6 Lizards

Four forest gecko and one West Coast green gecko were found within the UWHR Project sub-area and surrounds by Alliance Ecology during the 2020 survey. The majority (c. 93%) of habitats in the UWHR were assessed as 'high value' for lizards. West Coast green gecko are listed as 'Threatened – Nationally Vulnerable', whilst forest gecko is regarded as 'At Risk – Declining' (Hitchmough et al. 2026).

Though most lizards were found in low and open vegetation, this is likely a result of increased detectability in these habitats compared with taller vegetation. An evaluation of habitats within the BPCP Project Area found that the highest value lizard habitats were those nearest areas of high topographical diversity such as forested gullies surrounded by

sandstone erosion pavement and pākihi.

3.7 Terrestrial Invertebrates

Almost three thousand (n=2,834) individual invertebrates from 154 taxa were identified from the samples. A full list of taxa is provided in Appendix C. The species-richness of invertebrates was highest at Site 8 (n=76) and Site 5 (n=67) which were predominantly tall forest (c. 15m) and lowest at Site 10 (n=4) and Site 7 (n=15), which were predominantly short vegetation (c. < 0.3m) dominated by wire rush and tussock. The species richness at each sampling site is shown in Figure 8.

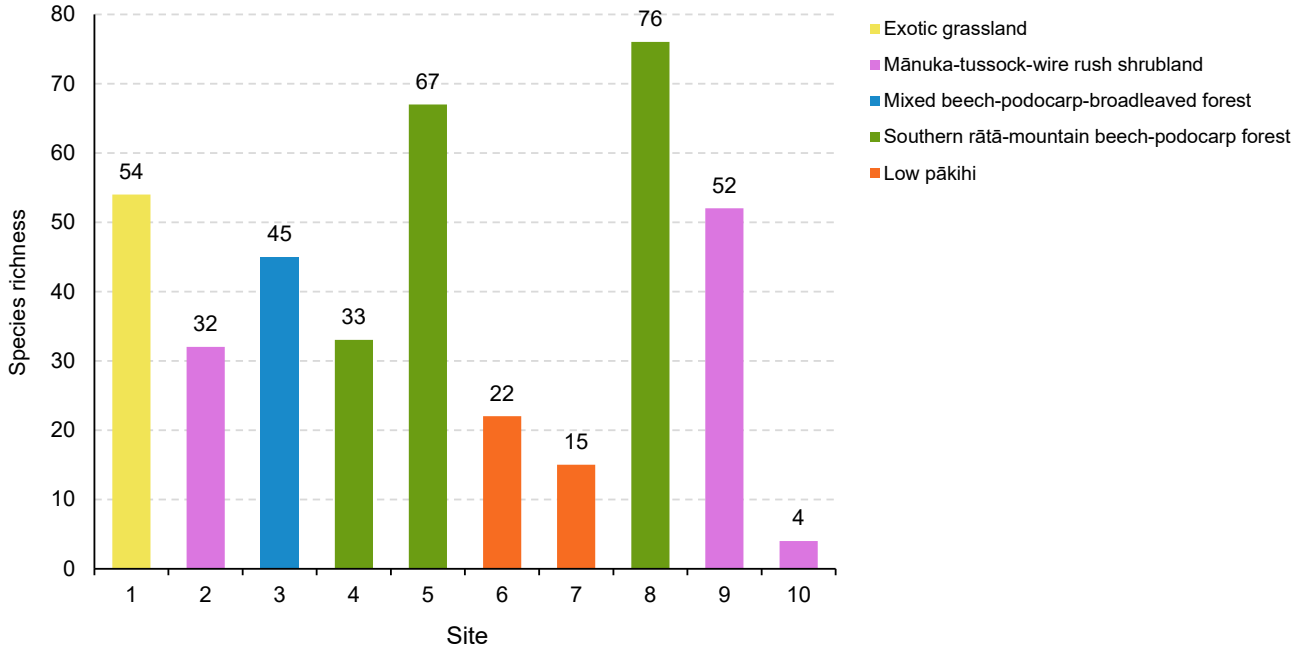


Figure 8: Species richness at each invertebrate sampling site within the UWHR Project sub-area.

The majority (94%) of the terrestrial invertebrates collected were native. By way of example, all of the ant species recorded during the survey were native. The lack of adventive species demonstrates that the UWHR Project sub-area invertebrate community retains a high degree of natural integrity, despite many decades of human activity in surrounding areas including mining, residential settlements, road construction, erection and maintenance of the powerlines and more recently recreational use.

4.0 Conclusion

The UWHR Project sub-area is approximately 19km long with the road formation typically 16.7m wide, connecting the Denniston and Stockton Plateaux. Approximately 4km of the length would be greenfield disturbance, with the remainder having been modified to some degree, primarily by existing roads and tracks. Vegetation cover within the UWHR Disturbance Area comprises mostly forest and shrubland. Small parts of the UWHR Disturbance Area comprise low vegetation, sandstone erosion pavement, cleared vegetation and water. The small amount of sandstone erosion pavement was a deliberate decision based on the irreplaceability of this naturally uncommon ecosystem when comparing the ecological impacts of the alternative proposed routes (Ecological Solutions

Limited 2026). Approximately 16.5ha of the UWHR Disturbance Area is comprised of scattered natural inland wetlands, with an additional 14.1ha of wetlands influenced by edge effects.

With respect to the non-vascular flora, the UWHR Project sub-area is known to contain eleven bryophyte species listed as 'At Risk' by de Lange et al. (2020) and Michel et al. (2026). Another 11 species of 'Threatened' or 'At Risk' lichens may be present. Five of the ten important habitat types for bryophytes occur within the UWHR Project sub-area, although generally in small patches including:

- Southern rātā-mountain beech-podocarp forest;
- Silver beech-mountain beech forest;
- Mānuka-mountain beech-podocarp shrubland;
- Mānuka-tussock-wire rush shrubland; and
- Low pākihi.

Fifteen bird species (of the 29 recorded to use the Buller Plateaux) were recorded along the UWHR Project sub-area in moderate numbers. Three species regarded as 'At Risk – Declining' were recorded including pihoihoi/New Zealand pipit, mātātā/South Island fernbird and kakaruwai/South Island robin. Roroa/great spotted kiwi ('Threatened – Nationally Vulnerable') are present in low densities surrounding the UWHR project sub-area and the area will include small parts of the home ranges of an unknown number of individual birds.

The UWHR Project sub-area provides habitat assessed as 'high value' to lizards. Two lizard species were recorded within the project sub-area including one regarded as 'Threatened – Nationally Vulnerable' (West Coast green gecko) and one 'At Risk – Declining' (forest gecko) (Hitchmough et al. 2026).

Terrestrial invertebrate communities within the UWHR Project sub-area have been shown to retain a high degree of natural integrity despite long-term human activities, with the majority (94%) of invertebrates collected in surveys identified as native.

5.0 References

de Lange, P., Blanchon, D., Knight, A., Elix, J., Lucking, R., Frogley, K., Harris, A., Cooper, J., and Rolfe, J. 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27. Department of Conservation, Wellington. 64 pp.

de Lange, P.J., Glenny, D., Frogley, K., Renner, M.A.M., von Konrat, M., Engel, J.J., Reeb, C., and Rolfe, J.R. 2020. Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31. Department of Conservation, Wellington. 30 pp.

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

Ecological Solutions Limited. 2026. Upper Waimangaroa Haul Road (UWHR) Options Assessment. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 24 pages.

Ecological Solutions Limited. 2026a. Buller Coal Plateau Continuation Project: Terrestrial

Ecological Impact Assessment Report. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. 98 pages + appendices.

Ecological Solutions Limited. 2026b. Buller Plateaux Vegetation Mapping. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. January 2026. 65 pages + appendices.

Ecological Solutions Limited. 2026c. Buller Plateaux Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 101 pages + appendices.

Ecological Solutions Limited. 2026d. Buller Plateaux Continuation Project: Escarpment Extended Project Sub-Area Baseline Surveys. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited, Kāeo, Northland. August 2026. 37 pages + appendices.

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson G.B., Reardon J.T., van Winkel, D., Makan, T., and Michel, P. 2026. Conservation status reptiles in Aotearoa New Zealand, 2025. New Zealand Threat Classification Series 50. Department of Conservation, Wellington. 32 pp.

Hurst, J.M., Allen, R.B. & Fergus, A.J. 2022. The Recce method for describing New Zealand vegetation – expanded manual. Version 5.

Meagher, D. 2020. Proposed Road Alignment, Stockton Plateau – Bryophyte Surveys 2019 – 2020. Unpublished report by Zymurgy Consulting Limited for Bathurst Resources Limited. 15pp + appendices. Zymurgy Consulting, Surrey Hills, Australia.

Michel, P., deRegnier, R., Emmitt, T., Ford, M., Perrie, L., Pritchard, A.S.E. 2026. Conservation status of mosses in Aotearoa New Zealand, 2025. Report 1155. Department of Conservation, Wellington. New Zealand Threat Classification System Series 49.

Ministry for the Environment (MfE).2020a. Wetland delineation protocols. Wellington: Ministry for the Environment.

Ministry for the Environment (MfE). 2020b. National Policy Statement for Freshwater Management (NPS-FM) 2020. Amended December 2025.

Mitchell Daysh Limited. 2026. Buller Plateaux Continuation Project Assessment of Environmental Effects.

Nichol, R. 2020. Baseline Bird Survey within Marshalls North, Marshalls South and Deep Stream, Stockton Plateau. Unpublished report prepared by Richard Nichol Ecology.

Nichol, R. 2022. Kiwi and Weka Survey, Winter 2022 Escarpment Mine and Denniston Permanent Protection Area Denniston Plateau. Unpublished report prepared by Richard Nichol Ecology Ltd.

Robertson, H.A., Baird, K.A., Elliott, G.P., Hitchmough, R.A., McArthur, N.J., Makan, T.D., Miskelly, C.M., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A., and Michel, P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 pp.

APPENDIX A

Vegetation plots within the UWHR Project sub-area

Plot reference	NZTM_East	NZTM_North	Vegetation group
OTS 17	[redacted]	[redacted]	Mānuka-tussock-wire rush shrubland
OTS 33 OS	[redacted]	[redacted]	Mānuka-tussock-wire rush shrubland
BCP10	[redacted]	[redacted]	Low pākihi
DS05	[redacted]	[redacted]	Weedy shrubland

APPENDIX B

Bryophytes recorded within the UWHR Project sub-area

Species of conservation concern are marked in bold (de Lange et al. 2020, Michel et al. 2026).
Species list recorded by Dr David Meagher (2020):

Achrophyllum quadrifarium
Acrobolbus cinerascens
Acrobolbus epiphytus
Acrobolbus knightii
Acrobolbus lophocoleoides
Acrobolbus saccatus
Acrobolbus tenellus var. *diversifolius*
Acrochila biserialis
Acromastigum anisostomum
Acromastigum cavifolium
Acromastigum colensoanum
Acromastigum interstisiale – ***'At Risk – Naturally Uncommon'***
Adelanthus falcatus
Adelanthus occlusus
Anastrophyllopsis subcomplicata
Andreaea mutabilis
Balantiopsis convexiuscula
Balantiopsis diplophylla
Balantiopsis tumida
Bazzania adnexa
Bazzania engelii
Bazzania hochstetteri
Bazzania involuta var. *submutica*
Bazzania monilinervis
Bazzania nitida
Bazzania novae-zelandiae
Bazzania tayloriana
Calyptrochaeta cristata
Campylopus kirkii
Ceramanus tuberifera – 'Data Deficient'
Cheilolejeunea sp.
Chiloscyphus aperticaulis
Chiloscyphus austrigenus subsp. *okaritanus*
Chiloscyphus gippslandicus
Chiloscyphus muricatus
Chiloscyphus novae-zeelandiae var. *novae-zeelandiae*
Chiloscyphus semiteres
Cladomnion ericoides
Cryptolophocolea leucophylla – 'Data Deficient'
Cryptolophocolea mitteniana var. *mitteniana*
Cryptolophocolea spinifera
Cuspidatula kirkii
Cuspidatula monodon
Cyathophorum bulbosum
Dendroligotrichum tongariroense
Dicnemon calycinum
Dicnemon dixonianum
Dicnemon semicryptum
Dicranoloma billardierei
Dicranoloma menziesii
Dicranoloma robustum
Dinckleria pleurata
Distichophyllum crispulum
Distichophyllum pulchellum
Distichophyllum rotundifolium
Drepanolejeunea aucklandica
Frullania ptychantha
Frullania rostrata
Goebeliella cornigera
Gottschea pinnatifolia
Gottschea tuloides
Herbertus oldfieldianus
Heteroscyphus billardierei – ***'At Risk – Naturally Uncommon'***

Heteroscyphus cuneistipulus
Heteroscyphus decipiens
Heteroscyphus echinellus var. *hyalinus*
Heteroscyphus triacanthus
Holomitrium perichaetiale
Hymenophyton flabellatum
Hypnodendron arcuatum
Hypnum cupressiforme var. *cupressiforme*
Hypopterygium commutatum
Hypopterygium rotulatum
Isotachis intortifolia
Kurzia compacta
Kurzia helophila
Kurzia hippurioides
Kurzia pallescens
Lejeunea sp.
Lembidium nutans
Lembophyllum clandestinum
Lepicolea scolopendra
Lepidogyna hodgsoniae
Lepidolaena novae-zelandiae – ***'At Risk – Naturally Uncommon'***
Lepidolaena palpebrifolia
Lepidolaena taylorii
Lepidozia hirta
Lepidozia kirkii
Lepidozia pendulina
Lepidozia procera
Lepidozia setigera
Lepidozia spinosissima
Leptoscyphus australis
Leptostomum inclinans
Leptotheca gaudichaudii
Leucobryum candidum
Lobatiriccardia alterniloba
Macromitrium longipes
Marchantia foliacea
Megaceros flagellaris
Metzgeria decipiens
Metzgeria leptoneura
Mniodendron colensoi
Mniodendron comatum
Mniodendron comosum
Monoclea forsteri
Neolepidozia patentissima
Neolepidozia praenitens
Nothogymnomitrium erosum
Plagiochila banksiana
Plagiochila deltoidea
Plagiochila ramosissima
Plagiochila stephensoniana
Plagiochila subfasciculata
Plagiochila trispicata
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Porella cranfordii
Porella elegantula
Pseudomarsupidium piliferum
Psiloclada clandestina subsp. *clandestina*
Psilopilum australe
Ptychomnion aciculare
Pyrrhobryum mnioides
Pyrrhobryum paramattense – ***'At Risk – Naturally Uncommon'***
Radula multiamentula
Radula tasmanica
Rhaphidorrhynchium amoenum
Rhizogonium distichum
Rhizogonium pennatum

Riccardia bipinnatifida
Riccardia cochleata
Riccardia colensoi
Riccardia crassa
Riccardia eriocaula
Riccardia nitida
Riccardia pusilla
Schistochila ciliata
Schistochila glaucescens
Schistochila kirkiana
Schistochila lehmanniana
Schistochila sp. 'lithophila'
Schistochila nobilis
Schistochila pseudociliata
Schistochila sp. aff. *pseudociliata*
Sciadocladus kerrii
Sciadocladus menziesii
Solenostoma inundatum
Solenostoma orbiculatum
Sphagnum australe
Sphagnum novo-zelandicum
Symphyogyna subsimplex
Syzygiella colorata
Syzygiella sonderi
Telaranea herzogii
Telaranea quinquespina
Temnoma quadrifidum
Temnoma quadripartitum
Thuidiopsis furfurosa
Thuidium laeviusculum
Trichocolea hatcheri
Trichocolea mollissima
Tricholepidozia lindenbergii
Tricholepidozia remotifolia
Tricholepidozia tetradactyla
Weymouthia cochlearifolia
Weymouthis mollis
Wijkia extenuata
Zoopsis argentea var. *argentea*
Zoopsis matawaia – ***'At Risk – Naturally Uncommon'***
Zygodon intermedius.

Opportunistic Survey – ESL (2025)
Location: UWHR (near an unnamed tributary of Burnett Stream)
Plot ID: Cedar Creek Road 'opportunistic pull'
Cultural: Natural
Grid reference (NZTM): [redacted]
Date measured: 15 May 2025
Altitude: 570 m asl
Area: c. 30 x 30 cm
Plot description: Sheets of bryophytes on bank wall, and bryophyte floor.

<u>Sheets</u>:
Acromastigum colensoanum
Acromastigum marginatum
Bazzania monilinervis
Bazzania nitida
Ceramanus tuberifera – 'Data Deficient'
Kurzia hippuroides
Lepidozia sp.
Zoopsis bicruris – ***'At Risk – Naturally Uncommon'***
Zoopsis ceratophylla – ***'At Risk – Naturally Uncommon'***
Zoopsis setulosa.

<u>Floor</u>:
Acrobolbus lophocoleoides
Acrobolbus saccatus
Acromastigum anisostomum
Cryptolophocolea trialata
Kurzia hippuroides
Lepidozia bidens
Lepidozia pendulina
Leptoscyphus excipulatus
Neolepidozia patentissima
Rhizogonium pennatum
Zoopsis setulosa.

APPENDIX C

Terrestrial invertebrates collected within the UWHR Project sub-area

Order	Family	Species
Acari	Unid.	Unid. sp.
Amphipoda	Talitridae	Unid. sp.
Araneae	Clubionidae	*Clubiona* sp.
Araneae	Lycosidae	*Anoteropsis adumbrata*
Araneae	Lycosidae	Unid. sp.
Araneae	Orsolobidae	Unid. sp.
Araneae	Thomisidae	*Diaea* sp.
Araneae	Thomisidae	*Sidymella* sp.
Araneae	Zoropsidae	*Uliodon* sp. ? Juv.
Araneae	Unid.	Unid. sp.
Coleoptera	Carabidae	*Ctenognathus helmsi*
Coleoptera	Carabidae	*Neoferonia* nr. *integrata*
Coleoptera	Curculionidae	Unid. sp.
Coleoptera	Hydrophilidae	Unid. sp.
Coleoptera	Leiodidae	Unid. sp.
Coleoptera	Scarabaeidae	*Saphobius* sp.
Coleoptera	Staphylinidae	Unid. sp.
Coleoptera	Unid.	Unid. sp.
Collembola	Unid.	Unid. sp.
Dermaptera	Labiduridae	*Parisolabis* sp. cf. *novaezeelandiae*
Diplopoda	Sphaerotheridae	*Procyliosoma delacyi striolatum*
Diptera	Agromyzidae	*Cerodontha australis*
Diptera	Cecidomyiidae	Unid. sp.
Diptera	Ceratopogonidae	Unid. sp.
Diptera	Chironomidae	Unid. sp.
Diptera	Chloropidae	*Diplotoxa* cf. *neozelandica*
Diptera	Chloropidae	*Tricimba* sp. nr. *watti*
Diptera	Dixidae	*Dixella* cf. *fuscinervis*
Diptera	Dolichopodidae	Unid. sp.
Diptera	Empididae	Unid. sp.
Diptera	Ephydridae	*Psilopa metallica*
Diptera	Ephydridae	Unid. Notophilinae
Diptera	Heleomyzidae	*Allophylopsis scutellata* group
Diptera	Heleomyzidae	*Allophylopsis* sp.
Diptera	Heleomyzidae	*Fenwickia* cf. *hirsuta*
Diptera	Huttoninidae	*Huttonina elegans*
Diptera	Keroplatidae	*Macrocera scoparia*
Diptera	Keroplatidae	*Pyrtaula* sp. 6 (of Toft)
Diptera	Muscidae	Unid. sp.
Diptera	Mycetophilidae	*Allocotocera crassipalpis*
Diptera	Mycetophilidae	*Allocotocera dilatata*

Diptera	Mycetophilidae	*Aneura appendiculata*
Diptera	Mycetophilidae	*Aneura longipalpis*
Diptera	Mycetophilidae	*Aneura pallida*
Diptera	Mycetophilidae	*Aneura* spp.
Diptera	Mycetophilidae	*Brevicornu* sp.
Diptera	Mycetophilidae	*Cycloneura* nr. *flava*
Diptera	Mycetophilidae	*Cycloneura* nr. *triangulata*
Diptera	Mycetophilidae	*Exechia hiemalis*
Diptera	Mycetophilidae	*Exechia* sp.
Diptera	Mycetophilidae	*Morganiella* sp. 1 (of Toft)
Diptera	Mycetophilidae	*Mycetophila* cf. *consobrina*
Diptera	Mycetophilidae	*Mycetophila conica*
Diptera	Mycetophilidae	*Mycetophila diffusa*
Diptera	Mycetophilidae	*Mycetophila dilatata*
Diptera	Mycetophilidae	*Mycetophila elongata*
Diptera	Mycetophilidae	*Mycetophila fagi*
Diptera	Mycetophilidae	*Mycetophila filicornis*
Diptera	Mycetophilidae	*Mycetophila marginepunctata*
Diptera	Mycetophilidae	*Mycetophila marshalli*
Diptera	Mycetophilidae	*Mycetophila minima*
Diptera	Mycetophilidae	*Mycetophila nitens* group
Diptera	Mycetophilidae	*Mycetophila* nr. *impunctata*
Diptera	Mycetophilidae	*Mycetophila* nr. *submarshalli*
Diptera	Mycetophilidae	*Mycetophila phyllura*
Diptera	Mycetophilidae	*Mycetophila spinigera*
Diptera	Mycetophilidae	*Mycetophila virgata*
Diptera	Mycetophilidae	*Mycetophila vulgaris* group
Diptera	Mycetophilidae	*Mycetophila* nr. *impunctata*
Diptera	Mycetophilidae	*Mycetophila* sp. 9
Diptera	Mycetophilidae	*Mycetophila* sp. "dark, wing unmarked"
Diptera	Mycetophilidae	*Mycomya* nr. *furcata*
Diptera	Mycetophilidae	*Neoaphelomera* sp.
Diptera	Mycetophilidae	*Neotrizygia* sp. 2 (of Toft)
Diptera	Mycetophilidae	*Paradoxa fusca*
Diptera	Mycetophilidae	*Phthinia longiventris*
Diptera	Mycetophilidae	*Taxicnemis* cf. *marshalli*
Diptera	Mycetophilidae	*Tetragoneura* sp. 15 (of Toft)
Diptera	Mycetophilidae	*Tetragoneura* sp.
Diptera	Mycetophilidae	*Zygomyia* "albinotata group"
Diptera	Mycetophilidae	*Zygomyia* "fusca group"
Diptera	Mycetophilidae	*Zygomyia* cf. *nigrohalterata*
Diptera	Mycetophilidae	*Zygomyia nigriventris*
Diptera	Mycetophilidae	*Zygomyia penicillata*

Diptera	Mycetophilidae	*Zygomyia similis* group
Diptera	Phoridae	Unid. sp.
Diptera	Polleniidae	*Pollenia* sp.
Diptera	Psychodidae	Unid. sp.
Diptera	Sarcophagidae	*Oxysarcodexia varia*
Diptera	Sciaridae	Unid. sp.
Diptera	Simulidae	*Austrosimulium* sp.
Diptera	Sphaeroceridae	"Leptocera (Limosina)" sp.
Diptera	Sphaeroceridae	*Howickia* cf. *myersi*
Diptera	Tachinidae	Unid. sp.
Diptera	Tephritidae	*Trupanea alboapicata*
Diptera	Tephritidae	*Trupanea* cf. *centralis*
Diptera	Tipulidae	*Amphineurus fatuus*
Diptera	Tipulidae	*Limonia* cf. *luteonitens*
Diptera	Tipulidae	*Limonia* cf. *sulphuralis*
Diptera	Tipulidae	*Limonia* sp.
Diptera	Tipulidae	*Metalimnophila* sp.
Diptera	Tipulidae	*Molophilus* sp.
Diptera	Tipulidae	*Nothophila fuscana*
Diptera	Tipulidae	*Pedicia* (*Tricyphona*) sp. 1 (of Toft)
Diptera	Tipulidae	*Zelandoglochina* cf. *octava*
Diptera	Tipulidae	Unid. sp. (Larvae)
Diptera	Trichoceridae	*Adura* sp.
Diptera	Trichoceridae	*Zedura* sp.
Diptera	Unid.	Unid. Larvae
Gastropoda	Unid.	Unid. microsnail
Hemiptera	Aphididae	Unid. sp.
Hemiptera	Auchenorrhyncha	Unid. Juv.
Hemiptera	Ceratocombidae	*Ceratocombus* cf. *aotearoae*
Hemiptera	Cicadellidae	*Paracephaleus curtus*
Hemiptera	Cicadellidae	Unid. sp.
Hemiptera	Coccoidea	Unid. Male scale
Hemiptera	Delphacidae	Unid. sp.
Hemiptera	Psylloidea	Unid. sp.
Hymenoptera	Aphelinidae	Unid. sp.
Hymenoptera	Braconidae	Unid. Alysiinae
Hymenoptera	Braconidae	Unid. Aphidiinae
Hymenoptera	Braconidae	Unid. Microgastrinae
Hymenoptera	Braconidae	*Neptihormius* sp.
Hymenoptera	Ceraphronidae	Unid. sp.
Hymenoptera	Diapriidae	Unid. sp.
Hymenoptera	Encrytidae	Unid. sp.
Hymenoptera	Eulophiidae	Unid. sp.

Hymenoptera	Formicidae	*Austroponera* sp. (male)
Hymenoptera	Formicidae	*Chelaner antarcticus*
Hymenoptera	Formicidae	*Chelaner* nr. *smithii*
Hymenoptera	Formicidae	*Huberia striata*
Hymenoptera	Formicidae	*Prolasius advena*
Hymenoptera	Ichneumonidae	*Aucklandella* sp.
Hymenoptera	Ichneumonidae	Unid. Campopleginae
Hymenoptera	Ichneumonidae	*Mesochorus* sp.
Hymenoptera	Ichneumonidae	Unid. sp.
Hymenoptera	Mymaridae	Unid. sp.
Hymenoptera	Platygastridae	Unid. sp.
Hymenoptera	Pompilidae	*Sphictostethus nitidus*
Hymenoptera	Proctotrupidae	Unid. sp.
Hymenoptera	Vespidae	*Vespula vulgaris*
Hymenoptera	Unid.	Unid. sp.
Isopoda	Styloniscidae	*Styloniscus* sp.
Lepidoptera	Unid.	Unid. Larvae
Lepidoptera	Unid.	Unid. sp.
Oligochaeta	Unid.	Unid. sp.
Opiliones	Unid. Eupnoi family	Unid. sp.
Opiliones	Triaenonychidae	Unid. sp.
Orthoptera	Anostostomatidae	*Hemideina crassidens*
Orthoptera	Rhaphidophoridae	Unid. sp.
Plecoptera	Notonemouridae	*Omanuperla bruningi*
Psocoptera	Unid.	Unid. sp.
Trichoptera	Unid.	Unid. sp.
Tricladida	Geoplanidae	Unid. sp.

APPENDIX G

Technical Evaluation to Accompany an Application for a Wildlife Act Authorisation for the Project (Ecological Solutions Limited 2026g)

ecoLogical Solutions
Environmental Consultants



August 2026

Buller Plateaux Continuation Project
Wildlife Act Authorisation Technical Report

Prepared for Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by: [redacted]
Ecologist

[redacted]
Ecologist

[redacted]
Ecologist

Reviewed by: [redacted]
Ecologist

Status: Final **Issued:** August 2026

ecoLogical solutions

tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 2/195 main highway,
ellerslie, Auckland, 1051
p: 021 578

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

Table of Contents

1.0 Introduction 5
2.0 Information Requirements 5
3.0 Purpose of the Proposed Activity 6
4.0 Actions to be Carried Out 6
5.0 Impact Assessment 9
6.0 Protected Wildlife 9
6.1 Species Known or Predicted in the Area 9
6.2 Avifauna 12
6.3 Lizards 13
6.4 Terrestrial Invertebrates 13
7.0 Impacts on Threatened, Data Deficient and At-Risk Species 13
7.1 Threatened Wildlife Species 14
7.2 At Risk Wildlife Species 15
7.3 Data Deficient Species 15
8.0 Meeting Best Practice Standards 15
9.0 Methods to Catch, Hold or Kill 16
9.1 Summary 16
9.2 Great spotted kiwi / roroa 16
9.3 Weka 17
9.4 South Island robin/South Island fernbird 17
9.5 Lizards 18
9.6 Powelliphanta patrickensis 18
9.6.1 Information Requirements 18
9.6.2 Search method 18
9.6.3 Handling method 19
9.6.4 Relocation 19
9.7 Powelliphanta augusta 19
9.7.1 Information Requirements 19
9.7.2 Search method 20
9.7.3 Handling method 20
9.8 Personnel to undertake authorised activities 20
10.0 Proposed Activity Locations 20
11.0 Holding or Relocating Wildlife 24
12.0 Actual and Potential Effects 24
13.0 Methods to Avoid/Minimise Adverse Effects 25

14.0 Offences and Current Charges 26
15.0 Proof of Consultation 26
16.0 Additional Supporting Documentation 27
17.0 References 27

Index to Tables

Table 1: Extent of vegetation types (i.e. habitats) removed within Disturbance Areas at each Fast Track Project Sub-area. 8

Table 2: 'Threatened' and 'At Risk' wildlife species that are known or predicted to be present within the Project Sub-areas. 10

Table 3: Management methods to avoid or minimise effects on 'Threatened' and 'At Risk' protected wildlife. 25

Index to Figures

Figure 1: Proposed Activity Locations – Fast Track Sub-areas 22

Figure 2: Location of pest proof exclosures and weka release locations associated with the Buller Plateau Continuation Project 23

1.0 Introduction

Bathurst Resources Limited (including its subsidiary companies BT Mining Ltd, Bathurst Coal Ltd, and Buller Coal Ltd) (collectively referred to here as 'Bathurst') are seeking Wildlife Act Authorisation (WAA) through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('BPCP', or the 'Project'). A WAA is being sought for the following five Project sub-areas:

- Stockton (including the Ngakawau Coal Handling Facility and Aerial Ropeway, 'Stockton');
- Mount Frederick South ('MFS');
- Escarpment Extended ('ESE');
- Upper Waimangaroa Haul Road ('UWHR'); and
- Cypress Mining Area ('Cypress').

For the purpose of this technical report, these areas are collectively referred to as the 'Project sub-areas'.

A WAA as defined in Clause 1 of Schedule 7 can be applied for under Section 42(4)(h) of the FTAA. As part of the FTAA, a stand-alone report is required under Schedule 7 to seek authorisation to survey, capture, handle and translocate protected wildlife (i.e. bird, lizard and specified invertebrate species) under the Wildlife Act (1953).

Ecological Solutions Ltd have been asked to provide this technical report in support of the WAA application covering all fauna management activities proposed to occur within the footprint of the Project sub-areas, as well as incidental killing or disturbance of protected wildlife during works.

The following sections of this report have been arranged to address the specific requirements outlined in Schedule 7 Clause 2(1) of the FTAA as laid in Section 2.0 below.

2.0 Information Requirements

The following information is required for the application to obtain a 'wildlife approval' (where 'wildlife approval' means a lawful authority for an act or omission that would otherwise be an offence under the Wildlife Act 1953) as set out in Clause 2(1) of Schedule 7 of the FTAA:

(1) For the purposes of section 43(3)(h), application for a wildlife approval must—

(a) specify the purpose of the proposed activity:

(b) identify the actions the applicant wishes to carry out involving protected wildlife and where they will be carried out (whether on or off public conservation land):

(c) include an assessment of the activity and its impacts against the purpose of the Wildlife Act 1953:

(d) list protected wildlife species known or predicted to be in the area and, where possible, the numbers of wildlife present and numbers likely to be impacted:

(e) outline impacts on threatened, data deficient, and at-risk wildlife species (as defined in the New Zealand Threat Classification System):

(f) state how the methods proposed to be used to conduct the actions specified

under paragraph (b) will ensure that best practice standards are met:

(g) describe the methods to be used to safely, efficiently, and humanely catch, hold, or kill the animals and identify relevant animal ethics processes:

(h) state the location or locations in which the activity will be carried out, including a map (and GPS co-ordinates if available):

(i) state whether authorisation is sought to temporarily hold or relocate wildlife:

(j) list all actual and potential wildlife effects (adverse or positive) of the proposed activity, including effects on the target species, other indigenous species, and the ecosystems at the site:

(k) where adverse effects are identified, state what methods will be used to avoid and minimise those effects, and any offsetting or compensation proposed to address unmitigated adverse effects (including steps taken before the project begins, such as surveying, salvaging, and relocating protected wildlife):

(l) state whether the applicant or any company director, trustee, partner, or anyone else involved with the application has been convicted of any offence under the Wildlife Act 1953:

(m) state whether the applicant or any of the company director, trustee, partner, or anyone else involved with the application has any current criminal charges under the Wildlife Act 1953 pending before a court:

(n) provide proof and details of all consultation, including with hapū or iwi, on the application specific to wildlife impacts:

(o) provide any additional written expert views, advice, or opinions the applicant has obtained concerning their proposal.

3.0 Purpose of the Proposed Activity

(a) Specify the purpose of the proposed activity:

Bathurst proposes to continue mining operations on the Buller Plateaux for a further 25 years as part of the BPCP. The purpose of the BPCP is to obtain the necessary approvals to enable the ongoing use of the existing infrastructure and mining operations and provide access to additional coal mining areas across the Buller Plateaux. Management of wildlife forms part of the mitigation and remediation activities integral to the Project.

4.0 Actions to be Carried Out

(b) Identify the actions the applicant wishes to carry out involving protected wildlife and where they will be carried out (whether on or off public conservation land):

Mining is proposed to be by conventional drill and blast, load and haul open pit mining and would be a 24/7 operation using existing coal handling infrastructure. The actions to be carried out involving protected wildlife will include vegetation clearance and habitat removal within the Project sub-areas to access coal reserves. The Project sub-areas are located on a combination of Public Conservation, LINZ, Buller District Council, and private (BRL titled) lands as outlined in the BPCP Project description (Bathurst Resources Limited 2026f).

Each of the Project sub-areas and the activities involved at each location are set out in more

detail in the Assessment of Environmental Effects accompanying the application (Mitchell Daysh Limited 2026). A brief summary of mining activities is also found in Section 1.1.2 of the Terrestrial Ecological Impact Assessment Report (Ecological Solutions Limited 2026a).

Specific species management measures to be implemented as mining proceeds are outlined in site- and species-specific management plans (Bathurst Resources Limited 2026) and have been designed to reduce the direct effects of mining on protected wildlife.

Specific actions relating to protected wildlife will include:

- Catch alive and liberate on site individuals of *Powelliphanta patrickensis*, *Powelliphanta augusta*, *Naultinus tuberculatus*, *Mokopirirakau granulatus* and *Oligosoma* aff. *newmanii* Buller for the purpose of salvage/relocation.
- Incidentally kill the species listed above that could not be salvaged or deterred/relocated.
- Collect *Powelliphanta* snail shells from monitoring plots for identification by the Department of Conservation (DOC) of the cause of mortality.
- Take somatic samples from the lizard species listed above for genetic testing
- Searching, capture and handling and permanent marking of the land snail *Powelliphanta patrickensis* for the purposes of snail salvage, relocation[1] (including relocation of salvaged snails and movement of snails as part of vegetation direct transfer (VDT)), and monitoring in accordance with the Powelliphanta Management Plan (BPCP-ENV-PLN-004).
- Surveying, capture, handling, banding and application of radio transmitters to roroa (great spotted kiwi, *Apteryx maxima*) for the purposes of monitoring, territory mapping and managing roroa in accordance with the Avifauna Management Plan (BPCP-ENV-PLN-003). This includes:
    - Capture and handling of roroa with the assistance of conservation dogs prior to disturbance due to mining activities and for the purposes of monitoring and/or health checks.
    - Disturbance of roroa when at risk of direct harm ('shepherding' out of harm's way).
    - Translocate roroa when at risk of direct harm due to habitat loss.
    - Uplift eggs and chicks for Operation Nest Egg when at risk of direct harm.
    - Take pin feathers from roroa as samples for genetic testing.
- Disturbance of indigenous birds during the breeding season to encourage them to nest outside areas destined for vegetation clearance in accordance with the Avifauna Management Plan (BPCP-ENV-PLN-003)).
- Capture, handling and translocation of kakaruai (South Island robin, *Petroica australis australis*) and mātātā (South Island fernbird, *Poodytes punctatus punctatus*) in accordance with the Avifauna Management Plan (BPCP-ENV-PLN-003)).
- Capture, handling, banding, application of radio transmitters and translocation of western weka (*Gallirallus australis australis*) from inside pest exclusion fenced in accordance with the Avifauna Management Plan (BPCP-ENV-PLN-003)).

[1] In this context, relocation refers to moving an animal a short distance to nearby suitable habitat, for example relocation of snails via VDT or salvage and removal to nearby predator exclusion fenced areas. Translocation refers to a long-distance relocation of animals that have larger home ranges, for example translocation of weka from within the predator exclusion fenced areas to the Blackburn Pakihi or translocation of roroa that have a high proportion of their habitat removed to a suitable site elsewhere (to be determined in consultation with the Department of Conservation and Ngāti Waewae).

- Capture, handling, application of radio transmitters and translocation (including as part of VDT) of West Coast green gecko *(Naultinus tuberculatus),* forest gecko *(Mokopiriakau granulatus)* and Newman's speckled skink *(Oligosoma* aff. *newmanii* "Westland"*)* in accordance with the Lizard Management Plan (BPCP-ENV-PLN-005)).
- Handling, capture, and translocation (including via vegetation direct transfer (VDT)) of any Helms's stag beetle *(Geodorcus helmsi)* incidentally encountered during the works. Note that no Helm's stag beetle have been detected in the Project sub-areas, but the area is within their known distribution and there are historic records.
- Incidental killing or disturbance of protected wildlife where the protected wildlife cannot be removed in advance of works .

More details relating to species management actions are set out in the species-specific management plans (Bathurst Resources Limited 2026)

The removal and translocation of western weka from the predator exclusion fenced areas, as set out in the Avifauna Management Plan (BPCP-ENV-PLN-003), is intended to protect *Powelliphanta* snails within the predator exclusion fenced areas from weka predation and assist in enabling an increase in snail abundance within the predator exclusion fenced areas. A sample of relocated weka will be monitored using radio-tracking in order to determine their fate.

All of the above actions as well as the incidental killing of protected wildlife which cannot be removed in advance of vegetation clearance or as part of VDT, will require WAA.

The specific habitats to be removed within the Project Sub-areas are set out in Table 1 below.

Table 1: Extent of vegetation types (i.e. habitats) removed within Disturbance Areas[2] at each Fast Track Project Sub-area.

	Extent of Disturbance (ha)			
	Stockton	**Mount Frederick South**	**Escarpment Extended**	**Upper Waimangaroa Haul Road**
Forest				
Mixed beech-podocarp-broadleaved forest	0.0	0.0	0.4	5.1
Southern rātā-mountain beech-podocarp forest	10.3	25.5	128.8	12.6
Silver beech-mountain beech forest	0.0	5.5	0.0	0.0
Shrubland				
Mānuka-mountain beech-podocarp shrubland	7.8	34	39.5	3.4
Mānuka/Gahnia-wire rush shrubland	0.5	0	8.7	0.0
Shrubland with exotic component	1.1	0	10.5	1.0
Mānuka-tussock-wire rush shrubland	6.0	3.2	88.3	6.7
Mānuka-mountain flax/wire rush shrubland	0.2	2.0	1.5	0.0
Low vegetation				
Low pākihi	2.4	83.4	122.1	5.9
Tussock-mountain flax shrubland	0.0	0.9	0.2	0.5
Exotic grassland	0.0	0.0	0.8	0.0
Non-vegetated land cover				

[2] The disturbance area is based on shapefiles released by Bathurst Resources Limited on 15 October 2025 and excludes the Waimangaroa Storage Area.

Bare Rock	2.1	19.3	41.8	0.4	
Vegetation cleared	1.1	1.6	58.0	9.2	
Water	0.0	0.0	2.1	0.0	
Total	**31.3**	**175.4**	**502.8**	**44.8**	**754.2**

5.0 Impact Assessment

(c) Include an assessment of the activity and its impacts against the purpose of the Wildlife Act 1953:

The Wildlife Act 1953 does not have a dedicated purpose statement. However, the Supreme Court has concluded that 'The purpose of the Act is to protect Wildlife' [3].

The actions proposed and described in Section 4.0 of this report are intended to protect wildlife from mortality or physical injury associated with vegetation clearance and other mining activities. Approximately 755 ha of vegetated and non-vegetated habitats are proposed to be cleared in the Project sub-areas. If actions are not taken to avoid and minimise the effects, this vegetation clearance will result in loss of habitat, injury, or death to a range of protected wildlife.

Proposed methods to capture roroa, weka, kakaruai, mātāta, lizards, and *Powelliphanta* are detailed in Section 9.0 of this report and the avifauna, Powelliphanta and lizard management plans for the Project (BPCP-ENV-PLN-003, BPCP-ENV-PLN-004 and BPCP-ENV-PLN-005 respectively). The actual and potential effects of the activity are detailed in Section 12.0 and measures to manage the identified effects are detailed in Section 13.0.

Wildlife will also be affected by activities associated with rehabilitation and residual effects management. This includes incidental translocation during VDT of any snails, Helms's stag beetles or lizards and capture and handling of weka to remove them from the pest proof exclosures. The capture and handling of weka will be done in accordance with the measures outlined in the Avifauna Management Plan (BPCP-ENV-PLN-003) in order to minimise adverse effects. This will also improve the survival and productivity of *Powelliphanta patrickensis* within these exclosures by releasing them from weka predation.

With Bathurst's implementation of the management measures detailed below, adverse effects on protected wildlife will be avoided to the extent practicable. Any temporary effects of capture and translocation of individuals will be minimal, but would include social disruption and increased competition for individuals that are relocated and individuals already resident in translocation areas.

6.0 Protected Wildlife

(d) list protected wildlife species known or predicted to be in the area and, where possible, the numbers of wildlife present and numbers likely to be impacted:

6.1 Species Known or Predicted in the Area

In total 28 species of birds, three species of lizard and two invertebrates that are specified within Schedules 1 – 5 of the Wildlife Act 1953, and are therefore either partially or absolutely protected, are known or predicted to be present in the project area. These species are set out

[3] Shark Experience Limited v Pauamac5 Incorporated [2019] NZSC 111 [11 October 2019] at paragraph 66

in the Terrestrial Ecological Impact Assessment (Ecological Solutions Limited 2026a).

It is impractical to manage specific effects on all bird species confirmed, known or predicted to be present within the BPCP during mining. Methods to reduce effects of vegetation clearance on birds are set out in the Avifauna Management Plan (BPCP-ENV-PLN-003) and include timing of vegetation clearance and use of deterrents to discourage birds from nesting in vegetation about to be cleared.

There are 16 protected wildlife species of conservation concern that are known or predicted to be within the Buller Plateaux as shown in Table 2.

Table 2: 'Threatened' and 'At Risk' wildlife species that are known or predicted to be present within the Project Sub-areas.

Species	Conservation Status	Conservation status qualifiers	Presence
Avifauna	**Robertson et al. 2021**		
Apteryx maxima (Great spotted kiwi/roroa)	Threatened – Nationally Vulnerable	Conservation Dependent Recruitment Failure	Known resident
Poodytes punctatus (South Island fernbird/mātātā)	At Risk – Declining	Climate Impact Data Poor Size Data Poor Trend	Known resident
Anthus novaeseelandiae (New Zealand pipit)	At Risk – Declining	Climate Impact Conservation Research Needed	Known resident
Petroica australis (South Island robin)	At Risk – Declining	Conservation Dependent Climate Impact Data Poor Trend	Known resident
Cyanoramphus auriceps (Yellow-crowned parakeet/Kakariki)	At Risk – Declining	Climate Impact Conservation Research Needed Data Poor Size Data Poor Trend Extreme Fluctuations	Known resident
Nestor notabilis (Kea)	Threatened – Nationally Endangered	Conservation Dependent Climate Impact Conservation research Needed	Known visitor
Falco novaeseelandiae ferox (New Zealand bush falcon)	Threatened – Nationally Increasing	Conservation Research Needed Increasing	Known resident
Phalacrocorax carbo novaehollandiae (Black shag)	At Risk - Relict	Biologically Sparse Conservation Research Needed Data Poor: Size Data Poor: Trend Secure Overseas	Known resident
Microcarbo melanoleucos brevirostris (Little shag)	At Risk – Relict	Conservation Research Needed Data Poor: Trend	Predicted

Eudynamys taitensis (Long-tailed cuckoo)	Threatened – Nationally Vulnerable	Climate Impact Conservation Research Needed Data Poor: Trend	Known seasonal resident
Charadrius bicinctus bicinctus (Banded Dotterel)	At Risk - Declining	Climate Impact Conservation Dependent Conservation Research Needed Data Poor: Size Partial Decline	Known visitor
Lizards	**Hitchmough et al. 2026**		
Oligosoma aff. *newmani* "Westland" (Newman's speckled skink)	Threatened – Nationally Vulnerable	Climate Impact Conservation Dependent Partial Decline Sparse	Known resident
Naultinus tuberculatus (West Coast green gecko)	Threatened – Nationally Vulnerable	Climate Impact Data Poor Size Data Poor Trend Sparse	Known resident
Mokopirirakau granulatus (Forest gecko)	At Risk – Declining	Climate Impact Conservation Research Needed Data Poor Trend Partial Decline Population Fragmentation	Known resident
Terrestrial Invertebrates			
Powelliphanta patrickensis	Threatened – Nationally Critical Walker et al. 2024	Conservation Dependent Climate Impact One Location	Known resident
Powelliphanta augusta	Threatened – Nationally Critical Walker et al. 2024	Conservation Dependent Climate Impact One Location	Known resident
Geodorcus helmsi (Helms's Stag beetle)	No status recorded in Leschen et al. 2012		Predicted

Of the birds listed in Table 2, New Zealand pipit, New Zealand falcon, kea, black shag, little shag and banded dotterel would not be substantially affected by the proposal. Specific management of roroa, South Island fernbird and South Island robin is proposed. Specific management of the three lizard species and *Powelliphanta* snails is also proposed, along with management of any Helms's stag beetles incidentally discovered or inadvertently transferred with VDT. No species-specific management of yellow crowned kakariki or long-tailed cuckoo is proposed and protection of those species would rely on the methods set out in the Avifauna Management Plan (BPCP-ENV-PLN-003)). In addition to the species set out in Table 2, specific management of western weka is proposed in relation to their removal from the predator exclusion fenced areas to reduce predation on *P. patrickensis*. More detail in relation to the management actions proposed is set out below.

6.2 Avifauna

Great spotted kiwi / roroa

Roroa are present in low densities across the Buller Plateaux and the population has been stable for several decades (McLennan 2020, Toy et al. 2021). Monitoring of roroa at the Buller Plateaux began in 1993 and has used call count monitoring, radio tracking, call mapping and use of trained conservation dogs. The results of these surveys are summarised by McLennan (2020).

More recently, a 2022 survey of roroa calls at the ESE sub-area recorded low-moderate numbers of calls. The survey area also included the western extent of the UWHR Sub-area (Nichol 2022). In the absence of survey data along the full UWHR route, roroa are expected to be present throughout that sub-area. A 2024 survey using acoustic recorders at the MFS sub-area recorded roroa on all 12 recorders deployed. These results also confirmed the presence of roroa near the current boundary of Stockton Mine, in previously rehabilitated areas (Stewart 2024). The population of roroa at the Cypress sub-area has been monitored using trained kiwi dog surveys, night listening surveys and capture and monitoring since 1997 (McLennan 1998). The pre-mining survey in 1997 identified ten birds (four pairs and two males) in or near the proposed disturbance areas of the Cypress North and South Pits. Surveys and telemetry-based monitoring undertaken in April and May 2010, identified and tracked ten birds (five pairs) whose territories overlapped the Cypress Mine footprint (McLennan 2010, McLennan 2011). Mining commenced in the Cypress mining area in 2014, by which time little change in territory distribution and size had been detected, with one pair's range partially overlapping the planned clearance areas. Monitoring and transmitter replacement then focused on this pair (2015–16). By 2022, monitoring (including by telemetry) showed five individual rōroa had home ranges within or near the Cypress South Pit. As at summer 2025, there were at least 11 individual rōroa (seven males and four females) within the Cypress sub-area indicating that numbers have been relatively stable since 1997. This suggests residents can adapt to habitat removal due to mining.

Further details on roroa distribution can be found in the relevant Project Sub-area reports (appendices of Ecological Solutions Limited 2026a) and Ecological Solutions Limited (2026b).

Other avifauna

'Threatened' and 'At Risk' avifauna species that are confirmed to be or possibly occur within the Project sub-areas are detailed in Table 2. Apart from roroa (discussed above), there are ten other 'Threatened' or 'At Risk' species. Five-minute bird counts (5MBC) performed by Ecological Solutions Limited (2026a) recorded long-tailed cuckoo, New Zealand bush falcon, South Island fernbird, South Island robin and yellow crowned parakeet within ESE. South Island robin was also detected at MFS and Cypress in 5MBC by Nichol (2020). New Zealand pipit has been detected at all the Project sub-areas (Ecological Solutions Limited 2026a, Nichol 2020). As well as ESE, South Island fernbird has been detected at Stockton, UWHR and Cypress sub-areas. Kea was detected by acoustic recorders within the MFS sub-area (see Ecological Solutions Limited 2026a Appendix D). Further details with respect to these avifauna detections can be found in the relevant Project sub-area baseline surveys provided as appendices to Ecological Solutions Limited 2026a.

Black shag and little shag have been sporadically recorded across the Buller Plateaux (Buckingham 1998, Overmars et al., 1998, Thomas & Toft 1997, Thomas et al. 1997, G. Bramley pers. obs. 2011), including black shags using constructed tarns at Stockton Mine (M Lambert unpubl. data 2024). Banded dotterel have been observed on the Denniston Plateau (Buckingham, 2011) and at Stockton Mine including near the Bathhouse and at Mt Frederick (M Lambert pers. comm., G Bramley pers. obs.). Given their mobility and use of rehabilitated sites

and constructed water features, it is considered unlikely these species will require active management.

Seventeen species of native birds which are considered 'Not Threatened' and have been recorded within the Project sub-areas include: western weka, grey warbler/riroriro (*Gerygone igata*), New Zealand bellbird (*Anthornis melanura*), silvereye (*Zosterops lateralis*), tomtit (*Petroica macrocephala*), tui (*Prosthemadera novaeseelandiae*), New Zealand fantail (*Rhipidura fuliginosa*), Swamp harrier (*Circus approximans*), morepork/ruru (*Ninox novaeseelandiae*), mallard x grey duck hybrid (*Anas platyrhynchos* x *superciliosa*), spur-winged plover (*Vanellus miles*), pied stilt (*Himantopus leucocephalus*), welcome swallow (*Hirundo neoxena*), kererū (*Hemiphaga novaeseelandiae*), pīpipi (*Mohoua novaeseelandiae*), Southern black-backed gull/karoro (*Larus dominicanus*), and paradise shelduck/pūtangitangi (*Tadorna variegata*).

Other 'Threatened' and 'At Risk' species recorded include South Island pied oystercatcher (*Haematopus finschi*) (At Risk – Declining), kākā (Nestor *meridionalis*) (At Risk – Recovering) and New Zealand grey duck/pārera (*Anas superciliosa*) (Threatened – Nationally Vulnerable). However, these are considered to be occasional visitors to the Buller Plateaux and are unlikely to be affected by the proposed activities.

6.3 Lizards

Three species of native lizards have been recorded within the Project sub-areas: West Coast green gecko (*Naultinus tuberculatus*) (Threatened – Nationally Vulnerable), Forest gecko (*Mokopirirakau granulatus*) (At Risk – Declining) and Newman's speckled skink (*Oligosoma* aff. n*ewmani* "Westland") (Threatened – Nationally Vulnerable). Surveys within and immediately around the ESE sub-area and Cypress sub-area have confirmed the presence of West Coast green gecko and forest gecko at those locations with Newman's speckled skinks also present at ESE. All three species are almost certainly present in all the Project sub-areas. The highest value lizard habitats in the Project sub-areas were those with high topographical diversity such as forested gullies surrounded by sandstone pavement and pākihi (Alliance Ecology 2024).

6.4 Terrestrial Invertebrates

The 'Threatened – Nationally Critical' *Powelliphanta patrickensis* snail occupies a range of between 3,500ha and 5,000ha, on or near the Buller Plateaux, including habitats within all the Project sub-areas.

The 'Threatened – Nationally Critical' *Powelliphanta augusta* snail occupies a range immediately near the former peak of Mt Augustus. The Project includes building a predator exclusion fenced area around this habitat to protect resident *P. augusta*. On that basis, salvage and relocation, as well as incidental killing of snails that cannot be salvaged, may be required during fence construction.

Helms's stag beetle have also been recorded on the Buller Plateaux (Sherley et al. 1994) and would also be affected by vegetation clearance if present. No Helms's stag beetles have been collected in pit fall trap surveys throughout the Project sub-areas, and we could find no other recent records, but their presence cannot be ruled out.

7.0 Impacts on Threatened, Data Deficient and At-Risk Species

(e) outline impacts on threatened, data deficient, and at-risk wildlife species (as defined in

the New Zealand Threat Classification System):

7.1 Threatened Wildlife Species

Impacts on protected wildlife are set out in Section 5.0. There are five 'Threatened' species which would be affected:

- *Powelliphanta patrickensis*;
- *Powelliphanta augusta*
- Roroa
- West Coast green gecko

Powelliphanta patrickensis ('Threatened – Nationally Critical') are known to be present across the Buller Plateaux. The range of this species is restricted to coal measures vegetation which includes the Denniston and Stockton Plateaux and immediate surrounds.

Powelliphanta augusta ('Threatened – Nationally Critical') were known to occur naturally across c. 8.5ha along the Mount Augustus ridgeline of the Stockton Plateau. The remaining natural habitat comprises c. 3ha near the former peak of Mt Augustus. Individuals of *P. augusta* have also been relocated to a small number of sites nearby (e.g. Mt Rochfort). The Project would construct a predator exclusion fenced area which would include all the remaining natural habitat of *P. augusta*.

Roroa ('Threatened – Nationally Vulnerable') are known to be present in low densities across the Buller Plateaux including all the Project sub-areas. Vegetation clearance within the Project sub-areas will affect roroa with territories that overlap the disturbance areas and at least their immediate neighbours. Radio tracking within Cypress sub-area has confirmed that residents with part of their home range removed by mining naturally adjust and reconfigure their home range in response. Whilst this likely carries a cost, such birds have gone on to successfully breed despite mining removing part of their home range (Bathurst Resources Limited 2023).

West Coast green gecko ('Threatened – Nationally Vulnerable') are present across the Buller Plateaux, occupying a range of habitats. They have been recorded in the ESE sub-area and near the Cypress sub-area and are possibly present in other sub-areas given the range of forest and shrubland habitats.

Impacts on Threatened species (excluding *P. augusta*) include:

- Habitat loss, fragmentation, degradation and general disturbance through vegetation clearance and earthworks including the deposition of overburden.
- Habitat fragmentation for the range-restricted and poorly mobile *P. patrickensis* could result in increased demographic stochasticity and reduced genetic variation.
- Direct mortality or injury that may be caused during vegetation clearance or earthworks activities.
- The creation of habitat edge effects, altering the composition and health of adjacent vegetation (i.e. habitat degradation), which may affect habitat suitability.
- Disturbance associated with noise, dust, lighting, and vibration from mining activities.

Effects on *P. augusta* include:

- Potential for mortality due to construction of the predator exclusion fenced area.
- Overall, the effects of the predator exclusion fenced area is expected to be positive for the *P. augusta* population due to the decrease in predation by rats and weka.

7.2 At Risk Wildlife Species

Impacts on protected wildlife are set out in Section 5.0. Four bird species and two lizard species which inhabit the Project Sub-areas where vegetation clearance will occur to enable mining are considered to be 'At Risk – Declining' including:

- Fernbird;
- South Island Robin;
- New Zealand pipit;
- Yellow-crowned parakeet;
- Forest gecko;
- Newman's speckled skink.

The impacts on these 'At Risk' species are similar to the effects on 'Threatened' species and include:

- Habitat loss, fragmentation, degradation and general disturbance through vegetation clearance and earthworks including the deposition of overburden.
- Direct mortality or injury that may be caused during vegetation clearance or earthworks activities.
- The creation of habitat edge effects, altering the composition and health of adjacent vegetation (i.e. habitat degradation), which may affect habitat suitability.
- Disturbance associated with noise, dust, lighting, and vibration from mining activities.

7.3 Data Deficient Species

There are no Data Deficient species (that are protected under the Wildlife Act 1953) known to be present within the Project sub-areas.

8.0 Meeting Best Practice Standards

(f) state how the methods proposed to be used to conduct the actions specified under paragraph (b) will ensure that best practice standards are met:

The management plans which accompany the Project application have been prepared in accordance with available best practice guidance as well as consultation with the Department of Conservation and local iwi. The plans will be updated as required, for example if new best practice standards are developed or new information with respect to the managed species becomes available.

Species management in accordance with site- and species-specific management plans intended to reduce the effects of mining on wildlife will be implemented. The best practice standards listed below will be adhered to, are incorporated within the relevant species management plans where relevant and will be updated as required:

- Key principles for lizard salvage and transfer in New Zealand (Department of Conservation 2019);
- Kiwi Best Practice Manual (Robertson et al. 2020);
- DOCCM-5597576 Birds: kiwi territory mapping v1.0 (Robertson 2018)
- Best practice techniques for the translocation of North Island robins (*Petroica longipes*),

South Island robins (*P. australis australis*) and Stewart Island robins (*P. a. rakiura*) (Collen et al. 2014); and
- Techniques used to translocate North Island fernbirds to Tiritiri Matangi island described by Parker (2002).

There are no current best practice standards for handling or otherwise managing *P. patrickensis*. The methods proposed here are informed by the Powelliphanta Management Plan (BPCP-ENV-PLN-004) which draws on experience and expertise in snail management across the Buller Plateaux.

Similarly, no best practice standards exist for weka handling and translocation. The methods specified here are informed by experience in capturing and relocating North Island weka, methods used for the transfer of fernbird to Tiritiri Matangi described by Parker (2002) and best practice methods described for North Island robins (Collen et al. 2014) and roroa (Robertson et al. 2020).

9.0 Methods to Catch, Hold or Kill

(g) describe the methods to be used to safely, efficiently, and humanely catch, hold, or kill the animals and identify relevant animal ethics processes:

9.1 Summary

Methods to catch, hold or kill (via humane euthanasia) animals for the Project are detailed in the respective management plans for each species as set out in Section 4.0. Summaries of the methods and protocols for each protected species are provided below. When handling wildlife, the animal welfare provisions of the Animal Welfare Act 1999 and its welfare codes (e.g., transport within New Zealand, frequency of trap checking) will be met.

9.2 Great spotted kiwi / roroa

BT Mining, which operates Stockton Mine has been implementing management of roroa since prior to mining commencing at Cypress Mining Area in c. 2016.

The capture, handling and radio tagging of roroa to monitor their habitat use, map territories and determine which birds, if any, will need to be 'shepherded' on prior to vegetation clearance or translocated for their own protection, will be undertaken following the Kiwi Best Practice Manual (Robertson et al. 2020) as detailed in the Avifauna Management Plan (BPCP-ENV-PLN-003). Birds will be marked with bands and/or transponders as well as radio transmitters in order to enable individual identification and minimise future handling. A sample of at least 50% of the adult birds able to be captured (at least one individual in each pair) and a sample of juvenile birds will be fitted with radio-transmitters in order to follow their movements. The capture and handling process aims to minimise stress and ensure the welfare of the birds throughout capture, handling, tagging, and release. Cultural practices, such as karakia, are also integrated into the process to respect Māori values and bird welfare.

While health screening is only mandatory for translocations beyond local ecological districts, birds showing signs of illness will be recorded and tracked, both for their welfare and to monitor any potential disease transmission.

Capture and handling are restricted to accredited handlers and trained personnel. Strict hygiene protocols are enforced, including equipment sterilization and single-use bird bags. Detailed data will be recorded for each bird, including physical morphometrics and photographs.

9.3 Weka

There is no specific guidance for the translocation of weka; consequently, the translocation process will adopt methods set out in the Kiwi Best Practice Manual (Robertson et al. 2020) as detailed in the Avifauna Management Plan (BPCP-ENV-PLN-003). The process aims to minimise stress and ensure the welfare of the birds throughout capture, handling, transport, and release. Prior to the completion of weka-proof fences and establishment of trapping, as many weka as possible will be shepherded out to minimise the amount of weka left to trap. Shepherding will be done using a systematic grid search method, where a line of people move from the farthest area of the fenced area towards the gate with the aim of moving any weka out and towards the gate. After this, trapping can commence using methods outlined in the below sections. If trapping fails to remove all weka from the weka-proof fenced areas, removal via poisoning may have to occur. Birds to be translocated from the predator exclusion fenced areas will be caught prior to any toxin operation to remove rodents and prior to any translocation of lizards and *P. patrickensis* into the predator exclusion fenced areas. Although it is proposed to relocate pairs together where possible in order to reduce disruption, they often do not maintain bonds after release.

Health screening is only mandatory for translocations beyond local ecological districts since local movements mimic natural dispersal patterns. However, birds showing signs of illness will not be moved, both for their welfare and to avoid disease transmission. Birds will be marked with bands to enable individual identification and minimize future handling and will not be held more than 24 hours following capture without feeding. A sample of at least 30 and no more than 50 weka, including adults and juveniles, will be fitted with radio-transmitters at any one time in order to follow their movements post release. Cultural practices, such as karakia, are also integrated into the process to respect Māori values and bird welfare.

Weka will be captured using live capture cage traps, which have been selected for their ability to safely capture an animal without causing harm. Once traps are armed, they will be checked at least twice daily or at a minimum within 12 hours from sunrise (as necessitated under the Animal Welfare Act 1999). Capture and handling are restricted to accredited handlers and trained personnel. Strict hygiene protocols will be enforced, including equipment sterilization and single-use bird bags. Detailed data will be recorded for each bird, including physical measurements and photographs. Transport boxes must comply with Department of Conservation standards, and only one bird will be housed per compartment to avoid injury or heat stress. Canvas bags may be used in rugged terrain, with regular ventilation.

Release locations will be within habitats undergoing pest control that are not at carrying capacity for weka, and that are not strongholds for *Powelliphanta* snails. Transport will typically be by vehicle or helicopter, with birds kept cool and secure to avoid stress or injury. Vehicles must be well-ventilated and enclosed car boots will not be used for transport. Driving should balance safety and efficiency, with gentle handling on rough roads. Finally, birds will be released near areas with shelter/cover. Known pairs can be released near each other, although pair bonds often dissolve.

9.4 South Island robin/South Island fernbird

Any capture and translocation programme for kakaruwai /South Island robin and/or mātatā/South Island fernbird will be undertaken in accordance with the best practice techniques for the translocation of kakaruwai/robins (Collen et al. 2014) and the methods detailed in Parker (2002) as detailed in the Avifauna Management Plan (BPCP-ENV-PLN-003). The process aims to minimise stress and ensure the welfare of the birds throughout capture, handling,

transport, and release.

Translocation sites will be within the proposed Buller Plateaux predator exclusion fenced areas in the first instance. There are four separate predator exclusion fenced areas to be built in a staged manner to coincide with mine disturbance and construction activities. Details of each predator exclusion fenced area are outlined in the Pest Control Plan (BPCP-ENV-PLN-022).

The team of ecologists undertaking the capture and relocation will be led by the Project Ornithologist(s) and supported by ecologists that are suitably qualified and experienced in the capture, handling, holding and release techniques to be used.

9.5 Lizards

The lizard search and capture methodology, translocation and monitoring process is detailed in the Lizard Management Plan (BPCP-ENV-PLN-005) which follows the key principles for lizard salvage and transfer in New Zealand (Department of Conservation 2019). Lizards will be captured and handled only by trained personnel under the supervision of the Project Herpetologist or suitably trained ecologists, using sterilised equipment and proper hygiene practices between each capture. Key data such as species, sex, age class, measurements, reproductive status, and photographs will be recorded. For transport, lizards will be placed in ventilated containers with natural materials from the capture site and kept at ambient temperature for no longer than four hours.

Lizards will be released within the pest exclusion fenced areas in the first instance into suitable habitat at least 20 metres apart, unless found together. Radio tags will be applied to up to 100 lizards to assist in monitoring translocation success and habitat use. Details of the release, including species, time, GPS location, and habitat type, will be documented.

9.6 Powelliphanta patrickensis

9.6.1 Information Requirements

Snails will be released into the predator exclusion fenced areas to maximise the likelihood of survival and ensure that no area which has received snails will be mined or disturbed in the future. In order to minimise unnatural genetic mixing, release sites will be located as close as possible to the source location. The location of the destination areas and numbers of *Powelliphanta* to be transferred to each destination area will be agreed in advance with the Department of Conservation based on the following information:

- Habitat quality at proposed destination areas.
- Abundance and genetic composition of the snail population already at proposed destination areas.
- Genetic composition of the snail populations at the various source areas.

This information will be available before any *Powelliphanta* are collected. Searching and monitoring techniques will follow those generally suggested in Walker (1997) but will preferentially target the most likely snail habitats within search areas and occur under favourable searching conditions, even if those occur up to three months before vegetation clearance is to occur.

9.6.2 Search method

Searches will involve moving aside vegetation, shifting leaf litter, checking the bases of flax, Gahnia and tussocks, feeling for *Powelliphanta* in logs, and root cavities (anything bigger than about 15 cm diameter) and amongst moss, and sorting through overhanging and ground-hugging vegetation. Previous searches have adopted a diurnal search method at 40 person

hours per hectare during any time of year. Investigation of survey results across the Buller Plateaux has revealed that it is more effective to target favourable conditions (i.e., nocturnal searches in warm and wet summer conditions) rather than use previous diurnal search methods (Lloyd 2024). Limited diurnal searching may be used in areas known to have a dense population of snails for the purposes of collecting and salvaging eggs. Nocturnal searches during optimal effective survey conditions of >6˚C air temperature and >75% humidity will be prioritised.

Where *Powelliphanta* are being felt for through and under vegetation, bare hands shall be used in preference. Where conditions dictate, e.g. ground is frozen, rubber gloves or a small stick may be used for brushing aside vegetation and wet litter. All searching shall minimise damage to the vegetation cover. At the completion of the search all the litter and vegetation that has been pushed aside shall be carefully returned to its origin. Travel through search areas shall minimise trampling by such means as avoiding standing on sensitive vegetation and where the option exists, walking on bare rock surfaces.

9.6.3 Handling method

All *Powelliphanta* will be handled carefully by experienced snail staff with hands free from contaminants (e.g. fuel). Handling shall be kept to an absolute minimum. Two litre containers with perforated lids that allow airflow, but do not let the animal escape, will be used to transport *Powelliphanta*. The containers shall be clean and contain damp litter 60mm deep (collected from where the snail was located) or wet paper. A maximum of five *Powelliphanta* shall be placed in an upright position (i.e. apex skyward) in each container. The container shall be kept cool at all times. If *Powelliphanta* eggs are found during search efforts, these shall be collected so as to minimise damage, such as using a sterilized teaspoon, and placed in a container as described above. Only one clutch of eggs will be stored in any container.

All live *Powelliphanta* and eggs found will be released as soon as practical following capture, and always on the same day as they were captured, at areas of comparable habitat within the nearest fenced exclosure. The location of the destination sites and numbers of *Powelliphanta* to be transferred to each destination site shall be agreed in advance with the Department of Conservation based on the following information, as available:

- Availability of appropriate snail habitat.
- Abundance and genetic composition of the snail population already at proposed destination sites.
- Genetic composition of the snail populations at the various source areas.

Powelliphanta shall be released individually (i.e. not in clumps) and in an upright position (i.e. apex skyward).

9.6.4 Relocation

As soon as practicable after capture, and in any case within 24 hours of capture, *Powelliphanta* will be moved to the destination site within predator exclusion fenced areas and placed into favourable habitat. Snails will be permanently marked to enable mark – recapture population estimates and monitoring. Searching and handling methods for *Powelliphanta* will follow those outlined in the current Powelliphanta Management Plan (BPCP-ENV-PLN-004) for all Project sub-areas.

9.7 Powelliphanta augusta

9.7.1 Information Requirements

Any snails salvaged from the footprint of the predator exclusion fenced area in advance of

fence construction will be released into the predator exclusion fenced area in similar habitat to that where they were found. Snail search and salvage will be undertaken no more than 72 hours prior to vegetation clearance for fence construction.

9.7.2 Search method

Searches will involve moving aside vegetation, shifting leaf litter, checking the bases of flax, Gahnia and tussocks, feeling for *Powelliphanta* in logs, and root cavities (anything bigger than about 15 cm diameter) and amongst moss, and sorting through overhanging and ground-hugging vegetation. Previous searches have adopted a diurnal search method at 40 person hours per hectare during any time of year. Investigation of survey results across the Buller Plateaux has revealed that it is more effective to target favourable conditions (i.e., nocturnal searches in warm and wet summer conditions) rather than use previous diurnal search methods (Lloyd 2024). Diurnal searching may be used immediately (<24 hours) in advance of fence construction. Nocturnal searches during optimal effective survey conditions of >6˚C air temperature and >75% humidity will be prioritised.

Where *Powelliphanta* are being felt for through and under vegetation, bare hands shall be used in preference. Where conditions dictate, e.g. ground is frozen, rubber gloves or a small stick may be used for brushing aside vegetation and wet litter. All searching shall minimise damage to the vegetation cover. At the completion of the search all the litter and vegetation that has been pushed aside shall be carefully returned to its origin. Travel through search areas shall minimise trampling by such means as avoiding standing on sensitive vegetation and where the option exists, walking on bare rock surfaces.

9.7.3 Handling method

All *Powelliphanta* will be handled carefully by experienced snail staff with hands free from contaminants (e.g. fuel). Handling shall be kept to an absolute minimum. Two litre containers with perforated lids that allow airflow, but do not let the animal escape, will be used to transport *Powelliphanta*. The containers shall be clean and contain damp litter 60mm deep (collected from where the snail was located) or wet paper. A maximum of five *Powelliphanta* shall be placed in an upright position (i.e. apex skyward) in each container. The container shall be kept cool at all times. If *Powelliphanta* eggs are found during search efforts, these shall be collected so as to minimise damage, such as using a sterilized teaspoon, and placed in a container as described above. Only one clutch of eggs will be stored in any container.

All live *Powelliphanta* and eggs found will be released as soon as practical following capture, and always on the same day as they were captured, at areas of comparable habitat within the predator fenced exclusion area.

Powelliphanta shall be released individually (i.e. not in clumps) and in an upright position (i.e. apex skyward).

9.8 Personnel to undertake authorised activities

All field staff undertaking authorised activities must be trained and directed by experienced fauna surveyors and handlers approved by the office of the Buller District Operations Manager for the Department of Conservation, located in Westport.

10.0 Proposed Activity Locations

(h) state the location or locations in which the activity will be carried out, including a map (and GPS co-ordinates if available):

The five Project sub-areas are situated on the Buller Plateaux, an area which includes the Stockton and Denniston Plateaux and is within the Ngakawau Ecological District and North Westland Ecological Region (McEwen 1984). The consent areas and coordinates are shown below in Figure 1. The total disturbance area within the Project Sub-areas is proposed to cover approximately 754.2 ha[4].

Figure 2 shows the specific location of the predator exclusion fenced areas (where weka would be captured and snails, lizards and potentially mātātā and kakaruai would be relocated to) and the proposed locations of weka releases which are at the edge of the landscape scale pest control proposed as part of the Project and located on public conservation land within the Ngakawau and Orikaka Ecological Areas and the intensive ground control management area at Blackburn Pākihi. The release locations are within the adjoining Ngakawau and Buller Ecological Districts.

[4] The Project area boundary is based on shapefiles released by Bathurst on 4 December 2025.

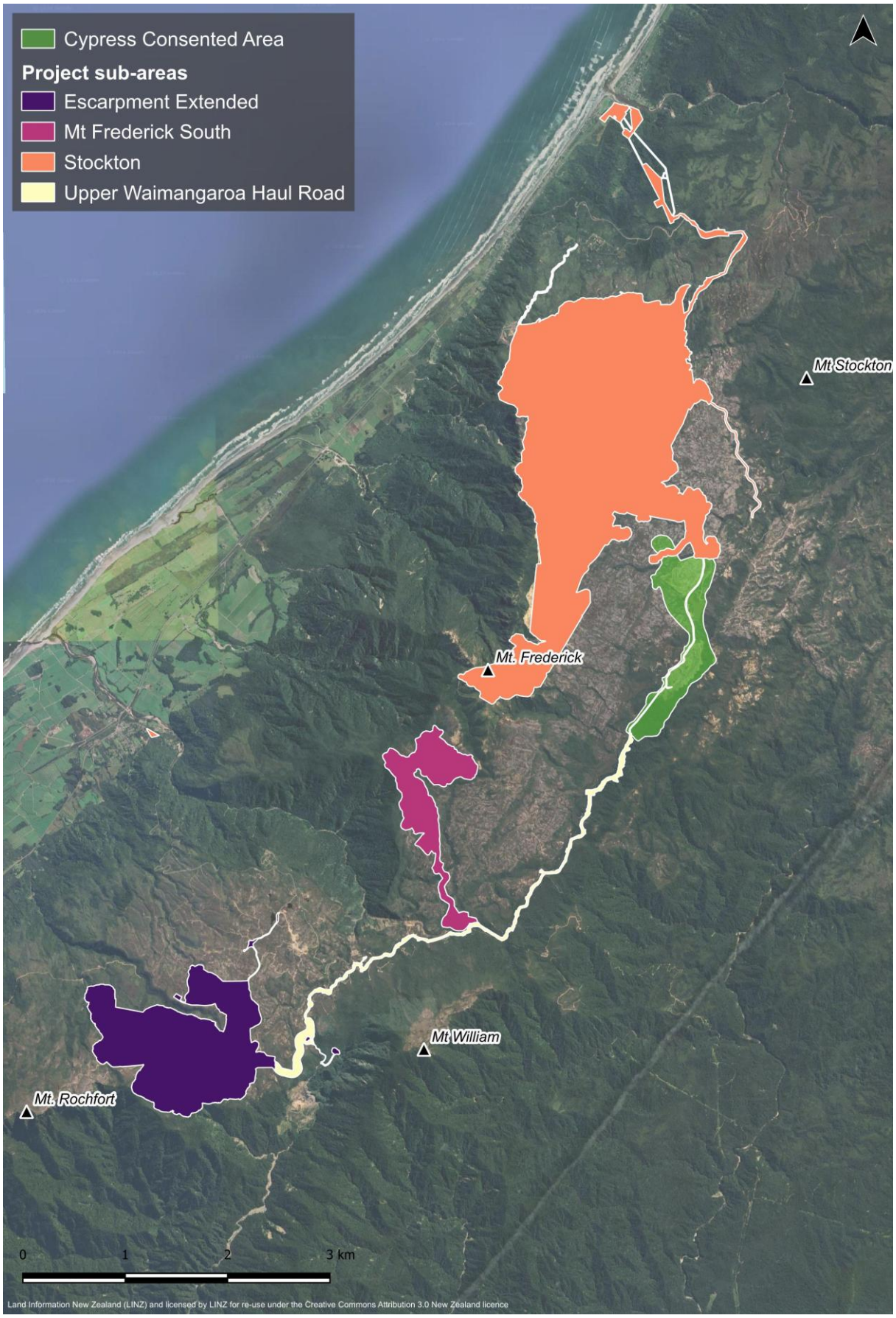


Figure 1: Proposed Activity Locations – Fast Track Sub-areas

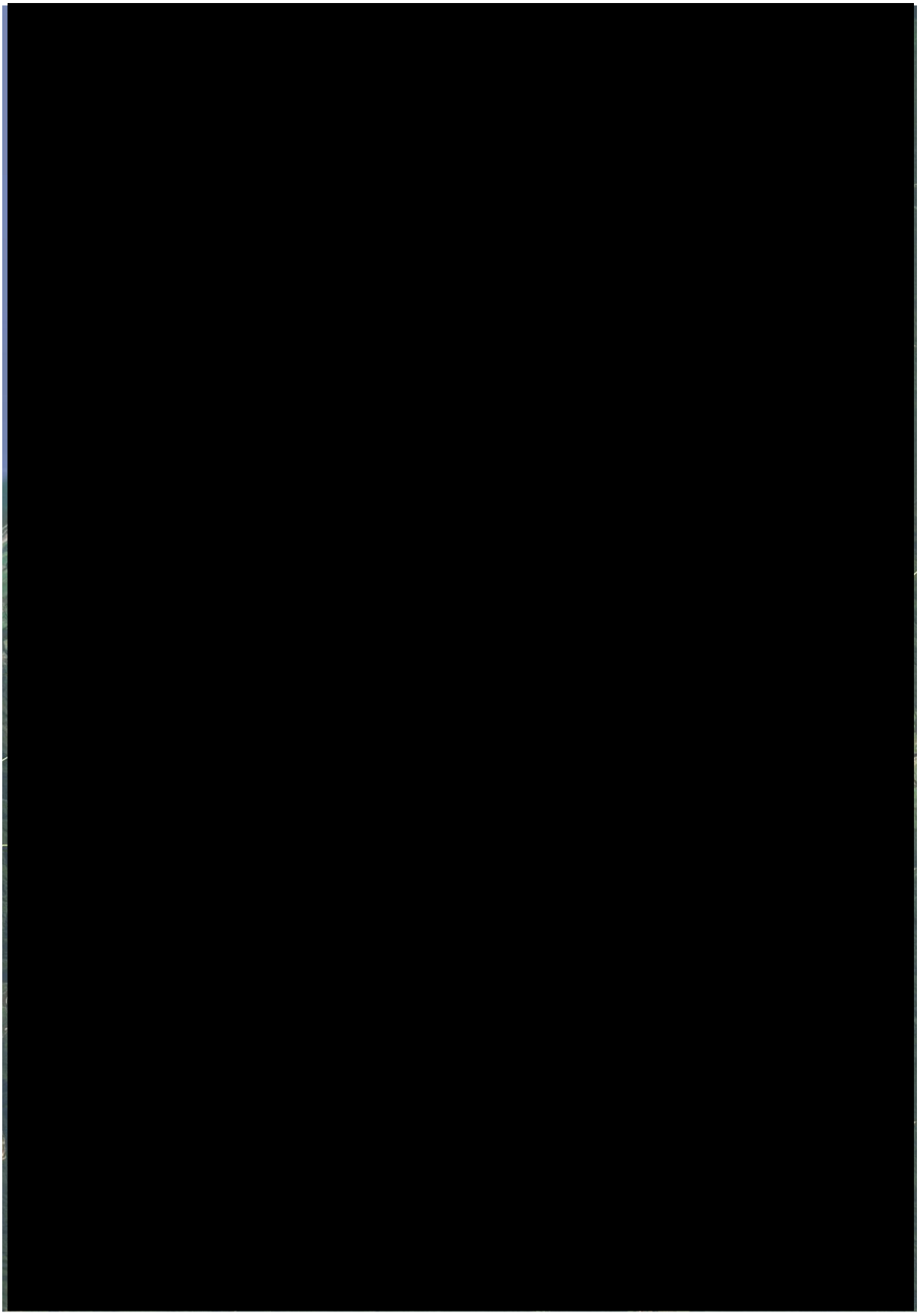


Figure 2: Location of pest proof exclosures and weka release locations associated with the Buller Plateau Continuation Project

11.0 Holding or Relocating Wildlife

(i) state whether authorisation is sought to temporarily hold or relocate wildlife:

A Wildlife Act Authorisation will be required to:

- capture, handle and radio tag roroa;
- translocate any roroa that are significantly affected by habitat removal;
- capture, handle, radio tag and translocate weka;
- capture, handle and relocate mātātā (fernbird) and kakaruwai (South Island robins);
- capture, handle, radio tag and relocate (including via VDT) lizards;
- capture, handle, permanently mark and relocate (including via VDT) *Powelliphanta* snails; and
- capture, handle and relocate (including via VDT) any Helms's stag beetles.

The proposed relocation/translocation sites include:

- Rehabilitated sites within the same Project sub-area (with respect to VDT).
- Predator exclusion fenced areas – within the Buller Plateaux.
- Pest Management Area – predator and weed controlled area surrounding and including the Blackburn Pākihi and Buller Plateaux.

A Wildlife Act Authorisation will also be required to disturb wildlife (birds) for the purpose of discouraging nesting in vegetation to be cleared.

A Wildlife Act Authorisation will also be required for incidental killing of individuals of all the above named species which cannot be relocated in advance of works.

12.0 Actual and Potential Effects

(j) list all actual and potential wildlife effects (adverse or positive) of the proposed activity, including effects on the target species, other indigenous species, and the ecosystems at the site:

Potential adverse effects of mining activities may include:

- Loss, fragmentation and degradation of habitat.
- Direct mortality or injury to individuals that may be harmed during vegetation clearance or earthworks activities.
- Temporary effects of capture and relocation/translocation of individuals may include social disruption and increased competition in translocation areas.
- The creation of habitat edge effects, altering the composition and health of adjacent vegetation (i.e. habitat degradation), which may affect habitat suitability for flora and fauna and promote invasion by pest species.
- Disturbance associated with noise, dust, lighting, and vibration from mining activities.

The activities for which these authorisations are sought will protect individuals, reduce the adverse effects of mining and assist in maintaining populations of the 'Threatened' and 'At Risk' species present in the vicinity of the works for the life of mining.

13.0 Methods to Avoid/Minimise Adverse Effects

(k) where adverse effects are identified, state what methods will be used to avoid and minimise those effects, and any offsetting or compensation proposed to address unmitigated adverse effects (including steps taken before the project begins, such as surveying, salvaging, and relocating protected wildlife):

Potential adverse effects have been identified in Section 5.0, Section 7.0 and Section 12.0 of this report. Measures to avoid and minimise these effects are outlined in the relevant management plans as identified in Table 3:

- Powelliphanta Management Plan (BPCP-ENV-PLN-004).
- Avifauna Management Plan (BPCP-ENV-PLN-003).
- Lizard Management Plan (BPCP-ENV-PLN-005).

Other directly relevant management plans intended to reduce or avoid effects on indigenous species and minimise or remediate effects of mining include:

- Weed Management Plan (BPCP-ENV-PLN-008).
- Biosecurity Management Plan (BPCP-ENV-PLN-007).
- Pest Control Plan (BPCP-ENV-PLN-022).
- Rehabilitation Management Plan (BPCP-ENV-PLN-002).

There is no specific management plan for salvage of *P. augusta* but methods will follow the relevant parts of the Powelliphanta Management Plan (BPCP-ENV-PLN-004).

Table 3: Management methods to avoid or minimise effects on 'Threatened' and 'At Risk' protected wildlife.

Species	Methods	Management plan
Roroa	Pre-clearance monitoring, capture and tracking to inform management. Monitoring for the life of mining. Translocation of individuals with a substantial proportion of their home range removed by mining. Salvage of eggs and chicks directly affected by vegetation removal for hand rearing as part of Operation Nest Egg. Handling and management undertaken by suitably qualified and experienced personnel.	BPCP-ENV-PLN-003
South Island robin	Pre-clearance survey, capture and relocation. Handling and management undertaken by suitably qualified and experienced personnel.	BPCP-ENV-PLN-003
Fernbird	Pre-clearance survey, capture and relocation. Handling and management undertaken by suitably qualified and experienced personnel.	BPCP-ENV-PLN-003
Powelliphanta patrickensis / P. augusta	Pre-clearance surveys to salvage snails within affected area. Handling kept to a minimum and carried out by suitably qualified and experienced	BPCP-ENV-PLN-004

	personnel. Snails kept in containers protected from elements and released into favourable habitat within predator exclusion fenced areas as soon practicable after capture, and in any case within 24 hours of capture. Released populations will be monitored by suitably qualified and experienced personnel.	
Lizards	Pre-clearance survey, capture and relocation to suitable habitat within predator exclusion fenced areas outside affected area. Handling and management undertaken by suitably qualified and experienced personnel.	BPCP-ENV-PLN-005

Where residual adverse effects have been identified, a separate assessment and proposal for managing these effects has been prepared by Alliance Ecology (2026).

14.0 Offences and Current Charges

(l) state whether the applicant or any company director, trustee, partner, or anyone else involved with the application has been convicted of any offence under the Wildlife Act 1953:

No such convictions have been recorded.

(m) state whether the applicant or any of the company director, trustee, partner, or anyone else involved with the application has any current criminal charges under the Wildlife Act 1953 pending before a court:

No such charges are pending.

15.0 Proof of Consultation

(n) provide proof and details of all consultation, including with hapū or iwi, on the application specific to wildlife impacts:

A Community and Stakeholder Engagement Report is included with the BPCP FTA application which outlines specific details of iwi engagement on the Project. This includes Bathurst's ongoing engagement with Te Rūnanga o Ngāti Waewae to support the preparation of a Cultural Impact Assessment (CIA), review effects assessments, and guide long-term involvement.

Written notifications of Bathurst's intention to lodge the application, together with an invitation for consultation was provided to Ngāti Apa ki te Rā Tō, Ngāti Tama ki Te Waipounamu Trust, Te Ātiawa o Te Waka-a-Māui Trust, Te Pātaka a Ngāti Kōata, Te Pātaka a Ngāti Kōata, Te Rūnanga o Ngāti Kuia Trust, Te Rūnanga o Ngāti Rārua, Te Rūnanga o Toa Rangatira.Te Rūnanga o Ngāi Tahu (Ngāi Tahu) advised the Fast Track Advisory Group on 24 June 2024 that it supports Ngāti Waewae exercising its rangatiratanga and rights as mana whenua for the BPCP area. Ngāti Waewae has prepared a Cultural Impact Assessment (CIA) to support the application. In the CIA, Ngāti Waewae outlined that as they were representing the interests of

iwi with ancestral connections, mana whenua interests, or other cultural interests that may be affected by the proposed project as it is located within the Ngāi Tahu Kāwatiri takiwā.

The CIA outlines that Ngāti Waewae supports the Buller Plateaux Continuation Project provided that the proposed mitigation, rehabilitation and compensation measures are fully implemented and that meaningful engagement with the rūnanga continues throughout the life of the project. Ngati Waewae have made a request for continued engagement throughout the BPCP project assessment.

Overall, the CIA seeks long-term protection of mana whenua values through active partnership, environmental restoration, cultural monitoring, and Ngāti Waewae participation in project decision-making and implementation.

The FTAA requires consultation to occur with iwi authorities and groups that represent hapū that are parties to Mana Whakahono ā Rohe. The West Coast Regional Council Mana Whakahono ā Rohe, signed in 2020 has representatives from Te Rūnanga o Ngāi Tahu, Te Rūnanga o Ngāti Waewae, and Te Rūnanga o Makaawhio. Of the three iwi authorities that are signatories, only Te Rūnanga o Makaawhio (Makaawhio) was the only relevant iwi authority whose interests had not already been addressed through other consultation processes.

In response to consultation, Makaawhio acknowledges that Buller sits within the Ngāti Waewae takiwā. Makaawhio expressed their support for the BPCP as a means to safeguard employment as well as acknowledging the broader contribution to the regional and national economy. Makaawhio also stated that the area is a valuable environmental asset and mining is to be undertaken in a responsible manner in order to benefit future generations.

16.0 Additional Supporting Documentation

(o) provide any additional written expert views, advice, or opinions the applicant has obtained concerning their proposal.

The management plans accompanying the application have been peer reviewed by appropriate experts and their comments are provided with the application.

17.0 References

Alliance Ecology. 2024. Baseline Lizard Monitoring Report, Buller Coal Continuation Project. Unpublished draft report prepared for Bathurst Resources Limited.

Alliance Ecology. 2026. Residual Effects Management Report Buller Plateaux Continuation Project. Unpublished draft report prepared for Bathurst Resources Limited.

Bathurst Resources Limited. 2023. Wildlife Permit Report for Monitoring Period 1 July 2022-30 June 2023. WC-59847-FAU (Cypress Mine within MP 41-515).

Bathurst Resources Limited. 2026. Draft Powelliphanta Management Plan (BPCP-ENV-PLN-004). Unpublished report prepared for Bathurst Resources Limited by Lloyd's Ecological Consulting Limited.

Bathurst Resources Limited. 2026. Draft Avifauna Management Plan (BPCP-ENV-PLN-003). Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited.

Bathurst Resources Limited. 2026. Draft Lizard Management Plan (BPCP-ENV-PLN-005). Unpublished report prepared for Bathurst Resources Limited by Alliance Ecology.

Bathurst Resources Limited. 2026. Draft Weed Management Plan (BPCP-ENV-PLN—008). Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited.

Bathurst Resources Limited. 2026. Draft Biosecurity Management Plan (BPCP-ENV-PLN-007). Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited.

Bathurst Resources Limited. 2026. Draft Pest Control Plan (BPCP-ENV-PLN-022). Unpublished report prepared for Bathurst Resources Limited by Alliance Ecology.

Bathurst Resources Limited. 2026. Draft Rehabilitation Management Plan (BPCP-ENV-PLN-002). Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited.

Buckingham, R.P. 1998. Surveys for *Powelliphanta* land snails in the upper Waimangaroa Valley, Blackburn-Orikaka pākihi, Mount Stockton and Mount Rochfort localities, South Island West Coast, New Zealand. Contract report No. 24/1 prepared for Solid Energy International by Wildlife Surveys. 11 pp. Plus maps.

Buckingham, R.P. 2011. Statement of Evidence of Rhys Philip Buckingham. Escarpment Mine Project.

Collen, R.; Armstrong, D.; Cromarty, P.; Empson, R.; Jamieson, I.; N. McArthur, N.; Parker, K.; Parlato, E.; Powlesland, R.; Ward-Smith, T. 2014. Best practice techniques for the translocation of North Island robins (*Petroica australis longipes*), South Island robins (*P. australis australis*) and Stewart Island robins (*P. a. rakiura*). Department of Conservation, Wellington. 22 pp.

Department of Conservation Lizard Technical Advisory Group. 2019. Key principles for lizard salvage and transfer in New Zealand. Wellington, New Zealand: Department of Conservation. 23pp.

Ecological Solutions Limited. 2026a. Buller Coal Plateau Continuation Project Terrestrial Ecological Impact Assessment Report. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. In prep. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2026b. Buller Plateaux Contextual Study. Unpublished report prepared for Bathurst Resources Limited. Ecological Solutions Limited, Kāeo.

Hitchmough R.A., Barr B., Knox C., Lettink M., Monks J.M., Patterson G.B., Reardon J.T., van Winkel D., Rolfe J., and Michel P. 2026. Conservation status of New Zealand reptiles, 2025. New Zealand Threat Classification Series 35. Department of Conservation, Wellington. 15 pp.

Leschen, R. A. B., Marris, J. W. M., Emberson, R. M., Nunn, J., Hitchmough, R. A., & Stringer, I. A. N. 2012. The conservation status of New Zealand Coleoptera. *New Zealand Entomologist*, *35*(2), 91-98.

Lloyd, B. 2024. Surveys for *Powelliphanta patrickensis* in areas rehabilitated after mining. Unpublished report for Bathurst Resources Limited by Lloyd's Ecological Consulting. 31pp.

McEwen, M. 1987. Ecological Regions and Districts of New Zealand. Third Revised Edition. Department of Conservation, Wellington, New Zealand.

McLennan, J. 2020. Great Spotted Kiwi on the Buller Plateau: Distribution, habitat-use and

conservation status.

Mitchell Daysh Limited. 2026. Buller Plateaux Continuation Project Assessment of Environmental Effects.

Nichol, R. 2020. Baseline Bird Survey within Marshalls North, Marshalls South and Deep Stream, Stockton Plateau. Unpublished report prepared by Richard Nichol Ecology.

Nichol, R. 2022. Kiwi and Weka Survey, Winter 2022 Escarpment Mine and Denniston Permanent Protection Area Denniston Plateau. Unpublished report prepared by Richard Nichol Ecology Ltd.

Overmars F.B.; Kilvington M.J. and Gibson R.S. 1998. Ngakawau Ecological District: Survey report for the Protected Natural Areas Programme. New Zealand Protected Natural Areas Programme Series No. 11. Department of Conservation, Hokitika. 178 pp.

Parker, K. A. (2002). Ecology and management of North Island fernbird (*Bowdleria punctata vealeae*) (Doctoral dissertation, University of Auckland).

Robertson, H.A., Colbourne, R. and McLennan, J., 2020. Kiwi best practice manual. Wellington, New Zealand: Department of Conservation. DOC-5592090. 116pp.

Robertson H.A., Baird K.A., Elliott G.P., Hitchmough R.A., McArthur N.J., Makan T.D., Miskelly C.M., O'Donnell C.F.J., Sagar P.M., Scofield R.P., Taylor G.A., and Michel P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 pp.

Sherley, G., Green, C., Owen, K. 1994. Distribution, conservation status and some features of the natural history of Dorcus stag beetles (Coleoptera: Lucanidae). Science and Research Series (75).

Stewart, P. 2024. Deep Creek Autonomous Acoustic Recorder Survey – Summer 2024. Prepared for Ecological Solutions Limited and Bathurst Resources Limited by Sound Counts Limited.

Thomas, B. and Toft, R.J. 1997. Surveys for Fauna in the Upper Waimangaroa Valley. Prepared by Landcare Research for Kingett Mitchell and Associated Ltd.

Thomas, B., Toft, R.J. and Mason, R. 1997. Fauna of the Proposed Northern Opencast Development, Waimangaroa Valley, Buller Coalfield. Landcare Research.

Toy, R.J, Toy, S., Mackenzie, D., Simister, K. and Yong, S. 2021. Distribution of great spotted kiwi (*Apteryx maxima*), 2012–2021. Notornis, 2021, 69(1):1–18.

Trewick, S., Hegg, D., Morgan-Richards, M., Murray, T. J., Watts, C., Johns, P. M., & Michel, P. 2022. Conservation status of Orthoptera (wētā, crickets and grasshoppers) in Aotearoa New Zealand, 2022. Department of Conservation, Wellington. 28 pp.

Walker, K. 1997. Techniques for monitoring populations of Powelliphanta land *Powelliphanta*. Ecological management No. 5. 81 pp.

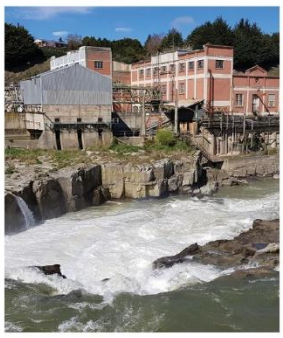
Walker, K., Walton, K. Edwards, E. Hitchmough, R., Payton, I., Barker, G and Michel, P. 2024. Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and *Powelliphanta*) Part 3. Rhytididae (carnivorous *Powelliphanta*).

APPENDIX H

Assessment of Rehabilitation Outcomes (Ecological Solutions Limited 2026h)

ecoLogical Solutions
Environmental Consultants







April 2026

Assessment of Rehabilitation Outcomes

Submitted to:

Bathurst Resources Limited

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by:	[redacted]	[redacted]
	Ecologist	
	[redacted]	[redacted]
	Ecologist	
	[redacted]	[redacted]
	Freshwater Ecologist	
	[redacted]	[redacted]
	Ecologist	
	[redacted])	[redacted]
	Principal Ecologist/ Herpetologist	
	(in relation to lizards)	
Reviewed by:	[redacted]	[redacted]
	Senior Ecologist	

Status:	Final	**Issued:**	21 April 2026

ecoLogical solutions

tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 2/195 main highway,
ellerslie, Auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386
www.ecoLogicalsolutions.co.nz

Executive Summary

BT Mining Limited ('BT Mining'), a subsidiary company of Bathurst Resources Limited ('Bathurst') operate Stockton Mine (which for the purposes of this report includes the adjacent Cypress mining area), which is New Zealand's largest open-cast coal mine located approximately 35km north-east of Westport. In 2024 the active mine site comprised 787ha, including 474ha of rehabilitated area. Rehabilitation at Stockton has been an evolving practice for over 30 years, informed by extensive field trials and refining of various techniques, which have included hydroseeding, planting and vegetation direct transfer (VDT).

Bathurst's current overall objectives with respect to rehabilitation are to create safe and geotechnically stable sites, incorporate landforms that are sympathetic to the surrounding landscape and encourage an indigenous, self-sustaining and diverse vegetation cover and ecosystem. Other specific objectives are required by current Stockton Mine Licences, by resource consent conditions for Cypress Mine, and by access agreements with Land Information New Zealand.

This report sets out the findings of vegetation (including bryophyte) and fauna surveys at planted and VDT rehabilitated sites where the rehabilitation approach and history are known, as well as a sample of non-remediated (historic) sites where no effort was made to rehabilitate them following disturbance. Outcomes for vegetation and terrestrial invertebrate fauna at constructed and natural tarns are also reported. In addition, historic drill sites where the drilling date and access method was known were surveyed to determine the long-term effects of drilling on local vegetation.

The purpose of this work was to assist in understanding how rehabilitated sites are performing with respect to variables relevant to mine closure such as species richness, indigenous dominance, canopy cover, growth rates, colonisation rates, weed presence and native species occupancy. A secondary purpose was to develop recommendations for future rehabilitation of the site based on outcomes at sites with a known history. This information is required to inform future applications for resource consents where the ability to remediate the site effectively for both vegetation and fauna, and a high degree of certainty with respect to outcome, will be important considerations for decision-makers.

The most successful rehabilitation method in terms of vegetation and fauna outcomes was VDT. VDT minimises structural damage to both vegetation and soils, and is able to support a range of animals with reduced mobility such as land snails, lizards and soil invertebrates. VDT results in higher vegetation cover, higher native species cover and provides favourable habitat for fauna and bryophytes when compared to other rehabilitation methods. Non-remediated sites had lower vegetation cover and retained fewer 'Threatened' and 'At Risk' plants than VDT sites. Bryophyte communities within VDT plots contained >25% of indicator taxa, as well as 'Threatened' and 'At Risk' species, confirming that this rehabilitation approach can retain and support mature bryophyte communities and species of conservation concern.

Population densities of *Powelliphanta patrickensis* snails in areas rehabilitated by VDT were similar to densities in undisturbed habitats, however planted sites supported very few snails.

Mean species richness of invertebrate samples was comparable at non-remediated, planted, and VDT sites, though there was larger range at VDT sites. Several non-remediated sites were located adjacent to forest and included forest and shrubland vegetation, therefore establishment of invertebrates was not unexpected. There were also several exotic species collected at rehabilitated sites which contrasts with natural sites sampled previously where indigenous species dominated. Native and exotic money spiders

(Linyphiidae), which are typical invaders of disturbed New Zealand ecosystems, were collected from all habitats.

Five-minute bird counts undertaken across areas rehabilitated by planting and VDT showed that the conspicuousness of New Zealand pipit ('At Risk – Naturally Uncommon') and fernbird ('At Risk – Declining') was similar in both of these rehabilitated vegetation types.

Natural tarns had significantly higher native vegetation cover than either constructed tarns with VDT or constructed and planted tarns, although overall vegetation cover and number of 'Threatened' and 'At Risk' species was not significantly different between treatments. Aquatic invertebrate surveys demonstrated that constructed tarns provided new and important habitat that was statistically indistinguishable from natural tarns.

Results from 32 drill sites across the Buller Plateaux indicate that drilling activities generally do not promote weed invasion. Most (78%) plots had no exotic species recorded.

Strategic planning of rehabilitation with final vegetation communities in mind would enhance future rehabilitation outcomes. Other recommendations to improve rehabilitation outcomes include site-wide considerations, recommendations with respect to VDT, creation of habitats for fauna, recommendations for planted sites, post-rehabilitation site management, creation of tarns, maintenance of bryophytes and monitoring as follows:

Site-wide considerations

i) Site-wide planning which takes into account and provides for local variation in soil depth, topography, exposure, slope angle, aspect, surface roughness and drainage to incorporate ecological gradients and local habitat variation would improve future rehabilitation outcomes across the site.

ii) Planting sites should be prepared using appropriate soil, ideally minimally handled soils of sufficient depth to allow for root establishment of target plants. Minimising structural breakdown of soils by using methods of stripping and placement that minimise handling (i.e., 'jumble dump') is preferred over using stockpiled soil.

iii) Notwithstanding the constraints of mine planning, soil stockpiles for subsequent plant establishment should ideally be minimally handled so as to maintain live vegetation and ideally be low (i.e. < 3m) and short term (< 5 years). Use of fresh soils should be prioritised over stockpiled soils, and dilution of organic soil layers with acidic overburden should be minimised.

iv) If soil stockpiles are to be maintained for more than three years, planting with local species or the transfer of sods containing local vegetation should be used to assist in promoting and retaining soil fauna, reducing sediment mobilisation and providing established plant material for transfer. Where stockpiles are vegetated, a target of 70% vegetation cover is proposed in order to assist in reducing erosion and mobilisation of sediment.

v) The pool of planting species should be expanded beyond that used historically or the standard nursery stock. Appropriate coal measures species that are amenable to nursery propagation, either as seedlings, cuttings or divisions, should be prioritised (e.g., wire rush (*Empodisma minus*), *Chionochloa juncea*). Methods for large-scale propagation of wire rush should be investigated and incorporated into applied research to support site rehabilitation.

vi) Rehabilitation planning should identify and consider the final ecosystem type achievable taking into account elements such as altitude, slope, drainage and aspect. Planting should be done in a way to facilitate succession towards the appropriate vegetation community (forest, shrubland, tussockland etc). This may

involve staged planting with key ecosystem engineer species (e.g., wire rush, mānuka) used initially to set the trajectory for the intended ecosystem type followed by supplementary planting (e.g., of podocarps) in following years once appropriate microhabitats are established.

vii) Storage of VDT and soils on existing high value vegetation should be avoided or minimised so as to optimise outcomes for the highest-value vegetation. Use of stockpiles of mixed soil and lower value vegetation (jumble dumping) may assist in maximising resources for use in rehabilitation.

viii) Where achievable, vegetation types typical of natural local measures vegetation should be the goal. Propagation and use of wire rush should be prioritised due to its ability to spread and establish ground cover, protect soils and create favourable growing conditions for other species. Mānuka should be similarly prioritised because of its relative abundance in most pre-mining vegetation communities. In order to achieve adequate, rapid vegetation cover of rehabilitated sites cost effectively, techniques such as germination of forest duff and litter from other vegetation types to provide a large number of seedlings, use of smaller plant grades, planting at higher density, greater use of jumble dumping and seeding/fascining as well as the strategic/targeted use of fertiliser will assist in meeting vegetation cover targets at planted sites.

ix) Some of the existing plantings contain species which are not local or not appropriate at the density at which they are used. For some species, this may be due to misidentification and/or contamination in the nursery. The use of species not typical of the local coal measures ecosystem should be avoided, or at least minimised. This includes bush and snow tussocks (*Chionochloa conspicua*, *C. flavescens*), koromiko (*Veronica salicifolia*, *V. stricta*), broadleaf (*Griselinia littoralis*), mountain akeake (*Olearia aviceniifolia*), Northern rātā (*Metrosideros robusta*), harakeke (*Phormium tenax* and hybrids) and kānuka (*Kunzea* spp.).

x) Attention to both nursery and site biosecurity will be required to prevent future invasions of 'new' weeds, invertebrate taxa and establishment of other unsuitable species.

xi) Specific attention to rehabilitation of bryophyte habitats would assist in maintaining the 'Threatened' and 'At Risk' species throughout their natural range. This includes steep, damp rock faces, boulder fields with sheltered cavities and a range of suitable vegetation types (pākihi, low forest, red tussock grassland).

xii) Development of specific methods for transitioning recent (rather than historic) rehabilitated sites dominated by exotic or non-local species towards an ecological state which better meets rehabilitation goals would improve ecological outcomes, e.g., for sites dominated by *Agrostis capillaris*, toetoe or *Chionochloa conspicua*, a method to transition them to a more diverse and appropriate habitat.

xiii) Formalising a diversity of approaches to short-term site stabilisation and *Juncus squarrosus* treatments would assist in enhancing establishment of native nursery plants and regeneration of native species.

In relation to VDT:

i) VDT should be used to the maximum extent practicable, especially for low-growing vegetation communities.

ii) Transfer of sods from forested areas, either as VDT or DT of slash provides habitat for fauna and assists in maintaining the existing seed bank and encouraging the area

to regenerate faster than by replanting alone. It is important to ensure there are minimal gaps between sods.

iii) The location of final VDT placement should be planned to provide for ecological connections with surrounding habitats as well as to provide 'islands' of habitat to act as a source of seeds/propagules for surrounding planted areas.

In relation to habitats for fauna:

i) Provision of habitat for fauna within or adjoining VDT could improve its value for fauna more quickly than allowing natural establishment of these features.

ii) Provision of fauna habitat should include creation of microhabitat features (e.g., individual logs/root plates, wood stacks, boulders as stacks and clusters), and macrohabitat features (e.g., logs with holes/root plates). This is particularly important for planted areas which would not otherwise have these features for decades. Creation of variable depth, stable and dry refuges would assist in providing habitat for fauna.

iii) To improve habitats for lizards, this should include excavation of dry (not water-filled) cavities below the surface to provide stable refugia which are protected from cold temperatures during winter.

iv) Topsoil and subsoil should be kept separate during the rehabilitation process and soil structural disturbance and compaction by heavy machinery should be avoided to provide favourable conditions for maintaining earthworms and therefore Powelliphanta snails.

v) Further investigation into the use of fascining, either alone or in combination with planting and seeding, to determine how the outcome of plantings can be improved for snails.

vi) Ensuring that VDT sites are ecologically connected to natural habitats and in proximity to gully habitat complexes to support lizard survival.

vii) Using optimally sized buckets to minimise loss of individual lizards during the VDT process.

viii) The development and implementation of scientifically robust research and monitoring programme(s) are recommended to confirm the benefits of VDT for lizards including radio-tracking lizards before and after VDT and long-term monitoring of lizard populations at VDT sites.

In relation to areas to be planted:

i) Boulders, rocks, logs, root plates and other biological resources should be used to create microhabitats and contribute relief to planted areas.

ii) Fertiliser such as blood and bone, worm castings and pelleted manures which are free of weed seeds should be used strategically to support vegetation establishment at targeted locations and using targeted methods (e.g., placed under the root ball rather than broadcast). Widespread application of fertiliser at high rates is not recommended.

iii) Hydroseeding of steep batters with locally sourced species may assist in reducing the potential for exotic species establishment.

In relation to site management:

i) Weeds have the potential to prevent closure criteria being achieved. Priority should

be given to avoiding weed incursions and managing known weed sources, particularly those that occur at the top of a catchment, are adjacent to vulnerable ecosystems, and are along access tracks (foot or vehicle).

ii) Weed control needs to be addressed on a site wide basis and prioritised to prevent the establishment and spread of heath rush and other exotic species into natural communities. Biosecurity measures such as boot washes at the entrances to all new rehabilitated areas would assist in reducing weed invasion, particularly for *Juncus* which is more likely to be spread on footwear and other equipment than by wind or animals.

iii) Soils known to contain *J. squarrosus* should be used for rehabilitating areas destined to become taller shrublands and forest only since these communities are likely to eventually shade out and supress this weed (Simcock 2011).

iv) Soils known to contain *J. squarrosus* should be used at locations separated from riparian areas to prevent seeds being spread down the catchment.

In relation to tarns:

i) Constructed tarns provide useful habitat for aquatic invertebrates almost immediately and when combined with VDT also have value for vegetation and terrestrial invertebrates.

ii) Tarns should be constructed on gently sloping banks, semi-natural hydrologic regimes and suitable substrates to support diverse plant communities.

iii) Constructed tarns should provide for soft, moist substrates and emergent vegetation.

iv) Large woody debris and/or root wads, as well as additional edge planting in the constructed tarns is recommended.

v) Tarns should ideally be constructed over a sediment base of rock/gravel floor.

vi) VDT should be used around tarns where achievable.

In relation to bryophytes:

i) Consideration should be given to habitat specificity – recognising unique habitat requirements for different species.

ii) Habitat design should create humid microsites, and a variety of hydrological conditions and substrates.

In relation to monitoring:

i) Permanent plots should be established to assess rehabilitation outcomes and should include the plots used in this report. In addition, control sites should be setup to compare succession in ‘natural’ vegetation types to rehabilitation sites.

ii) Recording of baseline information for all rehabilitation sites should be undertaken at the commencement of rehabilitation at each site. This includes recording slope angles, soils, drainage, erosion control and vegetation establishment (method, planting densities and the like). Additional information for vegetated sites can include whether additional native seed was applied, the use of wilding transplants (including number and species) and the degree to which live plants regenerated from stripped/replaced soils at the time of planting.

Table of Contents

Executive Summary ..... **i**
1.0 Introduction **1**
1.1 Background 1
1.2 Relevant Coal Mining Licence and Resource Consent Conditions 4
1.3 Scope of Report 7
2.0 Ecological Setting **7**
2.1 Ngakawau Ecological District 7
3.0 Rehabilitation at Stockton Mine (including Cypress Mine) **9**
3.1 History 9
3.2 Modern Rehabilitation Processes 11
3.3 Rehabilitation Methods 12
3.3.1 Landform and Erosion Control 12
3.3.2 Planting 12
3.3.3 Vegetation Direct Transfer 14
3.3.4 Seeding and Hydroseeding 17
3.3.5 Use of Fertiliser and Biosolids 18
3.3.6 Tarns 20
3.4 Bryophytes 21
4.0 Methods **22**
4.1 Vegetation Survey 22
4.1.1 Rehabilitated Sites 22
4.1.2 Drill Sites 27
4.1.3 Statistical Analysis 27
4.2 Bryophytes 27
4.3 Avifauna 28
4.3.1 Incidental Observations 28
4.3.2 Five-minute Bird Counts 28
4.3.3 Kiwi Dog Survey 28
4.4 Herpetofauna 29
4.5 Terrestrial Invertebrates 31
4.5.1 Soil Dwelling Invertebrates 31
4.5.2 *Powelliphanta* Snails 31
4.5.3 Surface Dwelling Invertebrates 31
4.5.4 Tarns 33
4.5.5 Identification and Statistical Analysis 34

4.6 Aquatic Fauna 34
5.0 Results 34
5.1 Vascular Vegetation 34
5.1.1 Rehabilitated Sites 34
5.1.2 Tarns 38
5.1.3 Drill Sites 40
5.2 Bryophytes 42
5.2.1 Rehabilitated Sites 42
5.2.2 Tarns 46
5.2.3 Bryophytes of Conservation Interest 49
5.3 Fauna 50
5.3.1 Avifauna 50
5.3.2 Herpetofauna 55
5.3.3 Soil Dwelling Invertebrates 56
5.3.4 *Powelliphanta* Snails 57
5.3.5 Surface Dwelling Invertebrates 58
5.3.6 Aquatic Fauna 61
6.0 Use of Rehabilitated Areas by Fauna 62
6.1 Avifauna 62
6.1.1 Five-minute Bird Counts 62
6.1.2 Great Spotted Kiwi 62
6.2 Herpetofauna 62
6.3 *Powelliphanta* Snails 63
6.4 Soil-dwelling Invertebrates 63
6.5 Other Terrestrial Invertebrates 64
6.6 Aquatic Fauna 65
7.0 Discussion 65
7.1 General Considerations 65
7.2 Landscape Considerations 65
7.3 Vegetation Direct Transfer 66
7.3.1 Vegetation 66
7.3.2 Bryophytes 67
7.3.3 Fauna 67
7.4 Planted Sites 67
7.4.1 Vegetation 67
7.4.2 Bryophytes 69
7.4.3 Fauna 69

7.5 Tarns 70
7.5.1 Vegetation 70
7.5.2 Bryophytes 70
7.5.3 Fauna 70
7.6 Non-Remediated sites 71
7.6.1 Vegetation 71
7.6.2 Bryophytes 71
7.6.3 Fauna 71
7.7 Drill sites 71
8.0 Recommendations 72
8.1 Introduction 72
8.2 Landscape-scale Considerations 72
8.3 VDT 72
8.4 Soils and Root Zones 73
8.5 Surface Micro-habitats 74
8.6 Planting 74
8.7 Weed Management 75
8.8 Fauna 75
8.9 Tarns 75
8.10 Bryophytes 76
8.11 Applied research 76
9.0 Summary 76
10.0 References 78

Index to Tables

Table 1: Conditions relevant to rehabilitation from the Stockton Mine CML 37-150. 4
Table 2: General conditions relevant to rehabilitation that apply to Cypress Mine Mine Permit MP41515 Consents Cypress BDC 030164. 6
Table 3: Indicator species for mature bryophyte communities proposed by Glenny (2012), and a modified indicator list adapted for this project. 22
Table 4: Plot cover summary data for rehabilitated and natural sites across Stockton Mine. 35
Table 5: Species richness for rehabilitated and natural sites at Stockton Mine. 35
Table 6: Plot descriptors for natural tarns and constructed tarns rehabilitated by VDT and planting. 38
Table 7: Vegetation descriptors for drill sites according to access method. 41
Table 8: Soil and physiography descriptors for drill sites by access type. 41
Table 9: Plot species richness at non-remediated sites and sites rehabilitated by VDT

and planting at Stockton Mine. 43
Table 10: Species richness and the proportion of indicator taxa at non-remediated sites and sites rehabilitated by VDT and planting at Stockton Mine. 43
Table 11: Species richness at natural and constructed tarns rehabilitated by VDT and planting at Stockton Mine. 46
Table 12: Bryophyte community descriptors at natural and constructed tarns rehabilitated by VDT and planting at Stockton Mine. 46
Table 13: Average number of birds per five-minute bird count at rehabilitated sites. 52
Table 14: Lizards recorded 14 January 2020 within VDT vegetation at Stockton Mine. 55

Index to Figures

Figure 1: Land use at Stockton Mine and Cypress Mining Area as at May 2024. 3
Figure 2: Planted area (foreground) and native planting into seeded exotic pasture (background) near Hope Dump, Stockton Mine. 13
Figure 3: Vegetation Direct Transfer on the batter below the Augustus Gardens at Stockton Mine. This vegetation was placed in 2007 and photographed in 2024 (approximately 17 years post placement). 15
Figure 4: Average number of species per plot (n=32) along transects in stored vegetation from Cypress Mining Area (from Ecological Solutions Limited 2025). 15
Figure 5: Average percentage cover of live vegetation in plots (n = 32) in stored vegetation from Cypress Mining Area (from Ecological Solutions Limited 2025). 16
Figure 6: Average percentage cover of bare ground in plots (n = 32) in stored vegetation from Cypress Mining Area (from Ecological Solutions Limited 2025). 16
Figure 7: Area rehabilitated in 2005-2006 using a combination of methods, which included planting and most likely fascining (from Lloyd 2024). 17
Figure 8b: Biosolids application trial area near Mt Frederick, Stockon Mine (established 2012, photographed 2015). 20
Figure 9: Tarn constructed approximately 2008 with planting and hand transfer vegetation at Mt Augustus Gardens, Stockton Mine, photographed 2024 (approximately 16 years after construction). 20
Figure 10: Location of direct transfer, planted, and tarn plots at Stockton Mine. 24
Figure 11: Location of plots at drill sites and non-remediated sites at the Buller Plateaux. 25
Figure 12: Location of plots at natural sites at the Buller Plateaux. 26
Figure 13: Locations of five-minute bird count stations at Stockton. 30
Figure 14: A malaise trap erected at site DT8. 32
Figure 15: A pitfall trap with a corflute cover raised approximately 5cm off the ground. 33
Figure 16: Mean (± SE) percentage total vascular vegetation cover among plot types. 36
Figure 17: Mean (± SE) percentage cover of native vegetation at rehabilitated and natural sites at Stockton Mine. 36

Figure 18: Mean (± SE) percentage vegetation cover at natural and VDT plots by vegetation type. 37
Figure 19: Mean (± SE) percentage cover of native species at natural and VDT sites by vegetation type. 38
Figure 20: Mean (± SE) vegetation cover for natural and constructed tarns. 39
Figure 21: Mean (± SE) number of PCI species for natural and constructed tarns. 39
Figure 22: Mean (± SE) cover of native species present at natural and constructed tarns. 40
Figure 23: Bryophyte secies richness at non-remediated and planted and VDT sites. 44
Figure 24: Planted vegetation where *C. tuberculata* was recorded (PL-04), Stockton Plateau. 44
Figure 25: Proportion of indicator taxa present at non-remediated sites and sites rehabilitated by VDT and planting. 46
Figure 26: Species richness at natural and constructed tarns at Stockton Mine. 47
Figure 27: Percentage of indicator taxa present at natural and constructed tarns. 48
Figure 28: Average number of birds per five-minute bird count at planted, VDT and natural sites. 51
Figure 29: Signs of great spotted kiwi in rehabilitated areas. 54
Figure 30: Soil-dwelling invertebrate abundance and species diversity at VDT (DT) and planted sites (PL). 56
Figure 31: Average soil-dwelling invertebrate abundance and species diversity (± SE) at natural (TN) and constructed tarns (TM). 57
Figure 32: Number of distinct taxa at native, exotic and unknown terrestrial invertebrates across rehabilitated vegetation. 59
Figure 33: Number of distinct taxa of native, exotic and ‘unknown’ terrestrial invertebrates at natural and constructed tarns. 60
Figure 34: Relationship between earthworm diversity and earthworm biomass at different rehabilitation sites (means ± SE) (from Boyer et al. 2011). 64

Appendices

Appendix A – Sampling sites

Appendix B – Vascular species list for planted sites

Appendix C – Vegetation types for natural, VDT and drill site plots

Appendix D – Bryophyte species recorded

Appendix E – Summary of invertebrate communities at each plot type

1.0 Introduction

1.1 Background

Stockton Mine is the largest opencast coal mine in New Zealand and is comprised of multiple pits, engineered landforms and rehabilitated areas. Stockton Mine (including Cypress mining area) currently comprises approximately 1,261ha with approximately 787ha disturbed and rehabilitated areas forming approximately 474ha as shown in Figure 1.

Stockton Mine encompasses mining within the Stockton Coal Mining Licence ('CML') (with associated conditions) which was granted in 1990 and backdated to 1987. Cypress mining area operates under a separate mining permit with associated resource consent conditions. Note that while there were no special conditions set out in associated Wildlife Act Authorities at Stockton and Cypress which would apply to provision of post-mining fauna habitat, the Powelliphanta Technical Advisory Group has provided advice with respect to planting and site rehabilitation, particularly at Mt Augustus.

The conditions of the Stockton CML require that the licence holder implements such rehabilitation research as may be necessary for effective rehabilitation of the disturbance areas. In addition, the licence holder is required to undertake a research programme to determine an effective method of revegetating the Webb and Stockton No 2 overburden dumps and to establish a vegetative cover of endemic species that conforms to locally occurring ecological patterns. Initially the focus was on creating stable landforms and treating historic acidic metalliferous drainage (also known as acid mine drainage) discharges to streams draining to the Ngakawau River.

Rehabilitation at Stockton is challenging: rainfall is high, soils are shallow, naturally acidic and infertile, temperatures are cold and there is low solar radiation. As a result, many species are slow to grow and disperse naturally. Natural vegetation and disturbed areas are also prone to invasion and displacement of native species by exotic plants, particularly gorse (*Ulex europaeus*) and heath rush (*Juncus squarrosus*).

Rehabilitation trials began at Stockton Mine in the early 1990s. Progressive Rehabilitation of disturbed sites remains a fundamental goal of the Stockton rehabilitation strategy with a view that the earlier sites are rehabilitated, the sooner a self-sustaining ecosystem can become established, and ongoing maintenance costs are reduced. In the past, under a previous mine operator, significant areas of vegetation, soils and overburden were removed to expose the coal seam, however the coal was not removed because suitable markets were not available. Rehabilitation of these sites was then undertaken, but the area was later "re-mined" when market conditions shifted, meaning that some locations have been rehabilitated more than once.

One of the most successful techniques used to date is vegetation direct transfer ('VDT') (Rodgers et al. 2011). Vegetation direct transfer is the process by which intact mats of vegetation and attached soils are removed and relocated to sites to be rehabilitated. This type of rehabilitation technique minimises structural damage to both vegetation and soils, and enables the relocation of short vegetation, as well as any associated fauna which survives or is moved in advance of works, in its entirety.

Resource consent A14.1d of the Cypress mining resource consents requires that rehabilitation develop a 'self-sustaining ecosystem' and this approach has also been applied more generally at Stockton. Self-sustaining ecosystem here refers to indigenous plant and animal communities that establish, grow, reproduce, and persist indefinitely in response to the ecological gradients present and are underpinned by natural ecological succession without human intervention, management or protection. These ecosystems maintain their own biodiversity, nutrient cycles, and resilience against natural disturbances (including weeds) and function as self-regulating, low-maintenance, or wild, environments.

A range of stabilisation and rehabilitation techniques have been developed to conserve soils and native ecosystems at Stockton. Current practice is fairly consistent at planted sites with 400mm granite capping overlain by 200mm soil. Locations with VDT are more variable, depending on the VDT resource (including soil).

Other methods of rehabilitation have included seeding (primarily with pasture grasses and legumes), planting into established exotic grasses or bare soil, and hydroseeding ahead of planting (usually of slopes or steep batters prone to erosion). Fertiliser or biosolid waste has been used in the past to enhance growth rates. Hydromossing has been investigated in a series of trials that included developing methods to grow and harvest mosses (e.g. Ross & Simcock 2004). There are also previously disturbed areas where there has been no remediation attempted. These sites include historic mines and settlements which pre-date rehabilitation efforts or which are outside the direct authority of Bathurst. These previously disturbed sites are referred to here as 'non-remediated sites'.

As at June 2024, approximately 474ha has been rehabilitated to varying degrees at Stockton Mine, including by the previous operator. VDT comprises approximately 17.4% of the revegetated rehabilitation completed. Only a small amount of rehabilitation (including planting and some VDT) has taken place within the Cypress mining area to date.

This report measures rehabilitation outcomes for vegetation and fauna at sites located on both Stockton and Denniston plateaux for three different rehabilitation approaches, including VDT, planting and non-remediated sites. Vegetation and fauna outcomes for natural tarns and constructed tarns were also measured. Lastly, vegetation outcomes at historic drill sites where access date and method are known were surveyed to determine long-term effects of drilling and associated disturbance on vegetation.

In addition, we remeasured three plots within the VDT portion of Strip 7 of the Cypress Mining Area, where the vegetation was measured before transfer and the sods for the plots relocated together. Long term monitoring of red tussock grassland and associated herbfield vegetation directly transferred from Cypress Mining Area is described in a separate report (Ecological Solutions Limited 2025b).

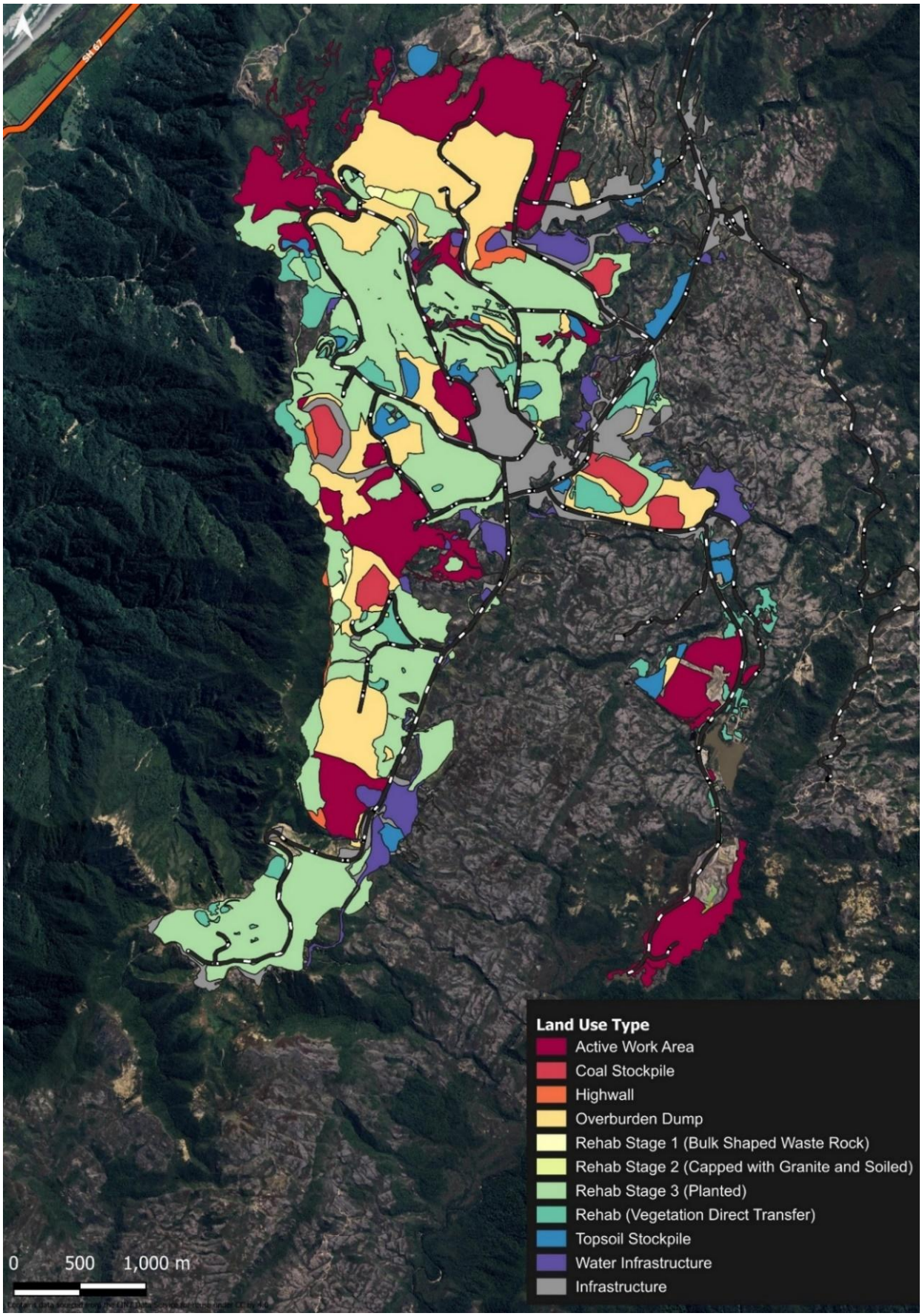


Figure 1: Land use at Stockton Mine and Cypress Mining Area as at May 2024.

1.2 Relevant Coal Mining Licence and Resource Consent Conditions

Rehabilitation outcomes in the CML 37-150 (Stockton Mine) consent which runs from1 April 1987 to 31 March 2027 include conditions A1(1), A1(2), A3(1)(a), (b), and (e), A5 and A13 (3) which are reproduced in Table 1.

Table 1: Conditions relevant to rehabilitation from the Stockton Mine CML 37-150.

Condition	
A1(1), (2)	Notwithstanding condition 1, the licensee shall prepare and forward reports and plans as follows: (1) The licensee shall forward for the approval of the Inspector in consultation with local authorities, including the local territorial authority, catchment authority, and Department of Conservation as the Inspector deems appropriate, annual working plans compiled in accordance with Section 57 of the Coal Mines (Opencast Coal Mines) Regulations 1986 for opencast mining or in accordance with Section 136 of the Coal Mines Act 1979 for underground mining: (a) A detailed plan for the proposed rehabilitation work to be undertaken in the next 12 months; (b) A progress report for the rehabilitation work carried out over the previous 12 months; and, (c) A detailed report indicating the likely extent, magnitude, and impact of surface subsidence predicted to occur as a result of mining in the next 12 months, and where appropriate, plans for monitoring and remedial work; (d) A progress report of the extent, magnitude, and impact of surface subsidence, and remedial measures carried out over the previous 12 months and; (e) An outline of the projected mining, subsidence, and rehabilitation areas for the next 6 years. (2) The plan and report required under subsection (1)(a) and (1)(b) above shall include: (a) Soil salvage including details of area, depth, volume and disposition; (b) Soil replacement including details of area, volume, depth, and source of replaced soil materials; (c) Soil stockpiles, disposition, salvage and consumption (d) Contouring and grading of earthworks (e) Surface pre-treatment and vegetation; (f) Fertilisation strategy and procedures; (g) Post-rehabilitation management; (h) Variations from the approved plans, the reasons for the variations, and their impact on the rehabilitation plan; (i) Results from any rehabilitation research carried out and any further work proposed; and, (j) Details of any proposed roads, access tracks, and exploratory drill sites.
A3(1)(a), (b), (e)	Notwithstanding condition 3; (1) The licensee shall: (a) Keep disturbance of the environment to a minimum and, in particular seek to minimise injury or damage to native plants and trees: (b) As far as possible prevent injury or damage to wildlife and native bird life: … (e) Control noxious weed species within the license area.
A5	Notwithstanding condition 5; (1) In planning and carrying out rehabilitation the licensee shall observe the following goals:

(a) To minimise hazardous conditions.
(b) To ensure short- and long-term stability of the site.
(c) To protect the land surface against wind or water erosion.
(d) To provide for adequate surface drainage.
(e) To minimise post-operational maintenance.
(f) To conduct rehabilitation progressively.
(g) To return land to an equivalent land capability to that which existed prior to disturbance, or to a state suitable for recreation, wildlife habitats or other use as specified in the detailed rehabilitation plan(A1(1a)).
(h) To preserve and restore landscape values in consultation with interested local agencies including the local territorial authority, catchment authority and Department of Conservation.

(2) Where soil or overburden materials to be disturbed are capable of sustaining plant growth, sufficient suitable soil or overburden materials must be salvaged for the purpose of soil replacement.
(3) Soil replacement in the disturbance areas must consist of sufficient suitable topsoil, subsoil or spoil materials to support a productive, erosion controlling vegetative cover that mees the intended post-development land capability.
(4) All excavations must be graded to contours that are compatible with the post-development land capability. All disturbed areas must be contoured to conform to the surrounding topography.
(5) When final pit walls are proposed to be left in the rehabilitated landscape, they must be geotechnically stable and at a slope angle that is compatible with the post-development land capability.
(6) As soon as possible after soil (or spoil) replacement a vegetative cover must be established that is compatible with the post-development land capability.
(7) The licensee shall undertake such rehabilitation research as may be necessary for effective rehabilitation of the disturbance areas.

A13(3) The licensee shall take such measures as are necessary (including the removal of waste coal stockpiles) to progressively rehabilitate the Webb and Stockton No. 2 overburden dumps and establish a vegetative cover of endemic species that conforms to locally occurring ecological patterns, sufficient to:

(a) Minimise the visual impact of overburden dumps
(b) Seek to minimise impact of overburden rehabilitation work on surrounding undisturbed areas.
(c) Minimise impact on the water quality of surrounding catchments.

Rehabilitation at the Cypress Mining Area only recently commenced, but the relevant general conditions are set out in Table 2.

Table 2: General conditions relevant to rehabilitation that apply to Cypress Mine Mine Permit MP41515 Consents Cypress BDC 030164.

Condition	
A14.1	The Consent Holder shall undertake rehabilitation and re-vegetation, to achieve an outcome generally in accordance with Figure 3.16 of the AEE (Refer Attachment 2 of these conditions) and in accordance with the following objectives: (a) In the short-term to create stable landforms by establishing a native vegetation cover and erosion-resistant surfaces that have physical and chemical characteristics that favour growth of sustainable plant communities and manage runoff and sediment generation; and (b) In the medium to long-term, to establish ecosystems similar in plant and animal species diversity and functioning to undisturbed ecosystems adjacent to the site that help the constructed landforms blend into the adjacent landscape and prevent erosion and sediment generation. In relation to stream function, the rehabilitation objective is for stream channel width to match the expected flow and for stream channels to be constructed so as to reflect existing channel complexity, including sinuosity and the removal of culverts where practicable. (c) To prevent weeds and pests invading the site so far as is reasonably possible, and otherwise to eradicate or control weeds and pests on the site. (d) To develop a self-sustaining ecosystem. (e) Red tussock communities (including red tussock wetland communities) are to be established in the western part of the rehabilitated valley floor in the north pit, including the western slope of the toe embankment, and the floor of the south pit.
A14.5	The Consent Holder shall, as far as practicable and to the satisfaction of the Peer Review Panel, ensure that rehabilitation is carried out such that the performance of any modified landform, watercourse, or any permanent structures and facilities under a Probable Maximum Flood or Maximum Credible Earthquake do not result in damage to landforms or structure greater than those that would have occurred under natural slope and landform conditions.
A14.6	The Consent Holder shall undertake progressive rehabilitation of all disturbed areas including highwall benches as areas of practical working size become available, in accordance with the Annual Work Plan and the Rehabilitation Management Plan.
A14.7	The Consent Holder shall, as far as practicable, salvage topsoil and forest duff from areas to be disturbed. All salvaged material shall be used for rehabilitation purposes in accordance with the principle of achieving a minimum of 100mm of topsoil on forest and shrubland rehabilitation and 300mm of topsoil on tussock rehabilitation over subsoils and/or 1.5-3m of non-acid generating overburden.
A14.8	The Consent Holder shall utilise, wherever practical given the characteristics of the land, direct transfer methods of rehabilitation.
A14.9	The Consent Holder shall translocate, as far as practicable, existing vegetation to the banks of new stream channels.
A14.10	Seed and plant resources shall be genetically sourced from the locality or Ngakawau Ecological District from at least 500m above sea level.
A14.11	Tussock that has been removed from the mine areas in accordance with the Rehabilitation Management Plan shall not be buried or destroyed, but shall be utilised as soon as possible in rehabilitation, and if surfaces for rehabilitation are unavailable, shall be stockpiled for re-use either within the mining permit area or at Stockton Mine, as far as possible.
A14.12	Any machinery utilised for any rehabilitation activities, including excavation of topsoil, that is brought onto or moved from the Cypress site must be cleaned before and after use in order to minimise the potential for weed species to be introduced onto or off the site.
A14.13	The Consent Holder shall translocate representative samples of the wetland vegetation other than red tussock for storage and later 'seeding' or nucleus establishment within the rehabilitated red tussock vegetation in the area identified in condition A14.1e.

1.3 Scope of Report

Ecological Solutions Limited was engaged to carry out ecological surveys at rehabilitated sites, including drill sites, tarns and previously disturbed (i.e., from mining, settlements or mining infrastructure), and then non-remediated sites where the rehabilitation approach and history is known. The purpose of these surveys was to assist in understanding how the sites are performing with respect to variables relevant to mine closure such as species diversity, indigenous dominance, percentage cover, growth rates, colonisation rates, weed presence and indigenous species occupancy. This suite of information will be used to inform future rehabilitation efforts, as well as applications for resource consents where the ability to remediate the site effectively for both vegetation and fauna, and a high degree of certainty with respect to outcome, will be important considerations for decision makers.

This report includes 10 sections as follows:

- Section 1.0 sets out the background to the Stockton CML and Cypress mining area and the consent conditions relating to rehabilitation there.
- Section 2.0 describes the ecological setting of Stockton Mine.
- Section 3.0 describes the rehabilitation undertaken to date at Stockton Mine.
- Section 4.0 describes the methods used to survey the rehabilitated sites.
- Section 5.0 sets out the results of the surveys.
- Section 6.0 describes the use of rehabilitated areas by fauna.
- Section 7.0 discusses the relative effectiveness of the rehabilitation methods and any other relevant observations.
- Section 8.0 makes recommendations for future rehabilitation based on the findings.
- Section 9.0 provides a summary.
- Section 10.0 lists the references used in preparing this report.

2.0 Ecological Setting

2.1 Ngakawau Ecological District

Stockton Mine (including the Cypress mining area) is located within the Ngakawau Ecological District and North Westland Ecological Region (McEwen, 1987). The boundaries of the Ngakawau Ecological District are defined by a line connecting Te Kuha to Mount Rochfort, Mount William and a peak west of Mt Lyall in the south, the Glasgow Range in the east and the Mokihinui River in the North. The coastal escarpment marks the boundary of the district to the west, with the coastal plain forming part of the adjacent Foulwind Ecological District. The district covers approximately 48,710ha and the boundaries were defined on the basis of geology, topography and vegetation (McEwen 1987, F. Overmars pers. comm. 2012).

The Ngakawau Ecological District is characterised by elevated coal plateaux (Stockton and Denniston, collectively the Buller Plateaux), southwest and west trending coastal hills and low mountains up to 1,400m asl in the north and southeast (McEwen 1987, F Overmars pers. comm. to G Bramley 2011). The area is characterised by a mild, wet climate and low annual water deficits (Leathwick et al. 2002). The district includes large areas of Eocene (40–50 million years old) quartzose sandstone, grit and conglomerate with Brunner coal seams forming dissected plateaux with highly distinctive vegetation. There are also smaller

areas of gneiss, granite, greywacke and argillite (McEwen 1987, Rattenbury et al. 1998, Nathan et al. 2002). Soils overlying granitic geologies are typically deeper and more fertile and occur most commonly in the southeast of the district (in the headwaters of the Mackley (Orikaka) River), with occasional instances elsewhere. The area experiences mild – cold temperatures and high annual rainfall and most of the district remains in indigenous vegetation (McEwen 1987). There is a strong altitudinal gradient in rainfall across the Buller Plateaux, with the annual average ranging from 3,799mm at Millerton (569m asl) to 7,490mm at Mt Frederick (1,056m asl). On average, rainfall exceeds evapotranspiration in all months on the Buller Plateaux, which is critical to the success of VDT and also influences the timing of planting. Short periods (hours) of high intensity rainfall are also a feature of the Buller Plateaux which affects rehabilitation, particularly the mobilisation of sediment and flashiness of streams draining the plateaux.

The Ngakawau Ecological District includes the distinctive coal measures vegetation and exposed sandstone erosion pavement which characterise the Buller Plateaux as well as large areas of wetland, including pākihi, shrubland and forest and much smaller areas of tussockland, herbfield and boulderfield. The Ngakawau Ecological District is the only ecological district in New Zealand defined by the presence of extensive elevated coal measure geology with its associated landforms, vegetation and flora. The Ngakawau Ecological District includes endemic species such as coal measures tussock (*Chionochloa juncea*) and *Celmisia morganii* (McEwen 1987, Overmars et al. 1998). It also includes naturally uncommon ecosystems including sandstone pavement, boulderfields of acidic rock, pākihi wetlands, seepages and flushes, and tarns (Ecological Solutions Limited 2026a). Some of these naturally uncommon ecosystems are considered threatened (Holdaway et al. 2012).

High-resolution drone photographs collected between 2021 and 2024 and a RECCE-plot based vegetation survey have been used to describe, discriminate and map the vegetation across the Buller Plateaux resulting in the identification of thirteen separate vegetation types (Ecological Solutions Limited, 2026b). Plant species of conservation concern present within the Buller Plateaux and surrounds includes 31 species of vascular plant, 41 species of terrestrial non-vascular plant (bryophyte), four species of aquatic bryophyte and eight species of lichen. Given that not all areas have been fully surveyed, new records of bryophytes (and invertebrates) are likely when new or additional areas are surveyed.

Principal Components Analysis has confirmed that altitude and slope are key ecological drivers of vegetation communities on the Buller Plateaux, along with aspect and the amount of bare rock (Ecological Solutions Limited 2026b). In terms of vegetation, sandstone erosion pavement provides habitat for a vegetation mosaic comprising stunted and prostrate mānuka (*Leptospermum scoparium* agg.) shrub-tussock–wire rush (*Empodisma minus*) and tussock (*Chionochloa juncea, C. rubra* and hybrids of these species) communities. Altitudinal sequences of lowland to subalpine vegetation occur on steep coastal hillslopes comprising mixed beech-kāmahi (*Pterophylla racemosa*)-podocarp (often rimu (*Dacrydium cupressinum*)) forest grading into beech (mountain beech (*Fuscospora cliffortioides*), silver beech (*Lophozonia menziesii*)) and Southern rātā (*Metrosideros umbellata*) forest which becomes more stunted with increasing altitude. Mānuka, pink pine (*Halocarpus biformis*), yellow-silver pine *(Lepidothamnus intermedius*) and *Gahnia* spp. are a significant component of the dense shrubland and low stature forest on the high elevation slopes of the Buller Plateaux (Newell 1990, Overmars et al. 1998). Forested gullies dissecting the sandstone pavement are typically dominated by stunted mountain beech, silver beech and Southern rātā in the canopy, with other common species including pink pine, yellow-silver pine, mānuka, mountain toatoa (*Phyllocladus alpinus*) and kamahi. On the peaks of Mt Augustus and Mt Frederick, subalpine herbs, grasses and cushion plants were common (*Celmisia* spp., wire rush, *Chionochloa* spp., and *Donatia novae-zelandiae*).

Birds present within the district include species adapted to forests, shrublands and open

areas, although numbers on the Buller Plateaux are generally lower than in the surrounding habitats which are mostly forests and are typically more fertile, have more structural complexity and higher food availability (including more fruiting species, Overmars et al., 1998). Pākihi shrubland provides habitat for South Island fernbird (*Poodytes punctatus punctatus*) which are also locally common throughout parts of the Tiger and Blackburn pākihi and at Te Kuha (within the Ngakawau Ecological District, Ecological Solutions Limited unpubl. data (2026), R Buckingham pers. comm. 2013, G Bramley pers. obs. 2013) and at the German and Caledonian terraces (immediately outside the Ngakawau Ecological District). Black shag (*Phalacrocorax carbo*) and little shag (*P. melanoleucos*) are characteristic of major rivers and other waterways. Long-tailed cuckoo (*Eudynamys taitensis*) are also seasonally present throughout the Ngakawau Ecological District and likely use densely forested areas around the Buller Plateaux, where one of their host species, brown creeper (*Mohoua novaeseelandiae*) is also present. Western weka (*Gallirallus australis australis*) are common across the Buller Plateaux using a range of habitats, including shrubland, pākihi and forest.

Tall forest vegetation on fertile sites within the ecological district provides habitat for other threatened bird species such as South Island kākā (*Nestor meridionalis meridionalis*), rōroa (great spotted kiwi, *Apteryx maxima*) and New Zealand falcon (*Falco novaeseelandiae*). Kea (*Nestor notabilis*) are also known from the district and have been observed occasionally at Stockton (McEwen, 1987, G. Bramley pers. obs., 2012).

The threatened land snails *Powelliphanta patrickensis*, *P. augusta* and sub-species of *P. lignaria* are also endemic to the district. *P. lignaria* occurs north of the Buller Plateaux, but the former species both occur on the Buller Plateaux with *P. augusta* formerly limited to the area surrounding Mt Augustus. Five species of terrestrial invertebrate with a threat status ranking are known from the Buller Plateaux, although there are number of species which have not been assessed (Ecological Solutions Limited 2026a).

The Ngakawau Ecological District hosts six species of lizards. This includes three species of skink; northern grass skink (*Oligosoma polychroma*), Newman's speckled skink (*O.* aff. *newmani* "Westland") and brown skink (*O. zelandicum*), and three species of gecko; West Coast green gecko (*Naultinus tuberculatus*), Nelson green (starred) gecko (*N. stellatus*) and forest gecko (*Mokopirirakau granulatus*) (Ecological Solutions Limited 2026a). Of these species, five are of conservation concern (Hitchmough et al. 2026), but only three are known to occupy the Buller Plateaux (Newman's speckled skink, West Coast green gecko, both listed as 'Threatened – Nationally Vulnerable'; and forest gecko considered 'Not Threatened').

3.0 Rehabilitation at Stockton Mine (including Cypress Mine)

3.1 History

Stockton No. 2 Mine opened in the mid-1970s following a long history of principally underground mining on the Stockton Plateau and at Millerton from the 1880s. Initially the key focus under the Stockton CML was to rehabilitate landforms for the purpose of reducing sediment runoff to waterways and ponds used for onsite water management. Soils were disposed of within overburden dumps as they were difficult to transport, generated sediment and initial rehabilitation trials considered them poor quality for plant growth. It was later recognised that mixed soils could be managed and be suitable for plant growth. A vegetated soil cap became integral to (and was more practical to deliver) on overburden dumps recontoured to reduce generation of acid mine drainage (AMD) resulting from the predominance of acid generating overburden. Over time there has been an increased drive

to establish a variety of ecosystems similar in structure, diversity and function to that of nearby undisturbed ecosystems.

In 1990 and 1991 the first rehabilitation trials were established at Stockton by R.D. Keating and Associates and the Fertiliser and Lime Research Centre (Massey University). Initially, they tested the suitability of diverse overburdens as surrogate soils for plant growth (Simcock et al. 2004). Initial failure of direct-transfer shrubland in early 1990s (it was placed on an acid seep) and the cost of VDT in trials in the late 1990s delayed development of this method. Direct seeding of red tussock (*Chionochloa rubra*) and fascining of mānuka (*Leptospermum scoparium*) was also considered unsuitable because both exhibited slow growth rates and produced limited overall cover so the substrate remained vulnerable to erosion (Simcock et al. 2004). Early rehabilitation efforts aimed to build up organic matter and nitrogen to boost plant growth and achieve stabilisation of sediments in the high rainfall environment at Stockton, thereby assisting in preventing sediment discharge to streams. Attempts to establish legumes to build soil organic matter and nitrogen were successful in the short term, but required applications of both lime and fertiliser. The most successful method developed was hand-salvage and planting of tussocks and rushes. An exotic rush (*Juncus squarrosus*), initially thought to be a native *Carpha*, was particularly easy to establish on waste rock surfaces (Simcock et al. 2004).

The coal mined from the Buller Plateaux generally sits within one mineable seam that is 4m to 15m thick beneath up to 35m of quartzose sandstones, grits and topsoil (collectively called ‘overburden’) (Wright 2009). Generation of AMD remains an issue at Stockton and is effectively managed via minimising oxygen and water ingress in engineered landforms through soil compaction and use of non-acid forming overburden as capping material.

By the mid-1990s, greywacke/sandstone surfacing was used where possible to overcome the acidity of mudstones (Simcock et al. 2004). Hand transplants of wilding red tussocks provided ‘instant’ large plants at some locations on rehabilitated areas. Nursery-raised plants were also trialled with high survival rates attributed to thorough hardening off at Stockton and a planting technique that ensured plant root balls were protected from erosion using rock mulching (Simcock et al. 2004). Planting density trials using native nursery-grown plants sourced from the Buller Plateaux were also established. Unsuccessful establishment of planted seedlings on angle of repose (35º to 37º) dump slopes due to erosion around the root ball led to research on alternative rehabilitation techniques which included short-term soil stabilisation using non-native grasses, manuka fascining, and in 1999, hydroseeding (Simcock et al. 2004). Some of these techniques were not progressed when overburden dump construction methods changed, reducing slopes to ~20 degrees and allowing placement of a root zone of mixed soils nominally 300mm deep. Success was also associated with delaying planting of nursery-species until slopes had naturally ‘armoured’ with rock. Between 2001 and 2004, hydroseeding and ‘dry seeding’ trials were carried out at Stockton Mine using mosses, lichens and colonising vascular plants (e.g., *Epilobium* sp.). These trials demonstrated that the moss hydroseeding technique sped up natural plant colonising processes, stabilised slopes and provided a green cover on areas difficult to rehabilitate (e.g., embankments and rock dump slopes) (Simcock et al. 2004).

Research over this period emphasised the importance of identifying low-acid generating root zones (avoiding the need for lime application) and of surface roughness to create sheltered microhabitats. The practice of ‘jumble dumping’ developed in which 1-3 m high windrows of stripped mixed soils and attached plants were dumped on the flat tops of overburden dumps. The technique meant soils were minimally disturbed (the trucks used a spreading run and mounds were not smoothed), and erosion risk was low. The technique allowed natural regeneration of plants in some areas, and water was trapped between some windrows, forming permanent ponds. Trials on some of these areas confirmed shelter was a critical factor promoting growth of native nursery-grown plants, but that some species and soil-less substrates also required fertilisers to establish and persist.

By the late 1990s, natural regeneration of native species on soil stockpiles had achieved nearly 100% cover at some locations (Simcock et al. 2004). Previous VDT, where sods of intact plants and soils (and any associated poorly mobile fauna) are moved intact from stripped areas, was also regenerating. VDT is described in more detail in Section 3.3.3 below. The value of soil with attached vegetation was recognised and minimal-disturbance techniques were developed to enable handling soils of varying competency and composition, such as pākihi. Direct transfer trials in 1998 quantified both cost and benefit of increased invertebrate and plant diversity compared with conventionally treated areas (Simcock et al. 1999). Creation of other small areas of VDT helped refine the technique, which initially used large machinery (3m wide buckets) that was able to remove shrublands up to 5m tall which were being stripped at the time.

In 1998, the first thorough assessment of rehabilitation costs was undertaken as part of assessing the Crown's liability, and as the State-Owned Enterprise Solid Energy New Zealand Limited (the then owner and operator of the Stockton mine) was indemnified against rehabilitation costs associated with previous operations. This added impetus to develop effective rehabilitation techniques for the site.

The use of 'large scale' VDT began at Stockton Mine in approximately 2005 – 2006 (B Walker, pers. comm.) and continued at Stockton until about 2012. Since that time only small areas of VDT have been completed annually.

The resource consent conditions, which were granted in 2005, for the Cypress Mining Area include a requirement to complete 12.5ha of VDT of red tussock grassland and herbfield vegetation, a requirement for different root zones and slopes for areas rehabilitated to tussock and shrubland and closure criteria (standards) with respect to species cover, diversity and weed presence. They also included the requirements to restrict propagation materials to sites above 500m ASL, create accessible habitat for kiwi and to re-establish a minimum number of *Powelliphanta patrickensis* in rehabilitated areas. These closure criteria were the first of their type applied at the Buller Plateaux and were developed further in the resource consent conditions applied at the existing Escarpment Mine (partially completed – currently on care and maintenance) and the Mt William North Mining Area (consented, but not yet developed).

3.2 Modern Rehabilitation Processes

Prior to removal of vegetation in preparation for opencast mining, edge protection is established, which includes constructing clean water diversions, bunds and erosion and sediment control measures. Large wood is then removed or felled, then vegetation, boulders and soils are removed and either placed in overburden storage areas or directly at specific rehabilitation sites, depending on the availability of sites ready to receive them. The underlying 'soft' overburdens (e.g. colluvial layers in valleys) are then removed, and sandstone is then fractured using explosives, removed by excavator and truck, and stored, ready for use in rehabilitation.

Once the coal has been removed, rehabilitation normally follows a three-stage process:

i) Backfilling the void with overburden material, which is managed to reduce the potential for AMD, followed by reshaping of material overburden areas. Overburden placement is also used to create geotechnically stable engineered landforms (ELFs).

   Weathered granite is a commonly used growth medium when available, since it does not generate acid. The fundamentals of the engineered cover construction from the base up are as follows:

   a. A base of coarse material is provided which acts as a "capillary" break to resist drying of the cap by capillary "suction" from areas that are dry and

have some suction capacity.

b. A graded zone is used to cover the capillary zone to support the core of the cap.

c. The core of the cap is a low permeability zone approximately 0.5m thick.

d. The provision of a layer of coarse material to prevent drying from the surface.

e. A subsoil and topsoil zone is established to protect the engineered cover from erosion and support rehabilitation.

f. Any drainage systems established on the engineered cover are constructed in enlarged compacted zones and lined with coarse sandstone, granite and/or mixed geologies (depending on availability) to resist erosion.

ii) Adding roughness to ELFs so as to promote vegetation growth, spreading root zones (generally soils), adding habitat materials (boulders, coarse wood) and then choosing and applying the combination of revegetation methods that deliver a) short term stabilisation, and b) native vegetation (i.e., planting, VDT, hydroseeding), followed by maintenance (primarily weed control and predator control).

iii) Civil works and construction of roads and water channels

The short-term goal of rehabilitation is to minimise erosion by establishing vegetation cover or erosion-resistant surfaces (e.g., rock mulch, flatter or rougher sites). Initial hydroseeding of soiled slopes remains a key measure to minimise erosion on sites vulnerable to erosion whilst native vegetation becomes established. Ideally, the desired long-term outcome is establishing a mosaic of ecosystems similar to those in the affected area prior to disturbance (Simcock et al. 1999). The ELF does not typically replicate the original detailed topography of the site, but is intended to create a landscape that is generally consistent with that present before mining began (Wright 2009).

3.3 Rehabilitation Methods

3.3.1 Landform and Erosion Control

Large-scale recontouring of overburden placement areas down to 20° slopes with irregular benching enables access for planting, controlled water flows and creating a more natural landform (Simcock et al. 2004). Erosion control methods vary according to slope angle and may include using rough surfaces with no seeding on flatter surfaces and rock mulching on shorter, steeper slopes. Typically, the only post-mining slopes exceeding 20º are highwalls, which are cut into the bedrock. Highwalls are terraced, featuring batter slopes and flat benches.

Wetland and tarn complexes are constructed by creating impeded drainage in flat areas. Impeded drainage is achieved via compaction of suitable substrate close to the surface. Poorly draining subsoil, low gradient and high rainfall contributes to surface saturation and ponding in small depressions which maintain wetland/tarn conditions and in particular, surface water.

3.3.2 Planting

Planting of locally sourced nursery raised specimens has been the dominant (conventional) rehabilitation technique used at Stockton Mine since the early 1990s. It has been used in conjunction with hand-transplanting individual plants, hydroseeding and straw-mulching to achieve vegetation cover on mixed soils and overburden.

Species planted

Up to 25 indigenous species have been used in rehabilitation plantings to date, with plants grown from seed, divisions and cuttings sourced from the Stockton Plateau (Kingsbury 2007, Simcock 2011). In the search for fast-growing nurse species that were readily available from suppliers, some species not local to the Buller Plateaux were also used in early years, e.g. *Carex comans* 'Frosted curls'.

Planting densities at Stockton have typically ranged from 7,500 to 10,000 plants per hectare with a proportion of this being individual 'wild' transplants. The most common species used have been those that have demonstrated consistently high survival and growth rates, including mānuka (*Leptospermum scoparium*), Southern rātā (*Metrosideros umbellata*), hebes (*Veronica* spp.), mountain flax (*Phormium cookianum*), red tussock (*Chionochloa rubra*) and *C. conspicua* (Simcock 2011). These species are typically planted together in varying proportions and spatial arrangements as shown in Figure 2. Dominant species have changed over time, depending in part on plant availability. Kingsbury (2007) developed different planting mixes for higher altitude/exposed areas and lower altitude/protected areas, although the extent to which these guidelines were applied remains unknown. Since 2011, dominant species have included *Ozothamnus vauvilliersii*, broadleaf (*Griselinia littoralis*), broad-leaved tussock (*Chionochloa conspicua*), hebe (*Veronica odora*, *V. mooreae*), and toetoe (*Austroderia richardii*).



Figure 2: Planted area (foreground) and native planting into seeded exotic pasture (background) near Hope Dump, Stockton Mine.

Propagation trials of 'species of significance', including 'Threatened', 'At Risk' and range-restricted species, have been undertaken as part of the existing Escarpment Mine activities (Ecological Solutions Limited 2024d). Seed and cuttings from species such as Parkinson's rātā, and *Pseudowintera traversii* and divisions from *Sticherus urceolatus* and *S. tener* have been collected from the existing Escarpment Mine footprint and surrounds, propagated in Bathurst's nursery, and transplanted into rehabilitated and natural areas at Stockton Mine and elsewhere. High survival has been observed for *Sticherus* and woody species such as pahautea (*Libocedrus bidwillii*), *Lepidothamnus intermedius* (yellow-silver pine), *Halocarpus biformis* (pink pine), *Dracophyllum densum* and *Dracophyllum rosmarinifolium*. Survival of small monocots and herbs has been more variable. Monitoring of selected individuals of *Metrosideros parkinsonii* and *Pseudowintera traversii* in 2021 revealed that 16 out of 23

individuals did not survive and the remaining seven could not be found, although survival and expansion of other species, including beech trees and herbs such as *Celmisia dallii* was better. (Ecological Solutions Limited 2024d).

Transplanting of individual 'wild' plants by hand has also been undertaken at many locations historically, targeting species of significance and species known to be tolerant of shifting such as red tussock (Ross 2008) and flax, (Kingsbury 2007). Transplants were routinely used (e.g. at Downers Dump) to provide 'instant' visible revegetation and supplement the nursery seedlings which were supplied as root trainers. In addition, Solid Energy staff (led by Paul Comeskey) and Drs Ruth Bartlett and Robyn Simcock intensively hand transplanted species from the Mt Augustus ridgeline to areas at Hood's Dump known as "the Mt Augustus gardens" beginning in 2008.

Earthworms

A 2024 survey of earthworms from 58 sampling sites located within planted areas undertaken by MBC Contracting found "most" sites were categorised as 'Low abundance and low diversity', with "some" sites (those with more than 16 worms per sample) being 'Good abundance, low diversity' (MBC Environmental 2024). No sites met the threshold for 'High abundance, high diversity' or 'Low abundance, high diversity', because worms representing the 'Deep burrowing' ecological grouping were absent from all sites. These rehabilitation sites dated from 2004 - 2023, but the majority of samples were from pre-2017 sites. This report should be used to establish locations for repeat surveys to better understand changes in earthworm communities at rehabilitated sites over time.

Of the 221 worms found, 25 were adults and the remaining 185 were juveniles. All were exotic, which is perhaps surprising given the isolation of Stockton, although only planted sites were sampled, and nursery plants are a likely source of exotic earthworms. No deep burrowing worms were found, with all worms being either 'dung' or 'topsoil' types. More worms were found at sites with higher leaf litter availability and generally higher fertility, e.g. biosolid treated sites with predominantly grass cover and healthy planted vegetation (B Walker, pers. comm.).

3.3.3 Vegetation Direct Transfer

Vegetation Direct Transfer, also known as "habitat translocation" or "community translocation", involves the removal and relocation of intact mats or sods of vegetation and attached soil (Rogers et al. 2011). The technique was first used at Stockton in the mid-1990s, although the practice has been refined since those initial attempts. Early VDT attempts had large gaps between sods; however, the current VDT process aims to minimise these gaps to ensure consistent vegetation cover. Providing an immediate ground cover of naturally-occurring vegetation via VDT is ecologically favourable compared with planting or seeding, as the latter may take 20–50 years to reach a dense cover of vegetation on mixed soils/overburden, whilst also being vulnerable to erosion and weed invasion for a prolonged period (Ross 2008). An example of VDT is shown in Figure 3.



Figure 3: Vegetation Direct Transfer on the batter below the Augustus Gardens at Stockton Mine. This vegetation was placed in 2007 and photographed in 2024 (approximately 17 years post placement).

Having sufficient area to place VDT sods immediately after they have been extracted can be a challenge in an active mining environment. For the Cypress mining area, 'storage pads' were created as an interim solution to store VDT material prior to backfilling. Monitoring of red tussock vegetation placed within the storage pads has confirmed that native species survival is generally high including for the 'At Risk' herb *Euphrasia wettsteiniana*, and average species richness in monitoring plots has increased as shown in Figure 4. Native dominance and cover have also remained high (generally >90% except in 2019 and 2020 as shown in Figure 5) and the percentage of bare ground has steadily declined since placement as shown in Figure 6.

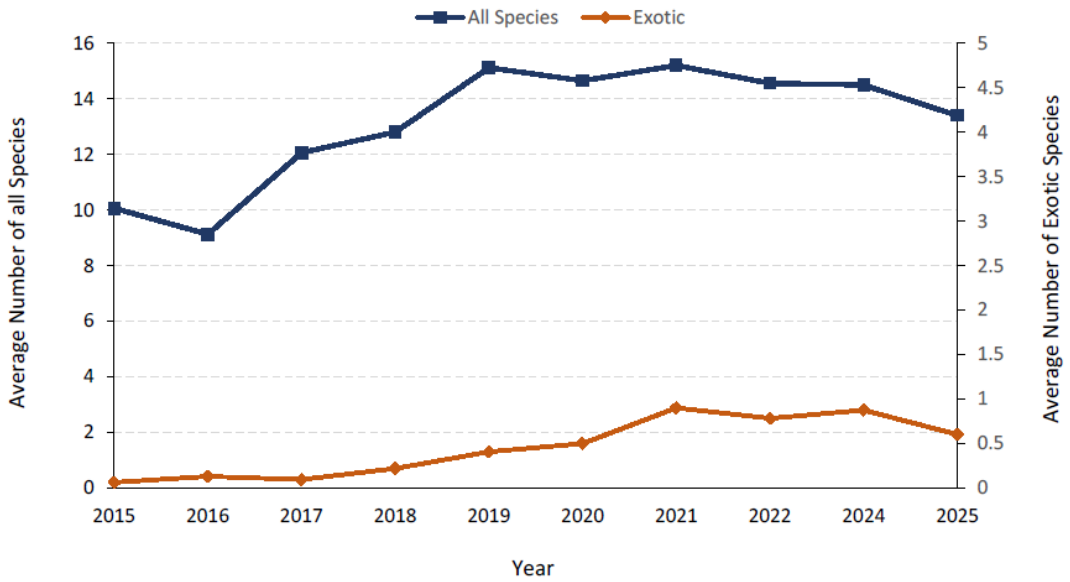


Figure 4: Average number of species per plot (n=32) along transects in stored vegetation from Cypress Mining Area (from Ecological Solutions Limited 2025).

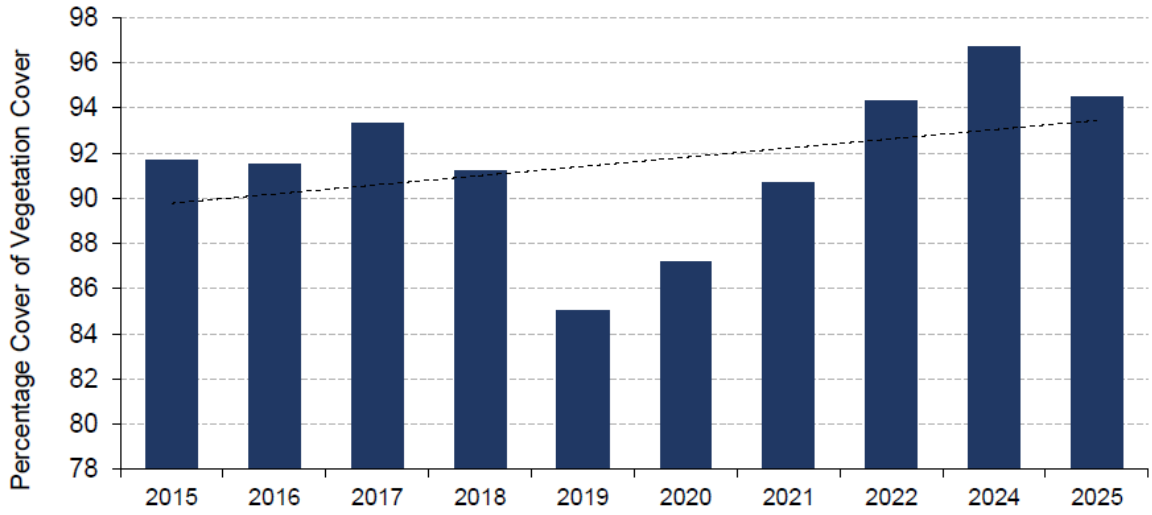


Figure 5: Average percentage cover of live vegetation in plots (n = 32) in stored vegetation from Cypress Mining Area (from Ecological Solutions Limited 2025).

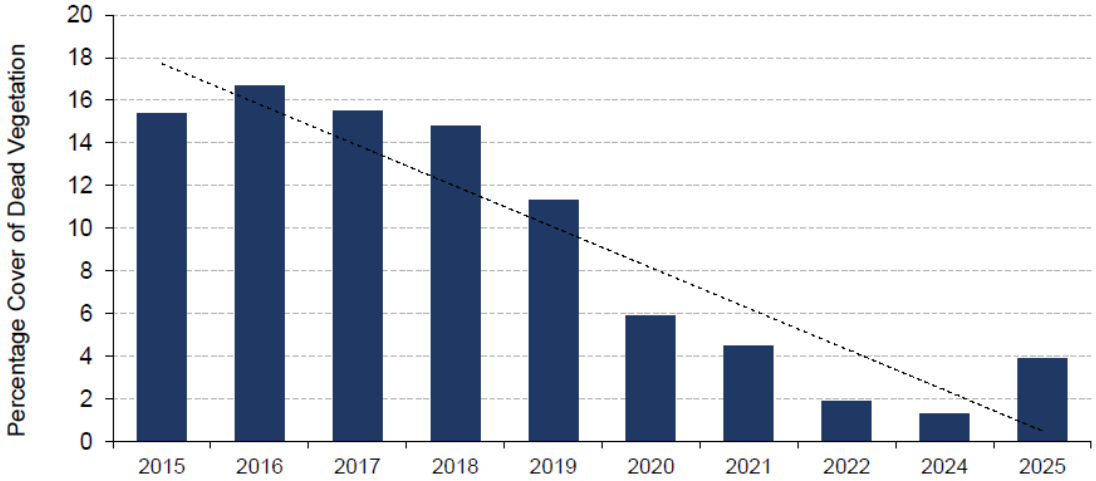


Figure 6: Average percentage cover of bare ground in plots (n = 32) in stored vegetation from Cypress Mining Area (from Ecological Solutions Limited 2025).

The invasion of weeds and presence of native shrubs (mostly mānuka) not normally found in red tussock ecosystems will both require careful management to meet stringent closure conditions of ≤ 5% exotic plant cover and ≤1% mean *Juncus squarrosus* cover) in post-mining vegetation (Ecological Solutions Limited 2025). Frequent monitoring also has the potential to damage vegetation (through trampling) and introduce and maintain weed populations, so limiting the frequency of monitoring and ensuring regular weed control are critical for meeting weed targets, particularly in VDT (Ecological Solutions Limited 2025).

VDT is an effective way to conserve plants which are not propagated by nurseries, to maintain large/old individual plants, and to translocate poorly mobile species of fauna such as snails and lizards (Rogers et al. 2011). VDT soils contain an earthworm biomass and diversity slightly lower and more variable than undisturbed soils, but significantly higher than stripped and stored soils (Boyer et al. 2011). Not all vegetation types are suitable for VDT, with taller vegetation (> 1.5m in height) and rocky soils being less suitable than shorter vegetation on more consistent soils. Red tussock/wire rush-mānuka vegetation responds

particularly well to direct transfer because of its short stature and shallow rooting depth (Simcock et al. 2011), meaning that whole root zones can be transferred with minimal disturbance. Although significant dieback and deaths of shrubs and trees (particularly podocarps) typically occur when transferring forest vegetation, regenerative capacity can still be retained in root plates, understorey vegetation and the seed bank retained in the soil (Ross 2008). In addition, some tree species are resilient to shifting and regrow from their base or trunk (notably rātā, but also some beech species).

3.3.4 Seeding and Hydroseeding

Seeding and hydroseeding have been trialled as methods to revegetate sites that are not suitable for planting or VDT such as road batters, embankments and overburden placement slopes.

A method of seeding called 'fascining' was first trialled in 1990 by placing branches with ripe seed capsules on various substrates, with most successful establishment on soil or finely weathered greywacke/granitic materials as opposed to overburden containing acid-forming rock (Solid Energy 2004). The branches provided shelter and a light mulch of dead leaves which facilitated seed germination, along with controlling soil erosion (Solid Energy 2010). Mānuka is the preferred species for fascining since it produces plentiful seed which is held for a long time on the plant (providing flexibility in harvesting) and ready germination, but this method is labour-intensive. Simcock et al. (2004a) considered that fascining produced slow, limited results compared to other methods of rehabilitation such as planting or direct transfer, but Lloyd (2024) considered that the benefits of fascining had not fully been evaluated in terms of its utility in creating suitable snail habitat. An example of such vegetation is shown in Figure 7.



Figure 7: Area rehabilitated in 2005-2006 using a combination of methods, which included planting and most likely fascining (from Lloyd 2024).

Hydroseeding is the application of a water-based slurry of seeds, adhesive, wood fibre, straw mulch or newspaper and fertilisers using machine-operated high-pressure hoses (Solid Energy 2010). Large-scale hydroseeding trials were implemented in 2002 on an overburden dump and along road sides/cut faces (Ross & Simcock 2004). The two methods used at the overburden dump (dry and wet application of moss mix with fragments of herbs) produced successful germination, particularly for *Epilobium* species. For the trials

along road sides and cut faces, eight treatments were trialled with varying amounts of mulch, fertiliser, moss, exotic grasses and seeds of native species (mānuka, koromiko, mountain flax). Successful germination of all species occurred at these sites, with flax being the most successful in terms of growth. Native species responded well where exotic grasses were excluded from the hydroseeding treatment. Trials using fragments of non-vascular plants and small colonising herbs (*Nertera depressa*, *Epilobium* species, and *Anaphalioides bellidioides*) have also been successful as part of specialised hydroseeding mixes containing adhesive, soil amendment and fertiliser.

Hydroseeding can establish vegetation cover quickly (i.e., within 3–6 months) compared to other methods such as planting (Ross 2008). Hydroseeding trials using native species indicated that areas that are south-facing (shady and retain moisture), have protected, stable microsites (e.g., logs and boulders) and are veneered with granitic overburden produce the best hydroseeding results (Ross & Simcock 2004, Solid Energy 2004). Adding soil and some fertiliser to hydroseeding treatments increased moss cover, which is desirable because moss helps to stabilise slopes, retain moisture and build soil and also speeds up natural plant colonising processes. The use of mosses within hydroseeding treatments also increased native plant cover. These trials also developed methods of propagating moss in tunnel houses (to reduce establishment of weeds and increase growth rates) as well as harvesting and processing methods.

Seeding and hydroseeding have not been used to create shrubland or forest vegetation types because it is expensive (particularly the collection of sufficient volumes of seed from commercially unavailable species) and trials have not yet demonstrated a high level of feasibility for this approach. Aerial sowing of native species was undertaken by Michael Kingsbury (Solid Energy), and more recently (at Cypress mining area) using drones, but is also limited by the effort required to collect adequate volumes of suitable seeds, although mānuka is commercially available. Hydroseeding and seeding are effective treatments for achieving erosion control on steeper slopes with limited accessibility for planting and VDT (Simcock et al. 1999, Solid Energy 2010).

3.3.5 Use of Fertiliser and Biosolids

The generally limited amount of soils available at Stockton poses a challenge for planting. Furthermore, soils across the Buller Plateaux are naturally infertile and therefore support plants adapted to those conditions. Despite this adaptation, the use of fertiliser and biosolids can be beneficial at sites where nitrogen and phosphorus are severely lacking, including planting into overburdens, indicate that plant establishment and survival is better when fertiliser is used (Solid Energy Limited 2004). Fertilisers may be applied:

- Directly to the root ball of each plant at planting;
- Via slits after planting;
- Mixed through the soil profile when spreading the root zone; or
- As broadcast fertiliser.

Where fertiliser is located, the underlying soil condition and the target species are all important factors to be considered in fertiliser application. Broadcast fertiliser at the soil surface is generally the least preferred option because whilst it facilitates growth of erosion control seeding, it also facilitates growth of *Juncus squarrosus* and other weeds and can contribute to the formation of a thick cover of exotic grass which is hard for native species to colonise/establish in.

The quantum and efficacy of fertiliser application is species and root zone dependant. Currently fertiliser and biosolids are strategically used in plantings depending on location and substrate. Plantings on mixed substrates including waste rocks, boulders, rock fines,

and soil or soil-like plant media where fertilisers have been applied have seen an improvement in growth and survival compared to older plantings situated on compacted overburden sandstone, also likely due in part to the provision of microhabitats (Ross 2008, Theinhardt 2003).

Theinhardt (2003) found that the addition of fertiliser on sites with soil had no significant effect on plant growth, however when fertiliser was added to sandstone or quarry rock substrates, plant growth was enhanced. In Theinhardt's trials toetoe and mountain flax responded most strongly to fertiliser, whereas the response of silver beech and koromiko depended on the substrate and level of exposure (Theinhardt 2003).

A 1997 fertiliser trial with nursery-raised plants showed an increase in height and ground cover of red tussock, Southern rātā and koromiko after addition of an NPK fertiliser tablet. Mountain flax has been commonly used in plantings for its fast growth and suitability as a nurse crop and as snail habitat; however, at infertile sites it requires repeated fertiliser applications to sustain growth and set seed (Simcock & Ross 2014).

The use of biosolids (dried and sterilised municipal sewage waste) to overcome high acidity and infertility of soils has resulted in some success in terms of increasing plant growth and improving the availability of nutrients (Waterhouse et al., 2014); however, the establishment of native plants at some biosolid sites has proven difficult. A more recent biosolids application field trial area using only native plantings is shown in Figure 8a. High mortality of nursery seedlings has occurred in some application trial areas where exotic grasses smother native plants as shown in Figure 8b. A pot trial adding biosolids into the propagation medium for red tussock (*Chionochloa rubra*) at the rate of one-part biosolids to four parts soil stockpile composite increased plant biomass, but also increased earthworm mortality (Waterhouse et al. 2014). The use of biosolids at the Stockton mine will cease when the current contract with Christchurch City Council expires later this year.



Figure 8a: Biosolids application trial area using only native plantings at Rockies South, Stockton Mine. Planted 2019, photographed 2024 (approximately 5 years old).



Figure 8b: Biosolids application trial area near Mt Frederick, Stockon Mine (established 2012, photographed 2015).

3.3.6 Tarns

Tarns are subalpine and alpine ponds, and in the context of the Buller Plateaux are ephemeral and permanent features of the sandstone pavement landscape, occurring in areas of impeded drainage (Simcock et al. 2011). Since the early 2000s there has been both deliberate and inadvertent rehabilitation of tarns on impermeable coal floor, in areas rehabilitated with VDT, and on flat compacted overburden areas, either as individual features isolated by landforms or bunds or as part of a tarn complex. At some locations. tarns have been used to help manage sediment in the short term. The substrate of constructed tarn floors is typically sediment, and margins and adjacent areas are generally either planted or receive VDT. An example of an inadvertently constructed tarn with planted and hand transferred vegetation is shown in Figure 9.



Figure 9: Tarn constructed approximately 2008 with planting and hand transfer vegetation at Mt Augustus Gardens, Stockton Mine, photographed 2024 (approximately 16 years after construction).

3.4 Bryophytes

VDT and rock transfer have both been undertaken at Stockton Mine, but the survival of bryophytes has typically not been monitored. Glenny (2012) found bryophytes recolonise VDT areas more effectively than hand-planted areas without soil. Glenny's comparison between bryophytes present in 'natural pākihi' and at sites rehabilitated by planting, showed that the two bryophyte communities shared only two common moss species, *Campylopus clavatus* and *C. introflexus*. Glenny (2012) noted that naturally uncommon bryophyte species typically have narrow and uncommon niches, and restored sites likely have fewer such niches unless they are intentionally created.

Terry (2017) surveyed rehabilitated sites at Stockton for bryophytes and lichens, noting that liverwort diversity had noticeably increased (43 liverworts, 20 mosses, and 17 lichens) since Glenny's 2012 survey. This increasing diversity suggests that there was sufficient shade and moisture present at older sites to support a wider range of bryophytes, particularly liverworts, preventing them from drying out. Terry (2017) also found that VDT supported more mature bryophyte communities, and contained more 'At Risk' and 'Data Deficient' lichens (e.g., *Cladia inflata*, 'At Risk – Declining', and *Parasiphula elixii,* 'Data Deficient', de Lange et al. 2018) than planted sites.

Glenny (2012) considered that a mature bryophyte and lichen community would be established when 25% of the indicator species for a particular vegetation type were present. The indicator species and vegetation types are set out in Table 3. Since 2012, taxonomic revisions have placed some species formerly in the genus *Telaranea* (Lepidoziaceae) in *Ceramanus*, *Kurzea*, *Neolepidozia* and *Tricholepidozia*. For simplicity we have included the latter genera as 'indicator taxa' in Table 3. Furthermore, because some bryophyte genera such as *Acromastigum* and *Pulchrinodus,* which were not listed as 'indicator species' in Glenny (2012), but do occur in 'mature bryophyte communities' (e.g., Glenny 1999, Glenny and Fife 2001, Glenny 2003), we have expanded Glenny's (2012) list to include the 'indicator taxa' set out in Table 3. Given that the indicator species identified by Glenny also occur in other habitats, we have grouped the habitat types.

For the purposes of assessing rehabilitation outcomes, we consider that if at least 25% of the indicator taxa listed in Table 3 have established, then the bryophyte community can be considered successionally advanced.

Note that no rehabilitated sites at Stockton comprise tall forest and are not expected to for some decades. Glenny (2012) considered that up to 50 years might be required for a mature bryophyte community to establish, but the outcome is likely to depend on a variety of factors including rehabilitation method and plant growth rates. There is currently no data available to confirm the length of time required.

Table 3: Indicator species for mature bryophyte communities proposed by Glenny (2012), and a modified indicator list adapted for this project.

Habitat type	Indicator species of mature communities	Habitat type	Indicator taxa of successionally advanced communities
Forest	*Bazzania adnexa* *Bazzania monilinervis* *Bazzania nitida* *Bazzania novae-zelandiae* *Gottschea pinnatifolia* *Kurzia hippuroides* *Lepidozia digitata* *Lepidozia kirkii* *Lepidozia pendulina* *Neolepidozia tetrapila* *Psiloclada clandestina* *Schistochila glaucescens* *Zoopsis argentea* *Zoopsis nitida* *Zoopsis setulosa*	**Forest, Shrubland, Pākihi / Tarns, open sandstone pavement**	*Acromastigum* *Bazzania* *Ceramanus* *Gottschea* *Kurzia* *Lepidozia* *Neolepidozia* *Pallavicinia* *Pleurophascum ovalifolium* *Psiloclada clandestina* *Pulchrinodus inflatus* *Rhacocarpus purpurascens* *Riccardia* *Schistochila* *Syzygiella colorata* *Telaranea* *Tricholepidozia* *Zoopsis*
Pākihi	*Kurzia hippuroides* *Pallavicinia rubristipa* *Pleurophascum ovalifolium* *Riccardia asperulata* *Riccardia cochleata* *Riccardia crassa*		
Open sandstone pavement	*Rhacocarpus purpurascens* *Syzygiella colorata*		

4.0 Methods

4.1 Vegetation Survey

4.1.1 Rehabilitated Sites

Twenty-one 10m x 10m vegetation plots at rehabilitated sites were surveyed in October and November 2023[1] including eight which had been subject to vegetation direct transfer (VDT sites), seven which were planted (PL sites) and six which were previously disturbed but not remediated (i.e., 'non-remediated' DS sites). Sites were chosen so as to sample a range of ages of rehabilitation, a range of vegetation types and a range of accessible locations across Stockton Mine to include higher and lower altitude sites.

The non-remediated sites were subject to disturbance from mining, associated infrastructure or settlements up to approximately 54 years ago and have since been left to naturally regenerate for varying amounts of time with no rehabilitation methods applied.

[1] 31st October 2023; 1st, 2nd, 15th, 18th, 20th, 21st and 22nd November 2023.

The approximate length of time since disturbance is provided in Appendix A.

To provide a comparison of the three rehabilitation methods to structurally similar, but undisturbed vegetation, data from a subset of plots (n = 10) collected using the same method as part of a wider Buller Plateaux mapping project (Ecological Solutions Limited 2026b) were used in statistical analyses. The locations of these plots are shown in Figure 10, Figure 11 and Figure 12 and are also provided in Appendix A. Vegetation within the plot was recorded using a modified RECCE method (Hurst et al. 2022). Each 10m x 10m plot was divided into four 5m x 5m quadrats and each quadrat was recorded separately. The north eastern quadrat of each plot was surveyed for bryophytes and lichens.

In addition, vegetation surrounding 12 natural tarns (TN sites) and six constructed tarns (TM sites) was also surveyed. The location of these tarns is shown in Figure 10. To define the survey area a tape measure was laid around the perimeter of each tarn, maintaining a 2m separation from the water. The area between the perimeter of the tarn and the tape measure was divided into two or four quadrats (depending on the perimeter length) and the same data was recorded as at the rehabilitated sites. Locations and descriptions of the rehabilitated sites and tarn sites are presented in Appendix A

Plant species were recorded within each quadrat along with their percentage cover and height classes. The physiography, slope, aspect and soil drainage were recorded for each plot, and soil depth was recorded for each quadrat. Physiography was assigned using the classes defined by Bell (2005). Slope angle and aspect were estimated using a compass. Soil depth was recorded using a 70cm steel soil probe near the centre of each quadrat.

Soil drainage class was assigned for each plot by digging an approximately 20cm deep hole, either adjoining or within the plot, and using soil features to assign one of five soil drainage classes (Taylor and Pohlen 1979). Other features such as surface water, soil saturation and vegetation type were also considered when determining drainage class. With respect to vegetation, the wetland indicator status of species assigned by Clarkson et al. (2021) was considered. Where the dominant ground cover species was obligate (e.g., wire rush) or facultative wetland (e.g. *Machaerina teretifolia*), soils were considered poorly drained.

The percentage of ground cover vascular vegetation, non-vascular vegetation (i.e., bryophytes), litter, bare ground and rock was estimated for each quadrat. The estimated average top height (m) and percentage canopy cover was also recorded for each quadrat. Any vegetation browse, invertebrates or birds encountered within the plot or nearby were also recorded, along with the rehabilitation method applied.

From the information collected, the following metrics were calculated for each plot:

- Number of species.
- Number of indigenous and exotic species.
- Proportion of indigenous species.
- Total percentage vegetation cover.
- Number of ‘Threatened’ and ‘At Risk’ species.
- Percentage cover of ‘Threatened’ and ‘At Risk’ species.

The number and type of colonising species (i.e., those not planted) were also recorded at planted sites.

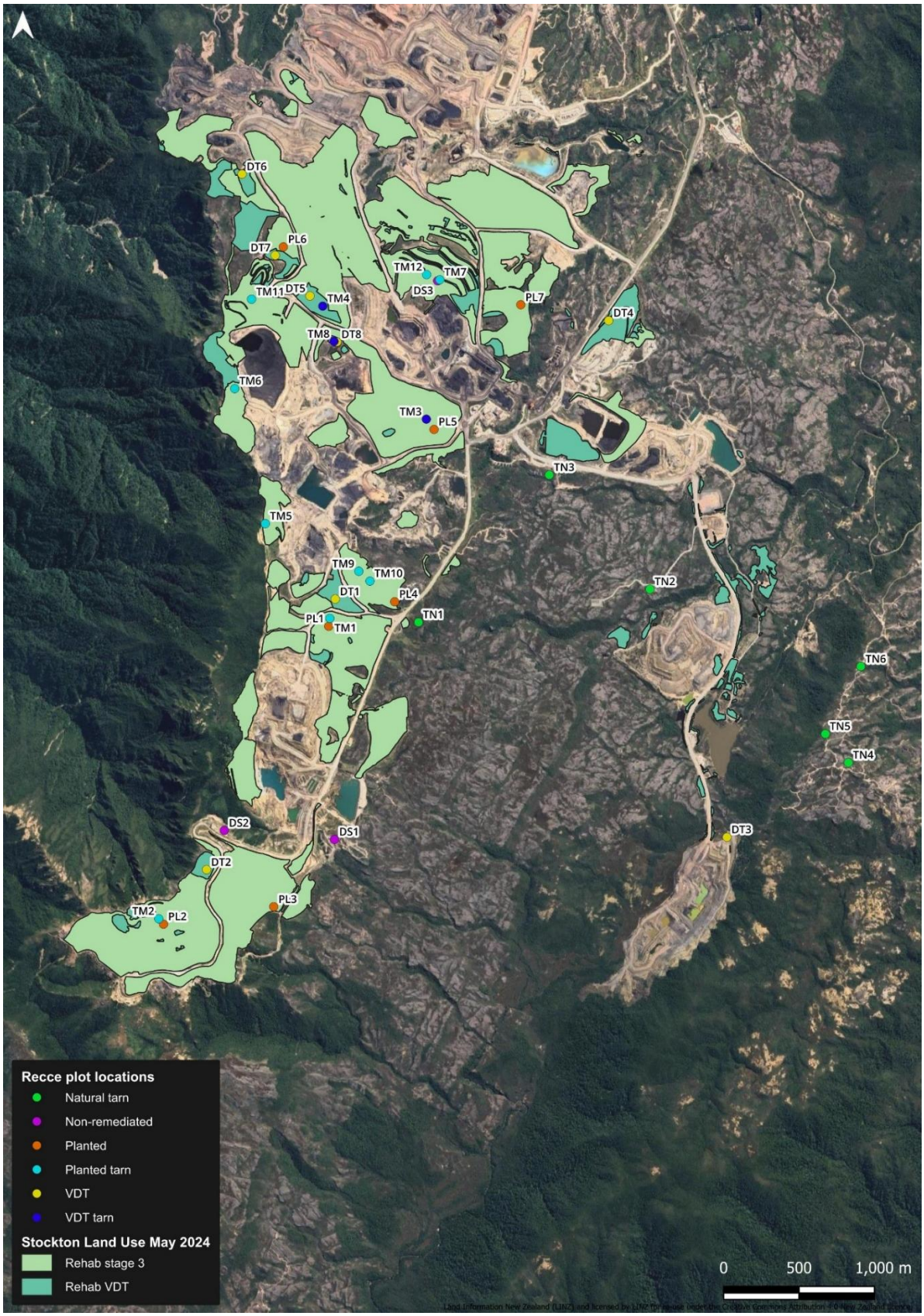


Figure 10: Location of direct transfer, planted, and tarn plots at Stockton Mine[2].

[2] Note Rehab Stage 3 are areas that have been planted.



Figure 11: Location of plots at drill sites and non-remediated sites at the Buller Plateaux.



Figure 12: Location of plots at natural sites at the Buller Plateaux.

4.1.2 Drill Sites

Thirty-two drill sites across the Buller Plateaux were surveyed to determine whether prospecting and drilling activities promoted the establishment or persistence of weedy vegetation. Six sites were surveyed south of Mt Frederick (DC sites), six near the Cypress mining area (STK sites) and twenty throughout the Denniston Plateau (DEN sites), as shown in Figure 11. The locations and descriptions of these drill sites are set out in Appendix A.

Access for drill rigs included helicopter (n=20), ground-based vehicle (n=3) and track-mounted drill rig (n=4). Access at five sites (one at Denniston, four at Stockton) was unrecorded, but it is likely these were helicopter access given the distance from roads and the lack of tracks to those sites. The sites were active between 1997 (Stockton) and 2023 (Mt Frederick South) with Stockton sites being drilled from 1997–2023 and Denniston sites drilled from 2011–2015. Due to the relatively small extent of their footprint (typically 10m x 10m or less) and comparatively minimal disturbance, none of the drill sites had been subject to any rehabilitation management. Vegetation at drill sites was surveyed using 5m x 5m RECCE plots as described in Section 4.1.1, with the drill hole located at the centre of each plot.

4.1.3 Statistical Analysis

To simplify the dataset used for statistical analyses, species cover and ground cover values and soil depths were averaged across the two sub-plots (for tarns) or four quadrats (for RECCE plots) of the plot so that each of these variables had only one metric per plot.

It was expected that there would be higher mean total vegetation cover, higher cover of native species and a higher proportion (in terms of cover) of plants of conservation interest ('PCI' i.e., plants considered to be 'Threatened' or 'At Risk' by de Lange et al. 2024) at natural plots compared to the other plot types, and that VDT sites would have higher mean total vegetation cover, higher cover of native species and a higher proportion of PCI than either non-remediated sites or planted sites. We also expected that vegetation surrounding natural tarns would have higher percentage cover, a higher proportion of native species and more PCI than vegetation surrounding constructed tarns.

Mean total vegetation cover, cover of native vegetation, and proportion of PCI were also compared between natural plots and VDT plots of the same vegetation type (beech forest, shrubland, tussockland). Due to small sample sizes (n: 2–4), no statistical tests were applied to these data.

High variation relative to the mean (overdispersion) is a common feature of count data, so to avoid some of the constraints of traditional ANOVA models, the generalised linear model (GLM) function in R (R Core Team 2022) was used with a quasi-Poisson error distribution and log-link function to determine whether the number of PCI varied between treatments (planted, direct transfer, non-remediated and natural (control)). Because the percentage cover (i.e., total cover and total native cover) exceeded 100%, a normal ("gaussian") distribution was used in the GLM models.

4.2 Bryophytes

The north-eastern quadrat of each vegetation and tarn plot was surveyed for bryophytes at the same time as the vascular plant survey described above. Terrestrial and epiphytic microhabitats sampled included ground cover vegetation, leaf litter and detritus, decomposing wood, soil, rock, bedrock and fissures, substrate overhangs, bark, and areas where moisture accumulated.

Specific efforts were made to detect adventive bryophytes such as weasel moss

(*Sphagnum subnitens*). Metrics reported here include species richness per plot, percentage cover, presence of 'Threatened' or 'At Risk' species (de Lange et al. 2020, Michel et al. 2026) and the proportion of 'indicator taxa' described above (Table 3).

In addition, bryophytes were surveyed along Monitoring Transect 4 at McCabe's tussock storage pad which consisted of red tussock (*Chionochloa rubra*) grassland. Red tussock grassland is particularly high value habitat for bryophytes. The vegetation was originally relocated from Cypress mining area to the McCabe's tussock storage pad in 2008. The vegetation had not been surveyed for bryophytes previously, but the presence of any bryophytes would indicate that they had either survived the VDT process or colonised the vegetation after placement.

4.3 Avifauna

4.3.1 Incidental Observations

All bird species encountered during the vegetation surveys were recorded.

4.3.2 Five-minute Bird Counts

Five-minute bird counts were collected using the standard method of Dawson and Bull (1975), modified for distance sampling. Only birds within 200m were recorded (i.e., a bounded survey) to try and limit the inclusion of birds heard outside the rehabilitated areas, particularly from adjacent unmodified areas.

A total of 46 permanent five-minute bird count stations were established at rehabilitated sites at Stockton at the locations shown in Figure 13 including:

- Between four and seven stations established within each of R6, Ross Dump, Campbells Dump and the Tussock Storage Pad in 2021.
- 24 stations at an additional 12 rehabilitated areas (eight planted sites and four VDT sites) in 2024.

Each station was sampled once by two observers on 18th February 2021 and again 6th or 7th March 2024. Each of the 46 stations was surveyed once by each observer. Stations were separated by at least 100m to provide representative coverage of each rehabilitated area. Data from five-minute bird counts undertaken at natural habitats on the Denniston Plateau was used to compare differences in species composition and numbers between rehabilitated and natural sites. Surveys were undertaken on two consecutive days, with fine weather, little wind, and only a light shower during some periods on the second day of each survey. Noise from heavy machinery introduced moderate to loud interference, which was particularly noticeable at the Tussock Storage Pad, Campbell's Dump, and the Mt Augustus Gardens area. It is recommended that additional bird surveys be undertaken during site shut-downs where possible.

A paired sample t-test was used to compare the average number of birds per five-minute bird count between planted and VDT rehab sites.

4.3.3 Kiwi Dog Survey

Nine sites were surveyed in February and March 2021 including R6, Plover, MF16, Mt Fred Tarn Trial, Mt Fred Quarry, A Drive, SN13, Hook Dump and SN05. Surveys used approximate transect lines within each site walked by Lynne Maguire (MBC Environmental Ltd) and a certified protected species conservation dog, Mica.

Three sites were surveyed in 2024, including R6, Mt Fred Quarry and Tyler Road, using the same method as the 2021 survey by Lynne Maguire (MBC Environmental Ltd) and a

certified protected species conservation dog, Petra. In addition, two trail cameras and two acoustic recorders were set at Mt Fred Quarry to record for three nights from 24 June 2024 to 27 June 2024.

4.4 Herpetofauna

To assist in determining whether VDT sites can support lizard populations, 100 Artificial Cover Objects (ACOs) were deployed in March 2019 at five VDT sites. Each ACO consisted of two stacked onduline sheets, each measuring approximately 500mm x 450mm. ACOs within the VDT sites were surveyed on the 14 January 2020 and again on 12 and 13 February 2024 to determine whether any lizards were using them.

Surveys included the checking of ACOs in conjunction with manual searching which included visual scans for West Coast Green gecko and turning over rocks or coarse wood for forest gecko or Newman's speckled skink. One of the five sites (Mt Frederick) was inaccessible due to programmed blasting activity and not surveyed. The 2020 survey involved 16.75 person hours of searching by four people and the 2024 survey involved 43.75 person hours also by four people.

The focus of these later surveys was to confirm the presence of West Coast green gecko in the VDT sites. To that end, surveys were undertaken in Hope Dump and Campbells as these were considered the most likely to have West Coast Green gecko due to the habitat type and quality there.

In accordance with standard protocols set out in Lettink & Monks (2016), information recorded for each lizard included:

- Location detected (GPS).
- Species.
- Snout Vent Length (SVL).
- Sex and reproductive status (gravid or non-gravid).
- Tail regeneration status (original or regenerating tail).
- Dorsal, ventral and lateral photos.
- ACO or CFC number (reptile shelters) or height above ground and tree species detected in (nocturnal surveys).

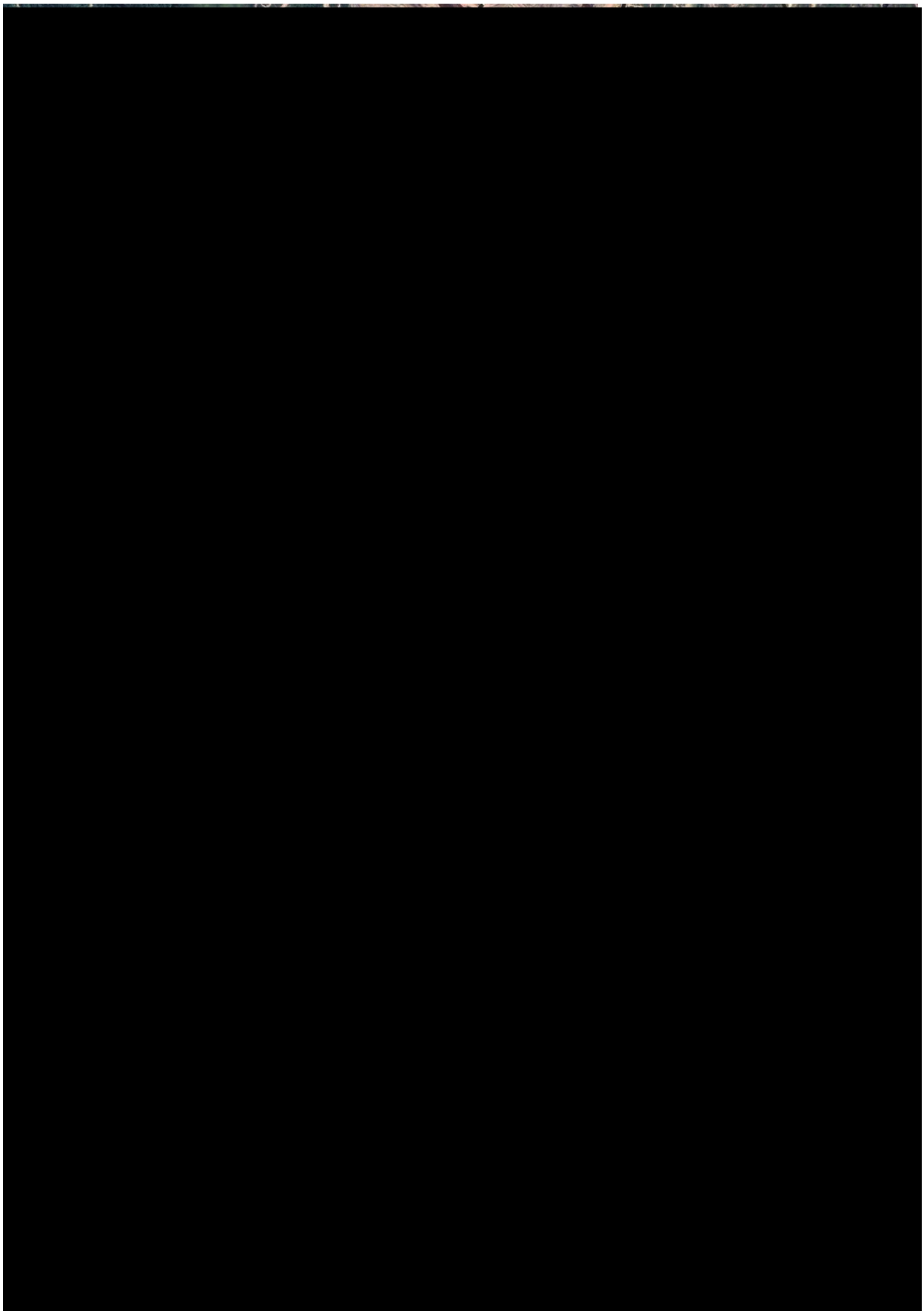


Figure 13: Locations of five-minute bird count stations at Stockton.

4.5 Terrestrial Invertebrates

4.5.1 Soil Dwelling Invertebrates

Twenty-eight soil samples with a volume of approximately 800cm^3 (8 litres, 20cm deep x 20cm wide) were collected, including seven from VDT sites, five from planted sites, ten from near constructed tarns and six from near natural tarns. The litter layer was included in the samples. Soil was bagged into large snap-lock bags and sent to Lincoln University for extraction and identification of soil fauna.

Soil samples were checked by hand for macrofauna (i.e., 0.5–50mm in size) before being placed into a Berlese funnel for extraction of microfauna. Berlese funnels are devices used to extract desiccation-intolerant invertebrates (e.g. earthworms) from samples of soil or leaf litter. They work by providing a heat source at the top of the device, gradually drying the soil from top to bottom. This encourages desiccation-intolerant invertebrates to move further down into the soil to stay moist, eventually falling into a sampling container or pottle placed underneath the device.

Soil samples were placed into Berlese funnel trays and left to dry for approximately seven days or until completely dry. A pottle filled with 100mL of 70% ethanol was placed under each Berlese funnel to catch any invertebrates from the sample. The light used to provide a heat source were Phillips 75W Bayonet light bulbs. Following collection, microfauna (i.e., organisms with a body size of <0.1mm, e.g. mites (Acari)) were identified using a stereo microscope.

4.5.2 *Powelliphanta* Snails

Field surveys for *Powelliphanta patrickensis*, a 'Threatened – Nationally Critical' terrestrial carnivorous land snail restricted to the Buller Plateaux, were undertaken by MBC Environmental during summer 2023–24 in rehabilitated areas on the Stockton Plateau (Lloyd, 2024, Walker et al. 2024). The purpose of these surveys was to assess whether different rehabilitation techniques are effective in supporting healthy populations of snails. Nocturnal surveys were undertaken along 8km of transects through planted areas and nearby undisturbed habitat, while nocturnal capture-recapture surveys were undertaken in two 70m x 70m plots in red tussock VDT at McCabe's Tussock Storage Pad. Nocturnal surveys were undertaken by two observers, working during the hours of darkness on warm moist nights, with overnight temperatures > 8°C and relative humidity remaining above 90%.

Data from snails ≥ 20mm in diameter were used in capture-recapture analyses to estimate plot population sizes and demographic changes (apparent survival rate, per-capita recruitment rate and population growth rate) between surveys (Lloyd 2024). Analyses were undertaken to determine snail age based on diameter and the proportion of reproductively mature snails in samples.

4.5.3 Surface Dwelling Invertebrates

4.5.3.1 Introduction

Five different methods were used to sample terrestrial invertebrates including malaise trapping, pitfall trapping, sweep netting, beat sampling and hand searching. Different methods were used in order to sample a range of microhabitat types which are utilised by different invertebrate species. A total of 39 sites were sampled in this survey, at the same locations as the vegetation plots.

At each sampling site, one malaise trap was set and three pitfall traps were installed. Pitfall traps were placed within 5m of malaise traps. Additionally, suitable vegetation surrounding

the site was sweep-netted and beat-sampled for at least ten minutes on the day the traps were installed. Traps were set between 31 October and 2 November 2023 and retrieved on 20 November and 22 November 2023. During the three weeks the traps were deployed, 349mm of rain fell and an average wind speed of 14km/h (range 9–25km/h) was recorded at Stockton (Bathurst Resources Limited unpubl. data). Specific methods are described for each sampling method in more detail below.

4.5.3.2 Malaise Trapping

Malaise traps are 'tent-like' passive intercept traps that primarily catch flying insects, particularly wasps (Hymenoptera) and flies (Diptera), but also moths (Lepidoptera, particularly if combined with an ultraviolet light). They are usually set in contact with the ground to collect low flying species, but can also be set in the forest canopy to sample high flying insects. Each malaise trap was nestled among short vegetation where possible so as to minimise damage and movement of the trap due to wind. One malaise trap was set at each site and an example of a malaise trap is shown in Figure 14. Deployment period was approximately four weeks. Traps were not emptied and reset during the deployment period.



Figure 14: A malaise trap erected at site DT8.

4.5.3.3 Pitfall Trapping

Pitfall traps were placed in a triangular formation around the malaise trap, spaced approximately 2–3m apart. The container was buried so that the lip was flush with the surface of the ground, so as to allow any invertebrates to crawl under and fall into the trap. Traps were approximately one-third filled with monopropylene glycol. A small piece of corrugated polypropylene (corflute) measuring approximately 20 x 20cm was placed over top of the container and held in place by weed mat staples to reduce rainfall directly entering the trap. An example of a pitfall trap set up is shown in Figure 15.



Figure 15: A pitfall trap with a corflute cover raised approximately 5cm off the ground.

4.5.3.4 Sweep Netting

Sweep netting involves use of a net (similar to a butterfly net, but often with a canvas bag) to sweep across vegetation to collect insects and other invertebrates living there. Sweep netting allows the collector to cover a large area relatively quickly, but does not typically capture ground dwelling invertebrates. A sweep net was used to sample suitable vegetation within 5m of the malaise trap for at least 10 minutes per site.

4.5.3.5 Beat Sampling

Beat sampling involves using a 'beating tray' which typically consists of a pale coloured cloth that is stretched out over a frame. The frame is then held under the plant and the plant is knocked firmly with a 'beating stick', causing any invertebrates on the plant to fall onto the tray where they can be retrieved and transferred to a sample jar. Beat sampling was used to sample suitable vegetation within 5m of the malaise trap for at least 10 minutes per site. Suitable vegetation included dense shrubs and trees over approximately 1m in height.

4.5.3.6 Hand Searching

Hand searching was used to search *Gahnia procera* (if present), which is the host plant of the forest ringlet butterfly (*Dodonidia helmsii*), and other plants (for example mountain flax, *Astelia* spp.) likely to house large, relatively immobile species such as leaf-veined slugs or stick insects for signs of these species. Up to 30 minutes was spent hand-searching suitable vegetation at each sampling site on the day when the traps were set.

4.5.4 Tarns

At each tarn, one malaise trap was set and sweep-netting and beat-sampling was undertaken. No pitfalls were used at tarns due to the likelihood of water flooding the traps and compromising the samples. Sampling protocols followed those outlined in Sections 4.5.3.2 and 4.5.3.4 to 4.5.3.6.

Malaise traps were deployed at tarns on 19 and 20 March 2024. They were left for four weeks and retrieved on 16 and 17 April 2024. During the four weeks the traps were deployed, 415mm of rain and an average wind speed of 14km/h (range 6–31km/h) was recorded at Stockton (Bathurst Resources Limited unpubl. data).

4.5.5 Identification and Statistical Analysis

Specimens were trapped in monopropylene glycol, and later transferred to 70% ethanol for storage and identification. Identification was performed under a dissecting microscope. For each sample a count of the number of taxa present as recognisable taxonomic units ('RTU') and identified species was recorded, with each taxon being marked as native, exotic or unknown (e.g., for a taxon identified at family level where the family is known to contain both introduced and native species).

A two-way ANOVA model was used to measure the effect of rehabilitation type and native/exotic status of the invertebrates on taxa diversity. Taxa diversity was transformed using square root to meet model assumptions of normality. A second ANOVA model was used to analyse the effect of tarn type and native/exotic status of the invertebrates collected.

4.6 Aquatic Fauna

Field surveys were undertaken by NIWA (now Earth Sciences New Zealand) in January and April 2024 at the tarns shown in Figure 10 in order to assess the success of tarn rehabilitation with respect to aquatic values (Watson et al. 2024). The field surveys focused on comparing water quality and physical variables as well as macroinvertebrate metrics between tarn types.

Water quality variables measured included pH, conductivity and dissolved metal concentrations. Physical parameters measured included tarn surface area, bank slope and altitude. Macroinvertebrates were collected using a D-frame kick net (250µm mesh) sampling a total area of $1m^2$ around different habitat types within each tarn. Macroinvertebrate metrics calculated included taxa richness, abundance and the percentage (%) of Chironomidae. Chironomidae are low-scoring taxa that typically dominate soft-bottomed habitats, prefer living in algal mats, are widespread haphazard dispersers and are often the most abundant invertebrate in aquatic ecosystems, especially degraded ones (Stark and Maxted 2007, Watson et al. 2024).

5.0 Results

5.1 Vascular Vegetation

5.1.1 Rehabilitated Sites

Cover data is summarised in Table 4. Natural (i.e., undisturbed) plots had the highest average total vegetation cover (182%, whereby vegetation cover exceeds 100% due to the layering and overlap of vegetation tiers). Of the three rehabilitation treatments, VDT plots had the highest total vegetation cover, highest canopy cover and the highest mean number of species per plot, followed by non-remediated sites and then planted sites (8 – 20 years post planting).

The number of species per plot (shown in Table 5) and the mean top height did not vary according to rehabilitation type. Soils were deepest at VDT sites (mean = 409 mm, ± 37 (SE)), followed by natural sites (mean = 366 mm ± 31 (SE)), non-remediated sites (mean = 235 ± 77 SE)) and planted sites (mean = 229 mm ± 31 SE)). Drainage was typically 'imperfect' at natural, VDT and disturbed sites, and 'well drained' at planted sites, however VDT sites showed the most variation in drainage.

Table 4: Plot cover summary data for rehabilitated and natural sites across Stockton Mine.

Site	n	Total vegetation cover*	Non-vascular cover	Litter cover	Rock cover	Bare ground	Top height	Canopy cover
VDT	8	136.7 ± 27.8 (109-165)	5.8 ± 5.4 (0.4-11)	6.9 ± 6.9 (0-14)	1.5 ± 3.1 (0-5)	3.4 ± 5.9 (0-9.3)	1.0 ± 0.3 (0.6-1.3)	38.5 ± 15.5 (23-54)
Planted	7	90.9 ± 38.2 (53-129)	15.8 ±15.6 (0.2-32)	5.4 ± 4.4 (2-9)	19.5 ± 15.9 (4-35)	4.9 ± 8.8 (0-13.7)	0.6 ± 0.2 (0.4-0.9)	19.6 ± 12.2 (8-32)
Non-remediated	6	111.5 ± 57.5 (54-169)	21.6 ± 17.2 (4-39)	7.7 ± 5.2 (2-13)	5.9 ±5.9 (0-12)	3.0 ± 3.0 (0-6)	0.9 ± 0.6 (0.3-1.5)	12.6 ± 11.4 (1-24)
Natural	10	181.7 ± 65.1 (117-247)	14.6 ±16.4 (0-31)	11.1 ± 7.3 (4-18)	2.0 ± 5.0 (0-7)	0.75 ± 1.1 (0-1.9)	2.2 ± 1.8 (0.4-4)	29.3 ± 15.2 (14-45)

*Data are shown as mean ± standard deviation (range)

Vegetation at VDT sites was variable and included low forest consisting of silver beech, mountain beech and *Archeria traversii*, shrubland dominated by mānuka, yellow-silver pine and Southern rātā, and low tussock-shrubland with red tussock, stunted mānuka, mountain flax and wire rush. Ground cover vegetation appeared to survive the direct transfer process well, however there was evidence of dieback on the taller trees such as beech and Southern rātā. This may be attributed to root damage during transfer or a change in environmental conditions compared to its original location (e.g., soil depth, drainage, aspect or exposure).

Planted sites contained a mix of forest, shrubland and tussockland species as well as a range of exotic species. Eighty-two vascular plant species including 19 planted and 63 colonist (naturalised, unplanted native) species were recorded at planted sites as set out in Appendix B. The four different treatments were similar in terms of species richness as shown in Table 5. Planted sites had more bare rock and bare ground than VDT and natural sites as shown in Table 4. However, rock cover in VDT is generally manipulated through deliberate additions of boulders as habitat features, rather than exposure of smaller rocks which is more typical of planted sites.

Non-remediated sites had variable vegetation type and structure. Low-growing grassland and shrubland with exotic grasses and rushes were present where large areas had been disturbed (e.g., Stockton Mine, Sullivan Mine), and taller shrubland with gorse was present in non-remediated sites adjoining undisturbed areas (e.g., Cedar Creek Road).

There was a low level of browse detected across all plots.

Table 5: Species richness for rehabilitated and natural sites at Stockton Mine.

Site	n	Species per plot		
		Mean ± SD	Min	Max
VDT	8	37.8 ± 4.8	27	45
Planted	7	32 ± 8.2	15	43
Non-remediated	6	21.8 ± 4.5	14	27
Natural	10	28.4 ± 7.3	13	46

Total vegetation cover

The total vegetation cover includes the cover of each species in each height tier, and is therefore a reflection of vegetation density. Mean total vegetation cover ranged between

91% in planted areas to 182% in the natural plots as shown in Figure 16. The mean total cover in the VDT plots was 137%. Total cover was statistically different between plot types ($F_{3,45}$ = 3.54, P = 0.02). Tukey's post-hoc testing revealed that natural plots had higher cover than planted (P_{adj} = 0.01). Adjusted p-values were not significantly different at the 0.05 level between natural and VDT plots (P_{adj} = 0.07), planted and VDT plots (P_{adj} = 0.33) or non-remediated and VDT plots (P_{adj} = 0.39).

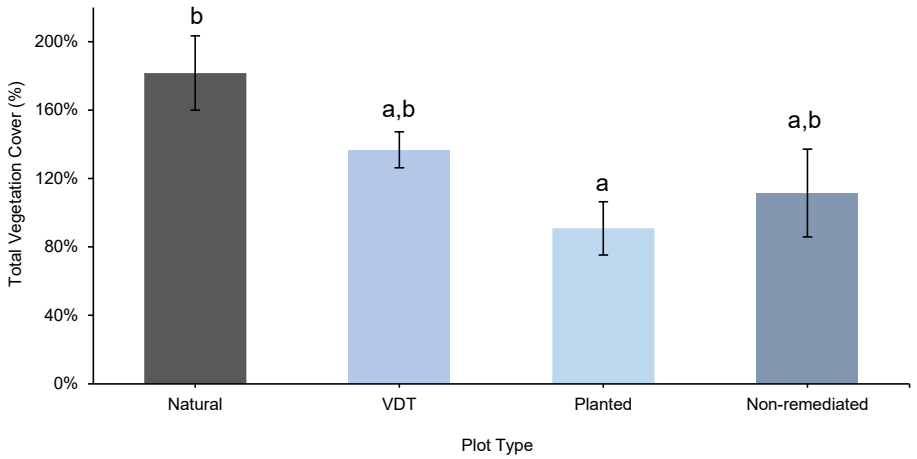


Figure 16: Mean (± SE) percentage total vascular vegetation cover among plot types.

Percentage cover of Native Vegetation

No exotic species were detected at plots in natural vegetation. The mean percentage cover of native vegetation was lowest at planted and non-remediated sites (80% and 72% respectively), i.e., non-remediated sites were the weediest (Figure 17). Overall, natural and VDT sites were statistically indistinguishable, but there was a significant difference between the percentage of native vegetation cover between plot types ($F_{3,45}$ = 7.34, P<0.001), with higher native vegetation cover at natural sites than at both planted sites (P_{adj} = <0.01) and non-remediated sites (P_{adj} = <0.01). There was no statistical difference in the percentage of native vegetation cover between VDT and planted sites (P_{adj} = 0.29) or between VDT and non-remediated sites.

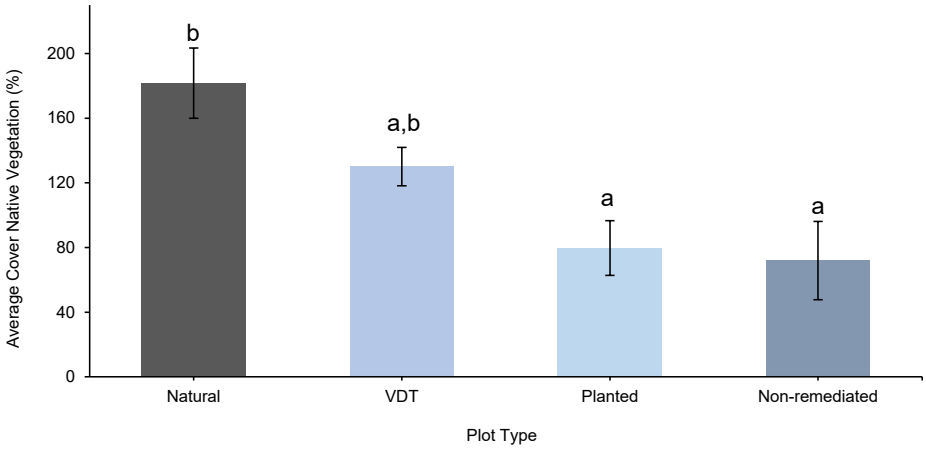


Figure 17: Mean (± SE) percentage cover of native vegetation at rehabilitated and natural sites at Stockton Mine.

Plants of Conservation Interest (PCI)

There was a significant difference in the frequency of PCI within each plot type ($c_{3,27}$ = 10.1; *P* 0.017). Plants of conservation interest occurred in 81% of natural plots, 57% of planted plots, 25% of the VDT plots and 16% of the non-remediated plots.

Logistic regression showed that PCI plants were more common in natural plots than either non-remediated (β= 2.99; SE = 1.35; *P*=0.02) or VDT plots (β= -2.48; SE = 1.13; *P*=0.02), but natural plots were not significantly different from planted plots (β= -0.47; SE = 1.55; *P*=0.68). Frequency of PCI in plots VDT and non-remediated plots was not significantly different either (β= 0.51; SE = 1.36; *P*=0.71).

The number of PCI was similar in beech forest plots (50%), tussockland plots (57%) and shrubland plots (57%).

Differences between natural and VDT plots of the same vegetation type

Natural and VDT plots were similar with respect to total percentage vegetation cover, percentage native vegetation cover and presence of PCI species as shown in Figure 18 and Figure 19. Total vegetation cover was higher at natural plots than VDT plots, irrespective of vegetation type ($F_{1,12}$ = 5.11, *P* = 0.03). Beech forest had higher vegetation cover than shrubland and tussockland, regardless of rehabilitation approach ($F_{2,12}$ = 6.33, *P* = 0.01).

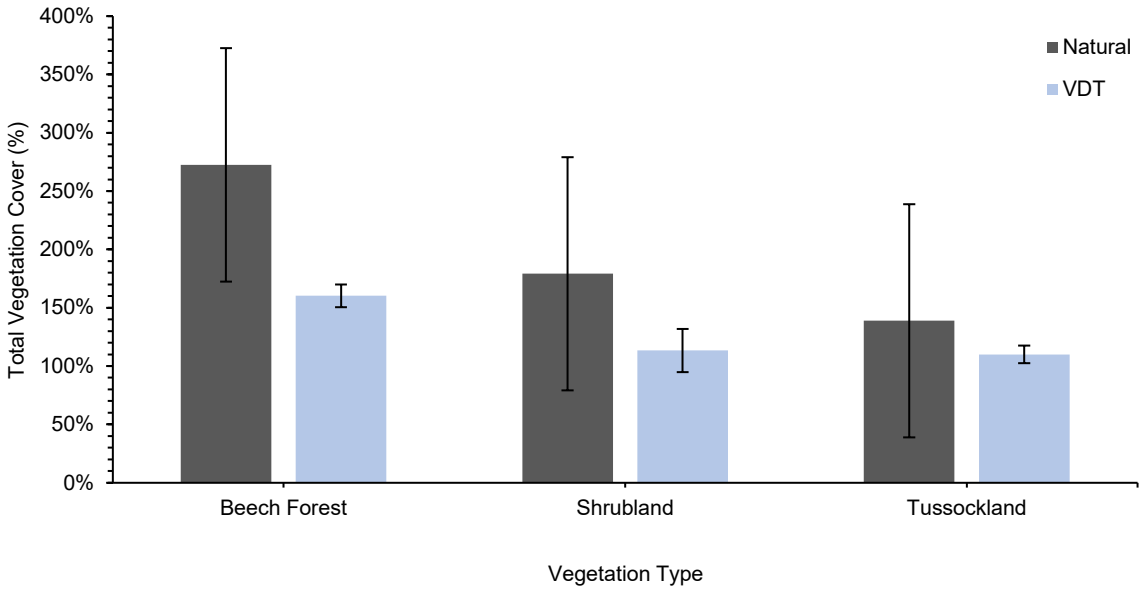


Figure 18: Mean (± SE) percentage vegetation cover at natural and VDT plots by vegetation type.

Indigenous vegetation cover was higher at natural plots than VDT plots, irrespective of vegetation type ($F_{1,12}$ = 6.29, *P* < 0.05). Beech forest had higher indigenous vegetation cover than shrubland and tussockland regardless of rehabilitation approach ($F_{2,12}$ = 6.02, *P* < 0.05). This is unsurprising since forest vegetation was taller and included more tiers.

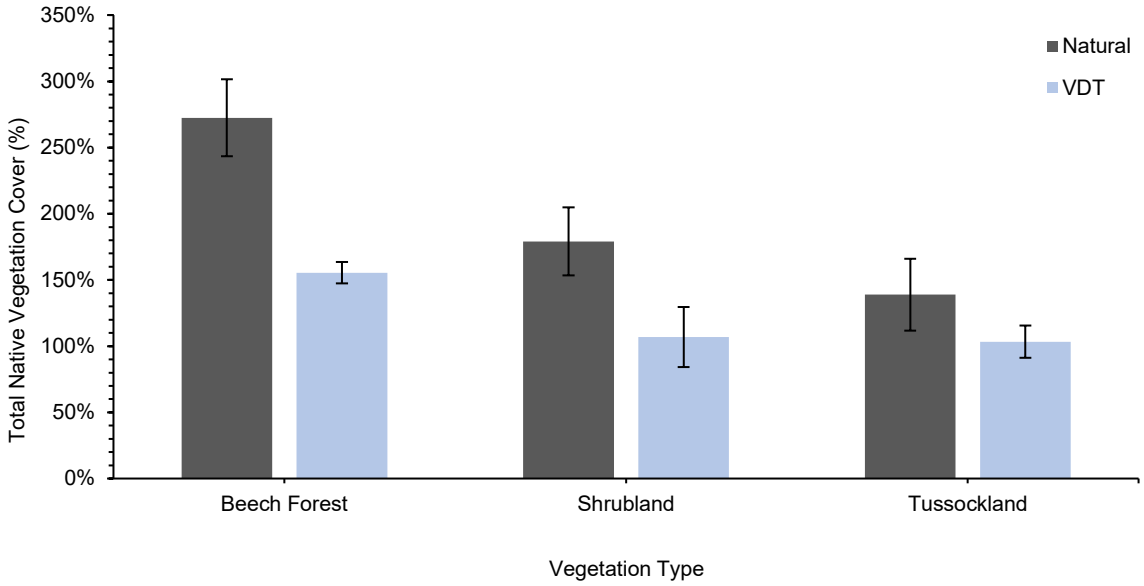


Figure 19: Mean (± SE) percentage cover of native species at natural and VDT sites by vegetation type.

5.1.2 Tarns

Natural tarns were similar to constructed tarns rehabilitated with VDT in terms of ground cover and vegetation parameters, although constructed and planted tarns had higher rock cover than natural tarns or constructed tarns with VDT and were more variable in terms of the number of species present (Table 6).

Table 6: Plot descriptors for natural tarns and constructed tarns rehabilitated by VDT and planting.

Site	n	Total vegetation cover*	Non-vascular cover*	Litter cover*	Rock cover*	Top height (m)	Canopy cover*	no. of species per plot	
								min	max
Constructed Tarn (Planted)	9	89.5 ± 53.9	10.4 ± 7.1	2 ± 0.6	27.3 ± 20.2	0.5 ± 0.3	10.4 ± 12	13	36
Constructed Tarn (VDT)	3	121 ± 13	8 ± 5.5	1.3 ± 1.9	3.8 ± 2.9	0.7 ± 0.2	25.8 ± 9.5	32	46
Natural Tarn	6	104.4 ± 45.9	6.7 ± 6.9	3.1 ± 5.3	3.7 ± 7.3	0.6 ± 0.4	23.5 ±11	22	34

*Data are shown as mean percentage cover ± standard deviation

There was no statistically significant difference in total vegetation cover or number of PCI between the different tarn types (Figure 20, Figure 21). However, native vegetation cover was significantly higher at natural tarns than at planted constructed tarns ($F_{1,16} = 8.46$, $P < 0.05$) as shown in Figure 22. Average soil depth was similar across all three tarn types (374 mm ± 63 (SE) for natural tarns, 357 mm ± 35 (SE) for VDT constructed tarns and 254 mm ± 45 (SE) for planted constructed tarns).

Although the total vegetation cover was similar across tarn types, the species composition of the vegetation varied. Vegetation at constructed VDT tarns was typically [mānuka]/red tussock-snow tussock shrubland (e.g., TM03), mānuka-square sedge-pākihi rush shrub-rushland (e.g., TM04) and mānuka-mountain beech shrubland (e.g., TM08). Mānuka-tussock/wire rush shrubland was the dominant vegetation type at natural tarns, except

TN05 which included a range of species from forest and shrubland vegetation types.

Constructed tarns where the surrounding vegetation had been planted were not typically representative of natural (i.e., undisturbed) tarn vegetation in terms of species composition, instead including species from a range of different habitat types (e.g., forest, low pākihi, shrubland) as well as upland species not typical of poorly-drained tarn ecosystems such as Southern rātā and *Ozothamnus vauvilliersii* as well as exotic grasses (including browntop and Yorkshire fog (*Holcus lanatus*)) and rushes (including heath rush and toad rush (*Juncus bufonius*)).

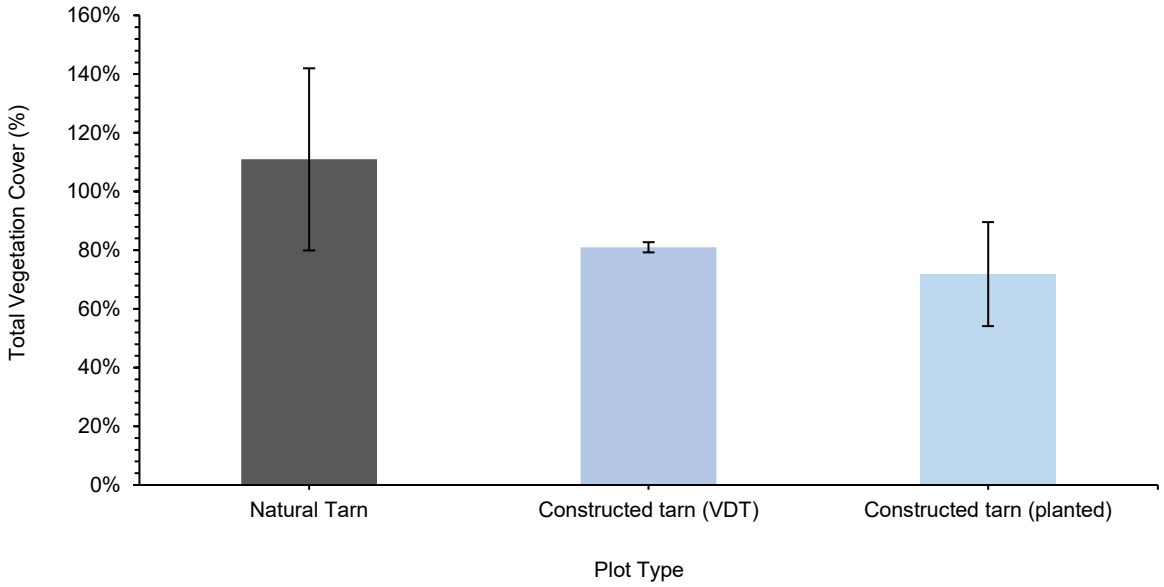


Figure 20: Mean (± SE) vegetation cover for natural and constructed tarns.

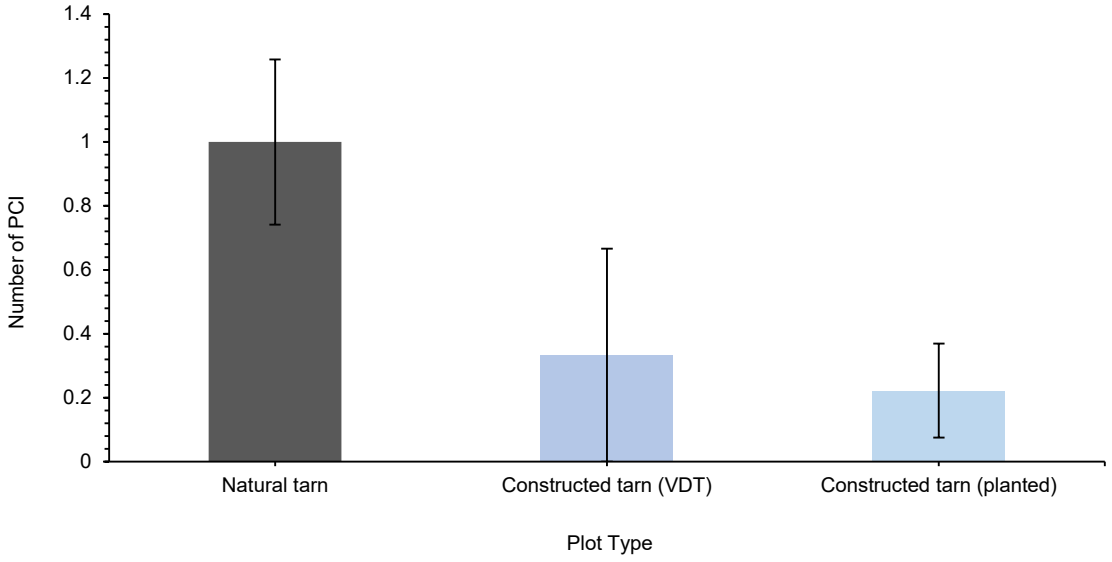


Figure 21: Mean (± SE) number of PCI species for natural and constructed tarns.

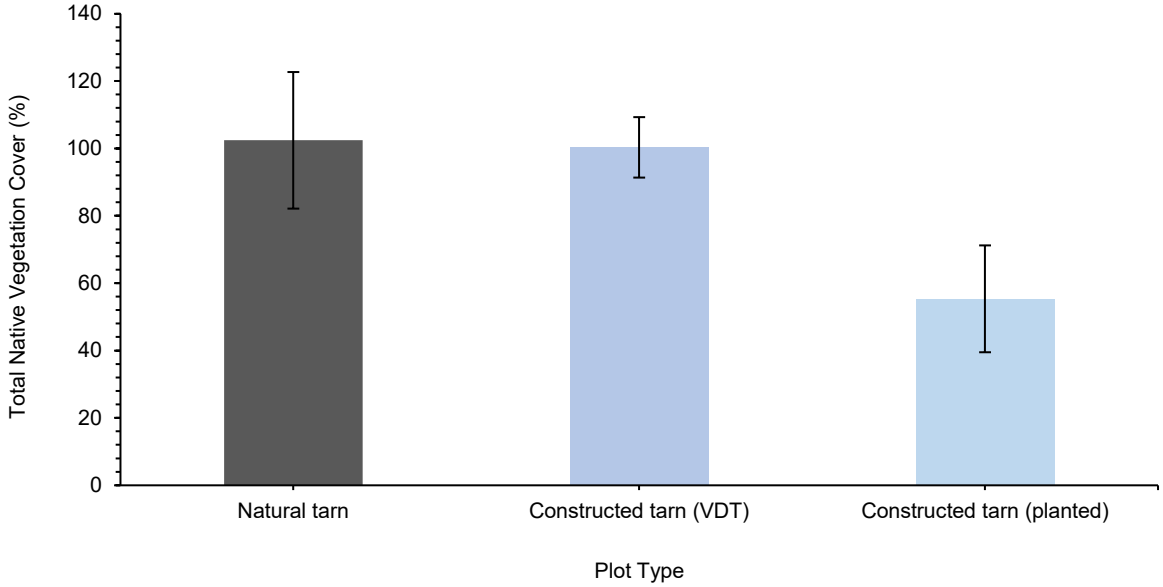


Figure 22: Mean (± SE) cover of native species present at natural and constructed tarns.

5.1.3 Drill Sites

5.1.3.1 Vegetation

Drill site locations are selected to target specific geological locations, but final placement of drill rigs considers potential for disturbance to vegetation and easy establishment and access of the rig. For that reason, areas of exposed rock or low pākihi are preferred as drill sites and forests are generally avoided. Vegetation at 17 of the 32 drill sites comprised low pākihi characterised by stunted mānuka (0.3–1m in height), coal measures tussock and wire rush with a variety of small shrubs, herbs and cushion-forming species. Eight drill sites were located within sandstone erosion pavement where ground cover of rock was between 45% and 90%. Two sites at Stockton and two at Denniston were within low forest dominated by mānuka, beech (mountain beech and silver beech and native conifers (mountain toatoa and yellow-silver pine). The two low forest sites at Stockton (drilled in 1997 and 2009) featured exotic grasses and rushes in the ground layer, but the species composition of the canopy and understorey layers were similar to surrounding undisturbed vegetation. No exotic species were recorded at the two low forest sites at Denniston.

The vegetation at the drill sites was mostly intact, and generally comprised similar vegetation to that of the surrounding undisturbed vegetation. This was particularly apparent for drill sites located within low pākihi and sandstone pavement communities at Denniston.

Overall, the presence of exotic species at drill sites was low, with only seven (22%) of the plots containing exotic species, five of which were at Stockton Mine. The most common exotic species was heath rush. PCI present at drill sites included the locally endemic species coal measures tussock (‘At Risk – Declining’) and *Dracophyllum densum* (‘At Risk – Declining’) (de Lange et al. 2024).

The percentage vegetation cover in the ground layer at drill sites ranged from 2% to 90%, depending on the vegetation type, but did not vary with access type as shown in Table 7. Total vegetation cover also varied with vegetation type, ranging from 6% at plots located within sandstone erosion pavement where vegetation was short and sparse to 231% in low forest where vegetation consisted of trees and shrubs present in multiple tiers.

5.1.3.2 Access

The four Mt Frederick South sites that were drilled in 2023 and accessed by helicopter had no exotic species present, and species composition was equivalent to natural sandstone pavement communities. Only one of the remaining 16 helicopter access sites which were older (drilled 2007–2013), and mainly on the Denniston Plateau, had an exotic species present (heath rush). Of the three ground-based access sites on the Denniston Plateau (2011–2013), one exotic species (heath rush) was recorded at one (33%) of the sites. None of the plots at the four track-mounted drill rig sites on the Denniston Plateau (drilled 2013–2015) contained exotic species.

Exotic species were most prevalent in the Cypress mining area of Stockton, which was drilled between 1997–2011. Two of those sites were accessed by helicopter and the remaining four did not have the access method recorded, but were likely to have been via helicopter since there were no vehicle tracks and only one walking track to Cypress mining area at that time. Five sites contained exotic species, ranging from one to five exotic species per plot, including browntop (*Agrostis capillaris*), castear (*Hypochaeris radicata*), gorse (*Ulex europaeus*), heath rush, soft rush (*Juncus effusus*) and sweet vernal (*Anthoxanthum odoratum*).

Table 7: Vegetation descriptors for drill sites according to access method.

	Helicopter	Ground-based	Track-mounted drill rig	Unknown
No. plots	20	3	4	5
Years active	1982; 2007; 2009; 2011–2013; 2023	2011; 2013	2013 - 2015	1997; 1998; 2011
Mean number of species	18	13	17	15
Mean proportion native species	0.99	0.98	1	0.91
Mean vegetation cover (%)	93	164	111	107
Mean ground cover (%)	54	64	49	48
Mean bare ground (%)	6	24	23	6
Mean non-vascular (%)	9	8	6	28
Mean rock (%)	26	3	21	13
Mean canopy cover (%)	11	2	25	7
Average top height (m)	0.65	1.00	0.43	1.80

5.1.3.3 Physical characteristics

Drill sites typically had a low slope angle (between 0 and 10°), poor soil drainage and low vegetation top height (between 0.2m and 1.7m), a result of being situated mainly on exposed sandstone pavement and low pākihi vegetation communities. Soil depth ranged from 0mm on bare sandstone pavement sites to c. 740mm under beech forest in the Cypress mining area of Stockton Mine. Physical characteristics of the drill site plots are summarised in Table 8.

Table 8: Soil and physiography descriptors for drill sites by access type.

Access	Mean soil depth (mm)	Typical drainage	Mean slope angle
Helicopter	180	poor	5
Ground-based	267	poor	2
Track-mounted drill rig	243	poor	3
Unknown	220	poor	3

5.2 Bryophytes

A total of 183 species of bryophytes (96 mosses and 87 liverworts) were recorded at rehabilitated (VDT and planted) sites, non-remediated sites, constructed tarns (planted & VDT) and natural tarn sites, including three species regarded as 'At Risk – Naturally Uncommon' (the liverworts *Cryptolophocolea tuberculata* and *Riccardia furtiva* and the moss *Pleurophascum ovalifolium* (de Lange et al. 2020, Michel et al. 2026)). In addition, the botanically interesting moss species *Pulchrinodus inflatus* ('Not Threatened') was recorded. A list of bryophyte species recorded is provided in Appendix D.

Six bryophytes associated with anthropogenetic and disturbed habitats were also recorded from five constructed tarns, one VDT site and one non-remediated site as follows:

- *Ceratodon purpureus* (native) was recorded from square sedge-mānuka shrubland (TM-04) and mixed shrubland (TM-06) around two constructed tarns on the Stockton Plateau;
- *Funaria hygrometrica* (native) was recorded from a planted mixed shrubland around a constructed tarn (TM-09) on the Stockton Plateau;
- *Leptobryum pyriforme* (adventive) was recorded from heath rush rushland from a non-remediated site (DS-01) on the Stockton Plateau;
- *Marchantia polymorpha* subsp. *polymorpha* (adventive) was recorded from planted mixed shrubland around a constructed tarn (TM-09) on the Stockton Plateau;
- *Tortula muralis* (native) was recorded from mānuka–red tussock/wire rush shrubland from a VDT site (DT-08) on the Stockton Plateau; and
- Weasel moss (adventive) was recorded from planted mixed shrubland around a constructed tarn (TM-03) on the Stockton Plateau.

These species are common greenhouse weeds, typically found on soil attached to nursery-raised plants and reported to be spreading in the wild in New Zealand. It is most likely that they arrived via nursery-raised plants during rehabilitation planting. There have been previous records of them on the Buller Plateaux and they may also be spreading there. Terry (2017) recorded *M. polymorpha* in high-quality VDT comprised of mānuka shrubland/ heathland on the Stockton Plateau. *M. polymorpha* was also recently recorded from riparian habitat associated with Pit Lake on the Denniston Plateau (S Gorinski, unpubl. data June 2025). Weasel moss was first recorded from red tussock grassland in Cypress valley near the Stockton Plateau by Glenny (1999). There appears to be no records of weasel moss on the Denniston Plateau. Weasel moss is known to outcompete the native *Sphagnum cristatum* where they co-occur after disturbance (Glenny 1999).

5.2.1 Rehabilitated Sites

Non-remediated sites, planted sites and VDT sites had similar bryophyte species composition, and were not significantly different from each other ($p>0.05$), as shown in Table 9, Table 10 and Figure 23.

Table 9: Plot species richness at non-remediated sites and sites rehabilitated by VDT and planting at Stockton Mine.

Plot type	Mean	Standard Error	Range
Non-remediated	22.1	3.51	11-36
Planted	19.8	2.83	11-32
VDT	17.1	2.19	9-25

Table 10: Species richness and the proportion of indicator taxa at non-remediated sites and sites rehabilitated by VDT and planting at Stockton Mine.

Plot type	Species (total)	Liverwort species	Moss species	Indicator taxa	Proportion of indicator taxa	'At Risk' taxa
Non-remediated	84	44	40	18	21%	1[a, ^]
Planted	75	35	40	19	25%	1[b]
VDT	78	40	38	21	27%	1

Notes:

[a]*Riccardia furtiva* (TN-01; DS-04), [b]*Cryptolophocolea tuberculata* (PL-04).

^Species of interest *Pulchrinodus inflatus* (TN-02, 03, DS-01).

The bryophyte community at planted sites typically comprised common and widespread pioneer and early seral species such as *Campylopus* species (*C. clavatus*, *C. introflexus, C. purpureocaulis*), *Cryptolophocolea mitteniana*, *Cuspidatula monodon*, *Dicranoloma* species (*D. billardierei*, *D. dicarpum*, *D. fasciatum*, *D. menziesii*), *Ditrichum* species, *Isotachis montana*, *Kurzia hippuroides*, *Lepidozia* species (*L. concinna, L. laevifolia*), *Macromitrium* species, *Polytrichadelphus magellanicus*, *Ptychomnion aciculare*, *Telaranea* spp., and *Wijkia extenuata*. One 'At Risk' liverwort, *Cryptolophocolea tuberculata* was recorded at a planted site (PL-04), as shown below in Figure 24. This species was found growing amongst indicator taxa including *Bazzania involuta, Gottschea pinnatifolia*, *Kurzia hippuroides, Lepidozia* species (*L. concinna, L. laevifolia, L. ulothrix*), *Riccardia* species (incl. *R. aequicellularis*, *R. bipinnatifida*, *R. cochleata*), *Rhacocarpus purpurascens, Syzygiella colorata, Telaranea* species and *Tricholepidozia lindenbergii*.

In total, 75 bryophyte species were recorded at planted sites (40 mosses and 35 liverworts). The highest diversity of bryophytes at a planted site was recorded under mānuka-tussock shrubland (PL-04, 32 species including 18 liverworts and 14 mosses).

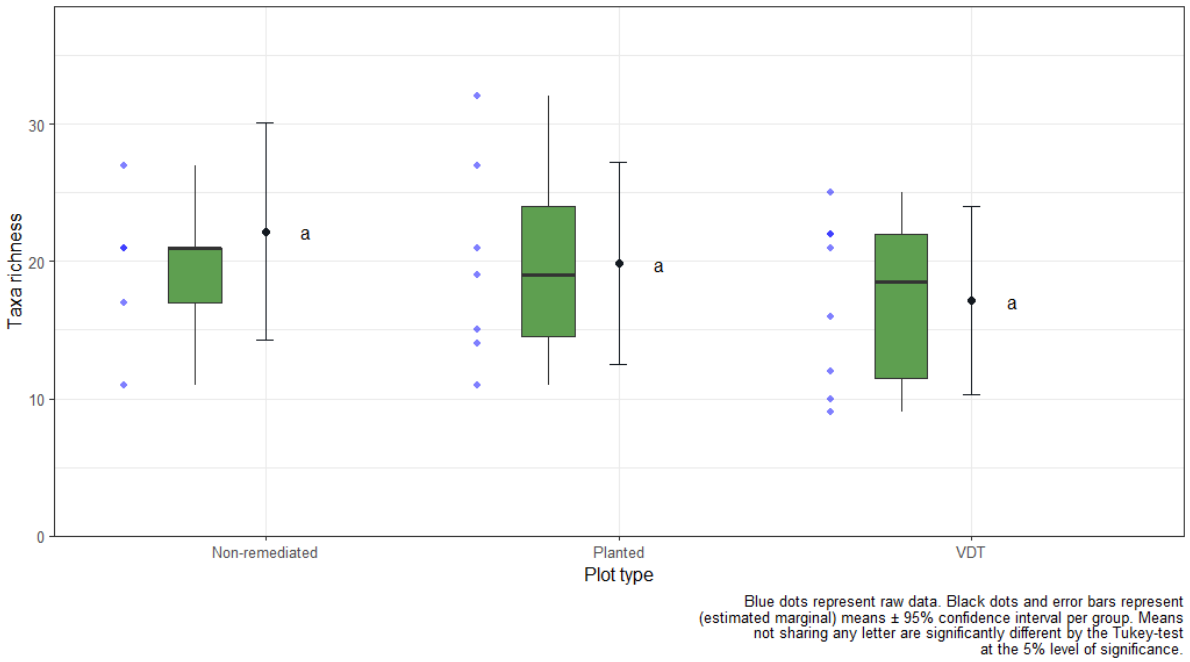


Figure 23: Bryophyte species richness at non-remediated and planted and VDT sites.



Figure 24: Planted vegetation where *C. tuberculata* was recorded (PL-04), Stockton Plateau.

The bryophyte community at VDT sites commonly comprised widespread species such as *Campylopus clavatus*, *C. introflexus*, *Dicranoloma billardierei*, *Distichophyllum pulchellum*, *Isotachis montana*, *Kurzia hippuroides*, *Lepidozia* sp., *Ptychomnion aciculare*, *Riccardia* sp., *Sphagnum* species (*S. falcatulum*, *S. squarrosum*) and *Wijkia extenuata*.

In addition, one 'At Risk' moss, *Pleurophascum ovalifolium* was recorded at two VDT sites (DT-02, 04). Indicator taxa at VDT sites were commonly present and included *Acromastigum* species (*A. anisostomum, A. marginatum*), *Bazzania* species (*B. adnexa*, *B. involuta*, *B. novae-zelandiae*), *Gottschea pinnatifolia*, *Kurzia* species (*K. hippuroides, K. helophila*), *Lepidozia* species (*L. concinna*, *L. laevifolia*, *L. ulothrix*), *Neolepidozia patentissima, P. connivens, Pallavicinia* sp., *Rhacocarpus purpurascens, Riccardia* species (incl. *R. crassa*), *Telaranea species* (incl. *T. herzogii*) and *Zoopsis setulosa*.

In total, 84 bryophyte species were recorded at VDT sites (44 liverworts and 40 mosses). The highest diversity of bryophytes (25 species, 12 liverworts and 13 mosses) was recorded under Archeria/mountain beech forest (DT-02).

The bryophyte community at non-remediated sites also commonly comprised *Campylopus* species (*C. bicolor*, *C. clavatus*, *C. introflexus*, *C. purpureocaulis*), *Brachytheciastrum paradoxum*, *D. billardierei*, *Heteroscyphus* species (*H. cuneistipulus*, *H. deceptifrons, H. fissistipus*), *Kurzia* species, *Isotachis montana*, *Macromitrium* species (incl. *M. longipes, M. microstomum*)., *Polytrichadelphus magellanicus*, *Ptychomnion aciculare*, *Riccardia* species (incl. *R. bipinnatifida, R. crassa*), *Solenostoma* species (*S. inundatum*, *S. totipapillosum*) and *Wijkia extenuata*. One 'At Risk' liverwort, *Riccardia furtiva*, was recorded growing on *Lepidolaena palpebrifolia* (DS-04). The botanically interesting moss *Pulchrinodus inflatus* was also recorded at a non-remediated site (DS-01). The exotic moss *Leptobryum pyriforme,* which as noted above, probably arrived via nursery-raised plants during planting, was also recorded from heath rush rushland (DS-01). Indicator taxa were common at non-remediated sites and included species such as *Kurzia* (*K. helophila, K. hippuroides, K. quinquespina*), *Lepidozia* sp., *Neolepidozia* (*N. patentissima*, *N. praenitens*), *Pallavicinia tenuinervis*, *Schistochila glaucescens, Telaranea herzogii, Tricholepidozia lindenbergii.*

5.2.1.1 Presence of Indicator Taxa

The number of indicator taxa was not statistically different across the three rehabilitation approaches (VDT, planting, non-remediation) ($P = 0.11$).

VDT plots met the criterion of ≥ 25% of the indicator taxa set out in Table 3 present typical of mature bryophyte communities (mean indicator taxa = 27% ± 4.4 SE). VDT plots averaged 21 indicator taxa dominated by liverworts, particularly from the family Lepidoziaceae (62%). The two moss species (*Pleurophascum ovalifolium* ('At Risk'), and *Rhacocarpus purpurascens*) were also present. *Gottschea pinnatifolia* (Schistochilaceae), usually associated with forest, was also recorded.

Non-remediated and planted sites did not meet the threshold to be considered a mature bryophyte community (mean indicator taxa = 15.5% ± 3.5 SE and mean = 20.7% ± 2.8 SE respectively) (see Figure 25 and Table 10).

Non-remediated sites contained 18 indicator taxa, with the community similarly dominated by liverworts from the family Lepidoziaceae (61%). The moss species present included *Pulchrinodus inflatus*. *Schistochila glaucescens* (Schistochilaceae), another species usually associated with forest habitats, was also recorded.

Planted sites contained 19 indicator taxa, again dominated by liverworts from the family Lepidoziaceae (63%). In addition, two species typically associated with forest were recorded, *Cryptolophocolea tuberculata* ('At Risk') (Lophocoleaceae) and *G. pinnatifolia.*

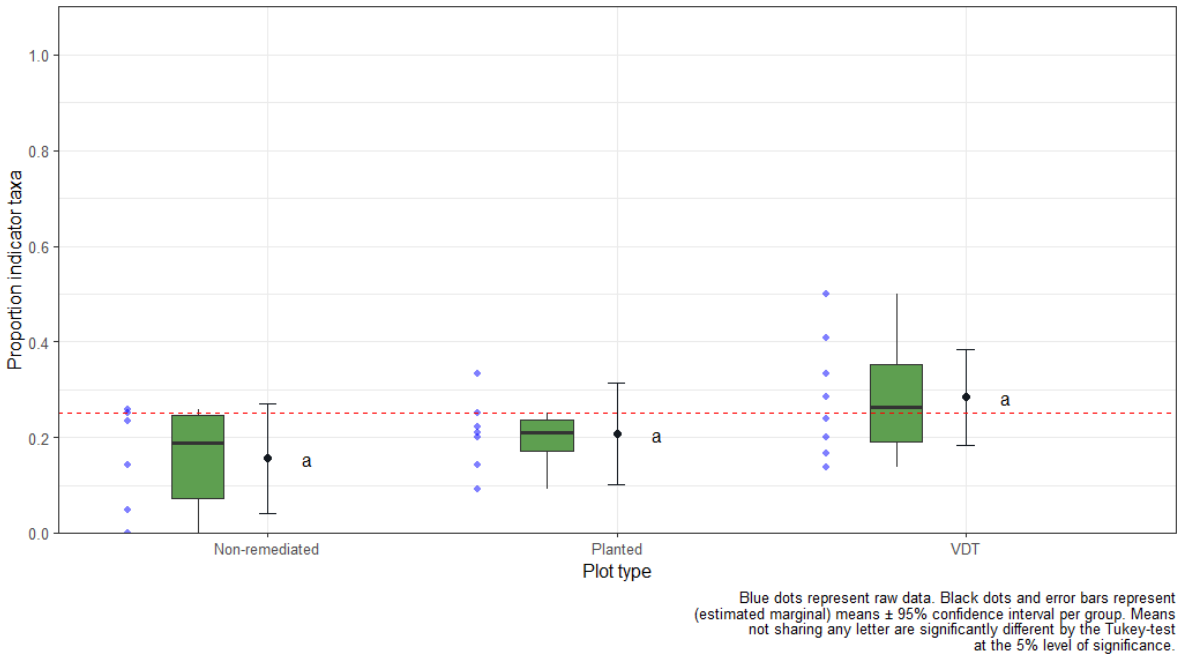


Figure 25: Proportion of indicator taxa present at non-remediated sites and sites rehabilitated by VDT and planting.

5.2.2 Tarns

Bryophyte communities at constructed tarns with VDT, constructed tarns with planting and natural tarns had similar species composition and were not significantly different from one another in terms of species richness ($p>0.05$) as shown in Table 11, Table 12 and Figure 26.

Table 11: Species richness at natural and constructed tarns rehabilitated by VDT and planting at Stockton Mine.

Plot type	Mean number of species	Standard Error	Range
Natural Tarn	12.5	1.81	4-16
Constructed Tarn (planted)	10.3	1.21	6-17
Constructed Tarn (VDT)	15.0	2.08	11-18

Table 12: Bryophyte community descriptors at natural and constructed tarns rehabilitated by VDT and planting at Stockton Mine.

Plot type	Species (total)	Liverwort species	Moss species	Indicator taxa	Proportion of indicator taxa	'At Risk' taxa
Natural Tarn	44	25	19	20	45%	2[a, b, ^]
Constructed Tarn (planted)	47	21	26	7	15%	-
Constructed Tarn (VDT)	38	16	22	11	29%	-

Notes: [a]*Riccardia furtiva* (TN-01; DS-04), and [b]*Pleurophascum ovalifolium* (TN-04-06; DT-02, 04). ^Species of interest *Pulchrinodus inflatus* (TN-02, 03, DS-01).

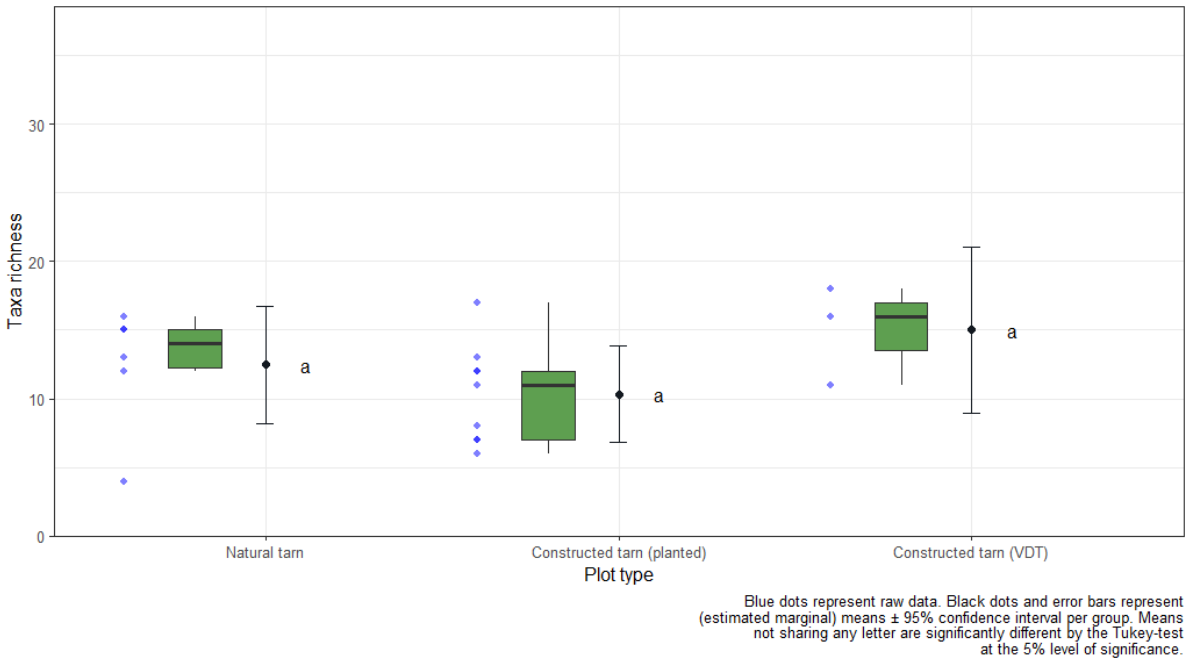


Figure 26: Species richness at natural and constructed tarns at Stockton Mine.

The bryophyte community at natural tarns typically comprised widespread species such as *Campylopus clavatus*, *C. introflexus*, *Dicranoloma billardierei*, *Kurzia hippuroides*, *Lepidozia* species (incl. *L. attenuata*, *L. concinna*), *Ptychomnion aciculare*, *Riccardia* species and *Wijkia extenuata.* Two 'At Risk' taxa were recorded near natural tarns, the liverwort *Riccardia furtiva* (TN-01) and the moss *Pleurophascum ovalifolium* (TN-04-6), as well as the moss *Pulchrinodus inflatus* (TN-02-3). These distinctive species were found growing amongst various indicator taxa including *Acromastigum anisostomum, Kurzia* species (incl. *K. compacta*, *K. hippuroides*, *K. quinquespina*), *Neolepidozia patentissima, Pallavicinia* sp., *Riccardia* species (incl. *R. aequicellularis*, *R. cochleata, R. crassa*), *Syzygiella colorata*, *Telaranea herzogii* and *Zoopsis setulosa*.

The liverwort *Lepidolaena novae-zelandiae* ('At Risk – Naturally Uncommon'), was also present as an epiphyte on a mountain beech branch adjacent to a natural tarn (TN-06).

In total, 44 bryophyte species were recorded at natural tarn sites (25 liverworts and 19 mosses). The highest diversity of bryophytes (16 species) was recorded under mānuka–tussock / wire rush shrubland (TN-06), including nine liverworts and seven mosses.

The bryophyte community at constructed tarns with planting typically comprised widespread species such as *Andreaea* sp., *Bartramia* sp., *Campylopus clavatus*, *C. introflexus*, *Dicranoloma billardierei, Isotachis* species (incl. *I. lyallii*, *I. montana*), *Kurzia hippuroides*, *Lobatiriccardia alterniloba*, *Marchantia berteroana, Polytrichadelphus magellanicus, Polytrichum* species (incl. *P. commune*, *P. juniperinum*), *Ptychomnion aciculare*, *Racomitrium* species, *Riccardia* species, *Solenostoma inundatum, Sphagnum falcatulum* and *Wijkia extenuata*.

Indicator taxa at planted tarns were limited to *Bazzania involuta, Kurzia hippuroides*, *Lepidozia* species (incl. *L. ulothrix*), *Neolepidozia praenitens* and *Riccardia aequicellularis.* No species of interest were recorded. Both the adventive weasel moss (at TM-03), and the liverwort *Marchantia polymorpha* (at TM-09) were recorded. Both these species probably arrived via nursery-raised plants during planting.

In total, 47 bryophytes (26 mosses and 21 liverworts) were recorded at natural tarns. The highest diversity of bryophytes (16 species, nine liverworts and seven mosses) was recorded under mānuka–tussock / wire rush shrubland (TN-06).

The bryophyte community at constructed tarns with VDT commonly comprised widespread species such as *Bartramia* sp., *Campylopus clavatus*, *C. introflexus*, *Ceratodon purpureus*, *Conostomum* sp., *Cryptolophocolea mitteniana*, *Isotachis* species (*I. montana I. lyallii*), *Lepidozia* species, *Macromitrium longipes*, *Neolepidozia* species, *Polytrichadelphus magellanicus*, *Racomitrium* sp., *Riccardia* species and *Sphagnum* species.

Indicator taxa included *Kurzia hippuroides*, *Lepidozia* species (incl. *L. hirta*, *L. laevifolia*), *Neolepidozia* species (*N. patentissima, N. tetrapila*), *Rhacocarpus purpurascens*, *Riccardia* species (*R. aequicellularis, R. crassa*), *Telaranea* sp., and *Tricholepidozia lindenbergii*. No species of interest were recorded. The adventive weasel moss was recorded from a mixed shrubland (TM-03).

In total, 38 bryophyte species were recorded at constructed tarns with VDT (22 mosses and 16 liverworts). The highest diversity of bryophytes (19 species, 11 mosses and eight liverworts) was recorded under Mānuka–tussock / wire rush shrubland (TN-06).

5.2.2.1 Presence of Indicator Taxa

Based on the presence of ≥ 25% of the indicator taxa set out in Table 3, natural tarns and constructed tarns with VDT met the criterion to be considered mature bryophyte communities (mean indicator taxa = 47.5% ± 4.6 SE; mean = 25.5% ± 5.5 SE, respectively) (see Figure 27). Although constructed tarns with planting had the highest species diversity (n = 47) of the approaches sampled, they did not meet the threshold for a mature bryophyte community (mean proportion of indicator taxa = 12.2% ± 3.4 SE).

Overall, natural tarns included 20 indicator taxa (45%), which was the highest proportion across all sites. The bryophyte communities at natural tarns was dominated by liverworts, particularly from the family Lepidoziaceae (55%). The two moss species *Pleurophascum ovalifolium* ('At Risk') and *Pulchrinodus inflatus*, and the 'At Risk' liverwort *Riccardia furtiva* were also recorded at natural tarns. Constructed tarns with VDT had a greater proportion of indicator taxa (29%) than tarns with planting (15%). Species of conservation interest were only recorded at natural tarns.

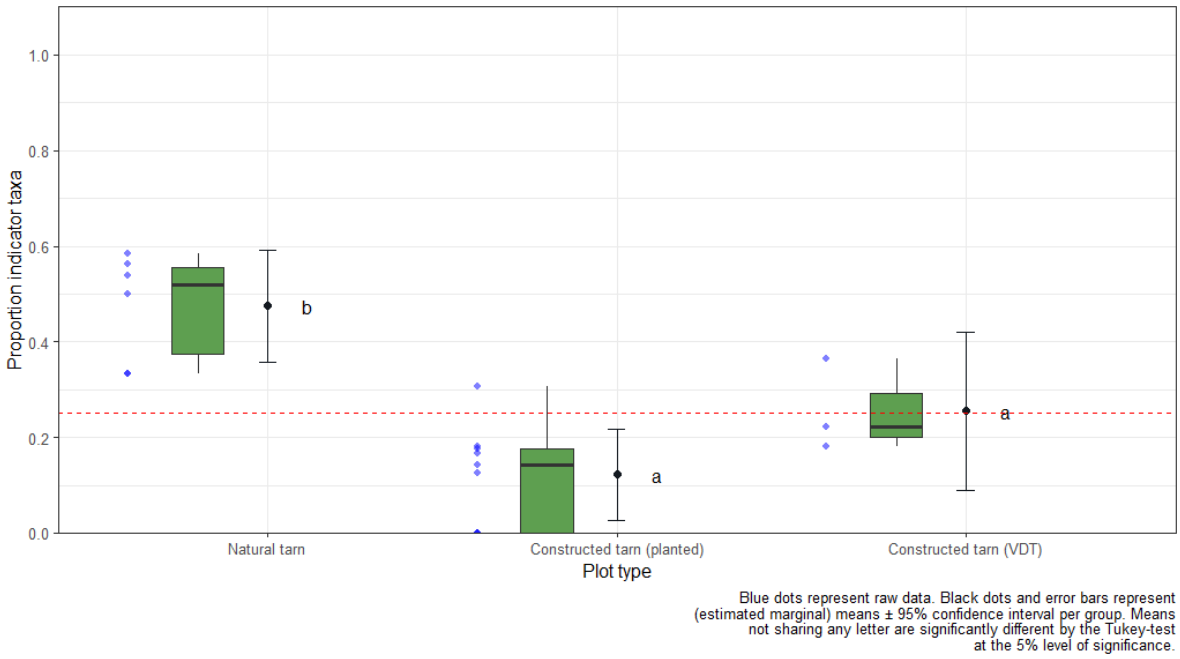


Figure 27: Percentage of indicator taxa present at natural and constructed tarns.

5.2.3 Bryophytes of Conservation Interest

Three 'At Risk – Naturally Uncommon' species were recorded at six locations, including:

- *Cryptolophocolea tuberculata* growing under mānuka-tussock shrubland at a planted site (PL-04).
- *Pleurophascum ovalifolium*. Sterile specimens were found in VDT habitat at site DT-02 (Archeria/mountain beech forest, 1,004m asl) and DT-04 (yellow-silver pine–mānuka shrubland, 726m asl), and surrounding natural tarns in mānuka–tussock shrubland types (TN-04–06).
- *Riccardia furtiva* growing under red tussock / wire rush shrubland (pākihi) surrounding a natural tarn (TN-01), and within a gorse dominated shrubland at the non-remediated site DS-04.

Cryptolophocolea tuberculata is an endemic liverwort primarily confined to the very rainy western sector of the South Island (22 records) mainly in dense mountain and silver beech forests, often on moist cliff faces (Engel and Glenny 2019, Schuster 2021). Two records are from Southland (c. 720m asl). Surveys of natural areas on Stockton Plateau have recorded *Cryptolophocolea tuberculata* growing on soil under stunted silver beech forest on Mt. Frederick (1,050m asl) (Glenny 2007), and within an underground cavity with a stream flowing beneath sandstone boulders, under sparse Southern rātā forest on Mt. William Range (688m asl) (Glenny and Dawson 2011).

Riccardia furtiva is an endemic epiphytic liverwort with a scattered population known from five records in the North Island (Coromandel, Tongariro and Tararua Ecological Districts) and 15 records from the South Island (Western Nelson, Westland and Stewart Island), including both Denniston and Stockton Plateaux. Surveys of natural areas on coal measure vegetation have recorded *Riccardia furtiva* in mountain beech–Southern rātā–silver pine forest (c. 700m asl) (Glenny 1999), yellow-silver pine scrub/forest (630m asl) (Glenny and Fife 2001), mountain beech-silver pine forest (740m asl), mountain beech–pink pine–*Dracophyllum townsonii* scrub (867m asl) (Glenny 2002), and on twigs of mountain toatoa; among mixed riparian scrub including gorse, Southern rātā and yellow-silver pine (Glenny 2008). We have recently recorded this species growing under Southern rātā/podocarp–beech–broadleaf forest at Conglomerate Stream on the Denniston Plateau.

A sterile specimen of the moss *Pulchrinodus inflatus,* which has never been observed with reproductive capsules (Fife 2017, Glenny 1999), was also found within heath rush rushland at the non-remediated site DS-01 (799m asl), and at two natural tarns TN-02 and TN-03 (c. 740 m asl.).

The liverwort *Lepidolaena novae-zelandiae* ('At Risk – Naturally Uncommon') recorded adjacent to a natural tarn (TN-06), has a sparse distribution, but can be relatively common at certain locations within the Buller Plateaux (D Glenny, pers. comm. August 2024). Typically epiphytic on myrtaceous species, frequently on mānuka, it also grows on beech (as observed in April 2025 and described here), and *Dracophyllum* (Glenny 1999).

One 'Threatened' and two 'At Risk' liverwort species and one 'At Risk' moss were recorded along Transect 4 including:

- *Neogrollea notabilis* ('Threatened – Nationally Critical').
- *Saccogynidium decurvum* ('At Risk – Declining').
- *Acromastigum mooreanum* ('At Risk – Naturally Uncommon').
- *Pleurophascum ovalifolium* ('At Risk – Naturally Uncommon').

Given that the affected vegetation had never been surveyed, but had been relocated, these

records demonstrate that these species can either successfully survive relocation and persist for at least 16 years or colonise VDT sites. On that basis, VDT facilitates the best outcomes for retention and maintenance of bryophytes.

5.3 Fauna

5.3.1 Avifauna

5.3.1.1 Incidental Observations

Several birds of conservation interest were observed incidentally at Stockton Mine during our survey of rehabilitated vegetation and tarns, including New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae,* 'At Risk – Declining'), New Zealand bush falcon (*Falco novaeseelandiae ferox,* 'Threatened – Nationally Increasing'), and banded dotterel (*Charadrius bicinctus bicinctus*, 'At Risk – Declining').

New Zealand pipit were observed frequently throughout the mine site. Pipit were often seen foraging in open habitats and have been observed at other mine sites on the West Coast.

New Zealand bush falcon were observed on one occasion just south of Mt Augustus chasing after a smaller bird along the ridgeline. Falcon are regular visitors to the mine and are often seen hunting smaller passerines (L. Maguire, pers. obs. MBC Environmental, 2024). Suitable breeding habitat, such as tall forest with podocarps, is present immediately outside the mine site.

A single banded dotterel was observed near the Bathhouse where it was foraging amongst the short stature shrubs present, including mānuka, toetoe (*Austroderia richardii*) and koromiko (*Veronica salicifolia*). Banded dotterel have been observed breeding at the mine before and have been seen on more than one occasion using rehabilitated sites at Mt Frederick (L Maguire, pers. comms., G Bramley pers. obs.).

5.3.1.2 Five-minute bird counts

Although call counts from rehabilitated sites were low, there was an almost two-fold increase (88%) in the number of bird species recorded between the 2021 survey and 2024 survey. This may be, at least in part, due to the smaller number of sites surveyed in 2021 (n=4) compared to 2024 (n=16). Most species present were common indigenous or exotic species. Three bird species of conservation interest recorded were recorded using rehabilitated areas (New Zealand pipit, South Island fernbird and South Island robin (*Petroica australis australis*)).

There was no significant difference in the average number of birds per five-minute bird count between planted (mean = 0.22, SD = 0.10) and VDT sites (mean = 0.14, SD = 0.03, t_{30}, p = 0.35).

Several species were more commonly recorded at planted sites, including the introduced blackbird (*Turdus merula*), common redpoll (*Acanthis flammea*), dunnock (*Prunella modularis*) and European goldfinch (*Carduelis carduelis*). The presence of these species may reflect the availability of grass seed in planted areas. New Zealand pipit, Western weka (*Gallirallus australis australis*) and welcome swallow (*Hirundo neoxena*) were also common in planted areas as shown in Figure 28. Indigenous species including South Island fernbird, South Island robin, South Island tomtit, Southern black-backed gull and swamp harrier were more commonly recorded at VDT sites. Paradise shelduck (*Tadorna variegata*) were only found in disturbed habitats, being associated with rehabilitated sites with open water and short vegetation dominated by grasses (such as around sediment ponds and water storage areas).

South Island fernbird were most often recorded within VDT sites, but were also recorded at two planted sites (N2 and W6, approximately 18 years and 16 years old respectively) in low numbers (mean number of birds per count = 0.25). Both planted sites comprised suitable habitat for South Island fernbird with small pockets of mānuka and tussock (*Chionochloa rubra, C. juncea*).

South Island robin were only recorded at two VDT sites; MF16 and R5, and in low numbers (average no. of birds per count = 0.25). Both sites were immediately next to the extensive mixed beech forest of the Mt Augustus ridgeline (within approximately 100m and 300m respectively). Five-minute bird counts are not the best method for detecting robin and this may underestimate their occupancy of rehabilitated sites. Robin home ranges are typically up to c. 5ha, so these birds may have been using both rehabilitated sites and adjacent forest habitat.

New Zealand pipit were encountered at all sites. New Zealand pipit were relatively common in areas that have been subject to disturbance, so it is unsurprising to have encountered them so frequently. The lowest densities were recorded at R6 (average birds per count < 0.25), where the vegetation was shrubland approximately 20 years post-placement. This observation is consistent with New Zealand pipit occupying rough, open areas rather than forest or shrubland.

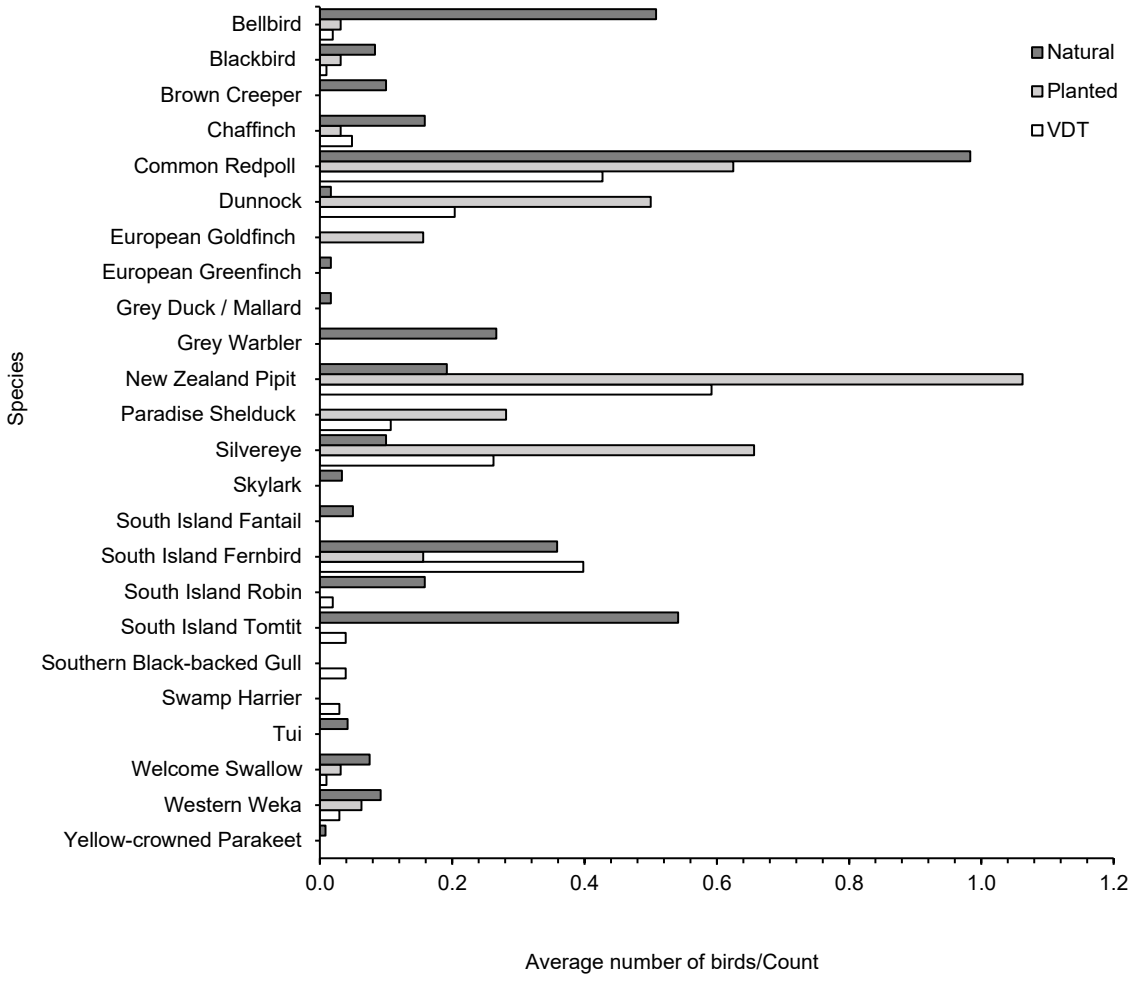


Figure 28: Average number of birds per five-minute bird count at planted, VDT and natural sites.

Table 13: Average number of birds per five-minute bird count at rehabilitated sites.

Status	Species	2021 *n = 43*	2024 *n = 92*
Endemic	Bellbird (*Anthornis melanura*)	0.000	0.033
	New Zealand Pipit (*Anthus novaeseelandiae novaeseelandiae*)	0.488	0.804
	Paradise Shelduck (*Tadorna variegata*)	0.000	0.217
	South Island Fernbird (*Poodytes punctatus punctatus*)	0.093	0.457
	South Island Robin (*Petroica australis australis*)	0.000	0.022
	South Island Tomtit (*Petroica macrocephala macrocephala*)	0.000	0.043
	Western Weka (*Gallirallus australis australis*)	0.000	0.054
	Total Endemic	**0.581**	**1.630**
Native	Silvereye (*Zosterops lateralis*)	0.256	0.402
	Southern Black-backed Gull (*Larus dominicanus dominicanus*)	0.143	0.000
	Swamp Harrier (*Circus approximans*)	0.047	0.011
	Welcome Swallow (*Hirundo neoxena*)	0.023	0.011
	Total Native	**0.469**	**0.424**
Exotic	Blackbird (*Turdus merula*)	0.000	0.022
	Common Redpoll (*Acanthis flammea*)	0.814	0.315
	Chaffinch (*Fringilla coelebs*)	0.070	0.033
	Dunnock (*Prunella modularis*)	0.000	0.402
	European Goldfinch (*Carduelis carduelis*)	0.000	0.054
	Total Exotic	**0.884**	**0.826**
	Overall Total	**1.934**	**2.880**

5.3.1.3 Great Spotted Kiwi/Rōroa

2021 Survey

The locations of rōroa sign within rehabilitated areas are shown in Figure 29. Of the nine sites surveyed in 2021, four may have been used to some degree by rōroa/great spotted kiwi.

Signs of rōroa were seen at several locations within R6 including two burrows, one roost, and seven scents as indicated by kiwi dog Mica. Additionally, there was a kiwi feather found in one of the burrows, providing positive confirmation of use. Vegetation in the R6 survey area included tall mānuka and flax, rehabilitated by a mix of VDT (approximately 9.1ha) and contiguous planting (approximately 4.6ha). The R6 site is bound by undisturbed beech forest to the west and an access road to the east. At Hook Dump one old burrow, three probe holes and two scents, as indicated by Mica, were recorded. At MF16 two probe holes were recorded and one probe hole was recorded at the Mt Frederick Tarn Trial.

Other areas near the surveyed sites had scents detected by Mica, however great spotted kiwi are known to use the areas surrounding the mine and it is possible that these scents were from outside the mine itself.

2024 Survey

The 2024 survey of three rehabilitated sites detected rōroa sign at R6 and Mt Frederick (MF16, MF7 and MF11). Three probe holes were found within R6 at the locations shown in Figure 29. These areas were rehabilitated by VDT and are located to the east of undisturbed beech forest.

Acoustic recorders deployed at Mt Frederick Quarry recorded ten kiwi calls over three nights, but trail cameras did not record any great spotted kiwi. These calls may have been from natural habitats nearby.

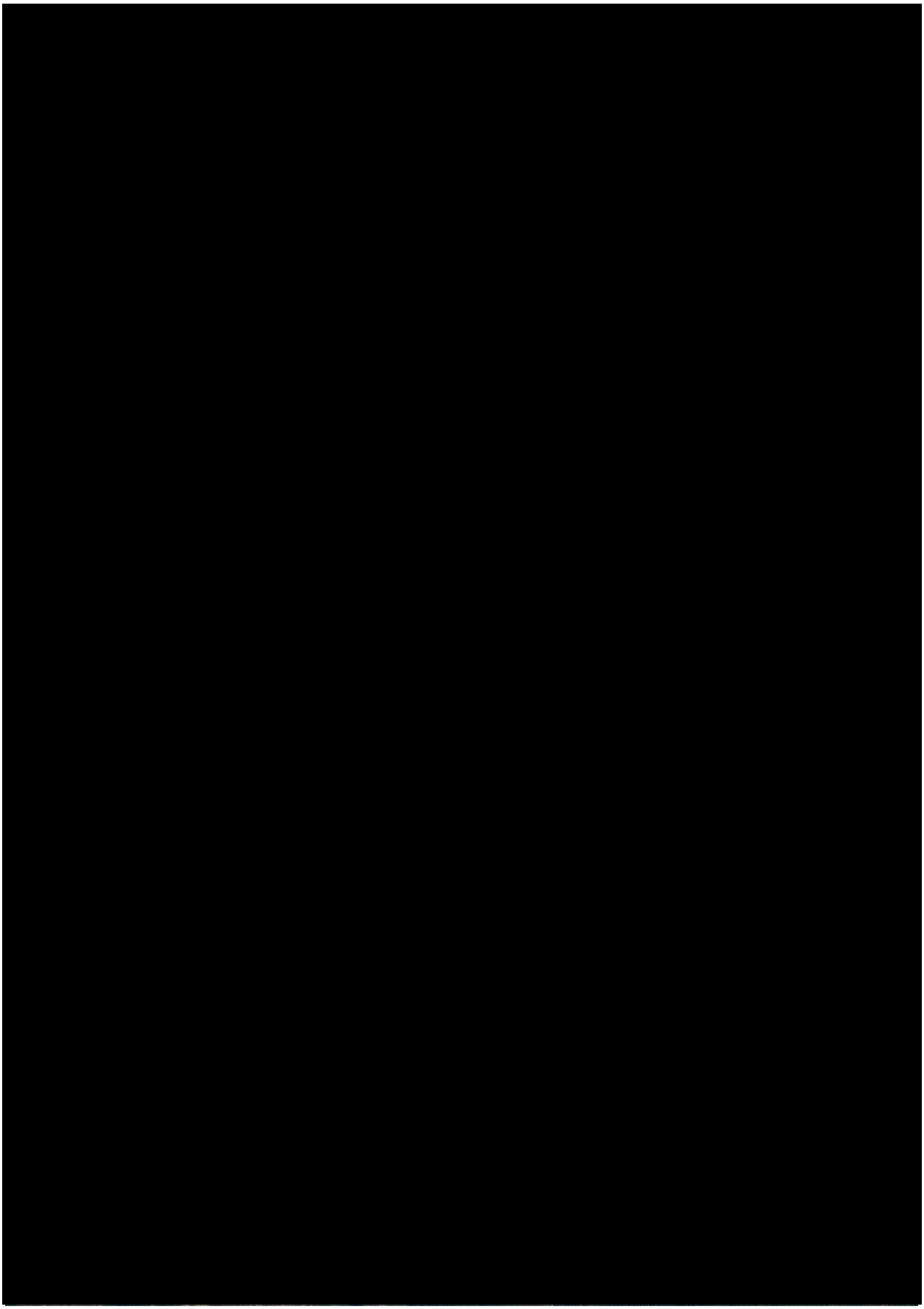


Figure 29: Signs of great spotted kiwi in rehabilitated areas.

5.3.2 Herpetofauna

Five forest geckos and one speckled skink were recorded at three of the four VDT sites surveyed in 2020 during ACO checks coupled with 16.75 person hours of searching by four searchers as set out in Table 14. The VDT sites appeared to provide high quality habitat for these species. These were the first records of forest gecko and speckled skink within VDT.

Table 14: Lizards recorded 14 January 2020 within VDT vegetation at Stockton Mine.

Species	Capture method	Habitat	Snout-Vent Length	Sex	Reproductive status
Hope Dump (2.64ha)					
Forest gecko	Manual searching	Under log (planted area)	75	Female	Not Gravid
Forest gecko	ACO check	Under ACO	85	Female	Gravid
Forest gecko	ACO check	Under ACO	88	Female	Not Gravid
Pavement trial / Rock cache (0.6ha)					
No lizards found					
Campbells (6.8ha)					
Newman's speckled skink	ACO check	Under ACO	Escaped		
Forest gecko	Manual searching	Under rock	88	Male	Not Applicable
Ross dump (4.15ha)					
Forest gecko	Manual searching	In rock crevice	Adult but could not determine SVL or sex		
Forest gecko	Manual searching	In rock crevice (different one)	Adult but could not determine SVL or sex		
Mt Fred (2.62ha)					
Not able to access site due to blasting activities					

Surveys undertaken on 12 and 13 February, 2024 recorded two forest gecko and one Newman's speckled skink during incidental searching of old ACOs. However, no West Coast Green gecko were observed during 43.75 person hours by four searchers. West Coast Green gecko were not detected in either survey and it remains unknown whether the VDT habitats are able to support West Coast green gecko.

5.3.3 Soil Dwelling Invertebrates

5.3.3.1 Rehabilitated Sites

In general, the soil fauna of rehabilitated sites was not particularly diverse (min = 1 species, max = 13 species, n=12) as shown in Figure 30. The most commonly collected invertebrates were beetles (Coleoptera, n = 10 species), followed by roundworms (Nematoda, n = 7) and terrestrial worms (Opisthopora, n = 6). Species diversity was highest at DT1 and lowest at DT8 and PL4.

Up to 15 individual soil dwelling invertebrates were collected per site (median = 3) as shown in Figure 30. Abundance was highest at DT1 and lowest at sites DT8 and PL4.

In general, both abundance and diversity of soil dwelling invertebrates were higher at direct transfer sites than at planted sites as shown in Figure 30.

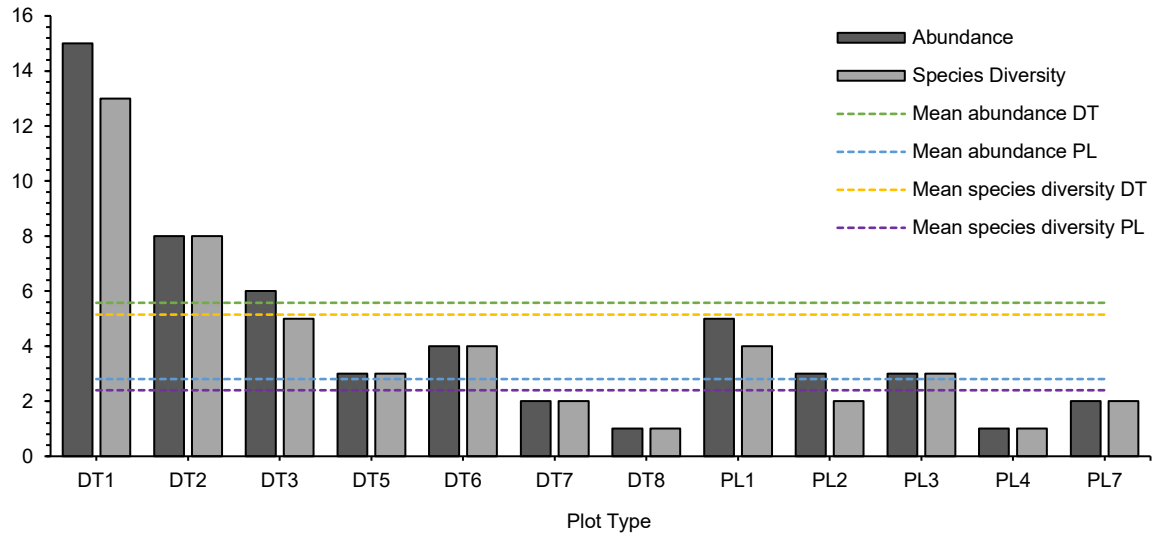


Figure 30: Soil-dwelling invertebrate abundance and species diversity at VDT (DT) and planted sites (PL).

5.3.3.2 Tarns

The diversity of terrestrial invertebrate species collected from around natural tarns (TN) ranged from 1–7 species (median = 5) as shown in Figure 31. The most commonly collected invertebrates were beetles and roundworms (Coleoptera and Nematoda, n = 12), followed by mites (Acari (n = 9).

Invertebrate abundance ranged from 1–8 individuals per sample (median = 5) and was highest at TN4 and TM4 (n = 8) and lowest at TM9 (n = 1) as shown in Figure 31.

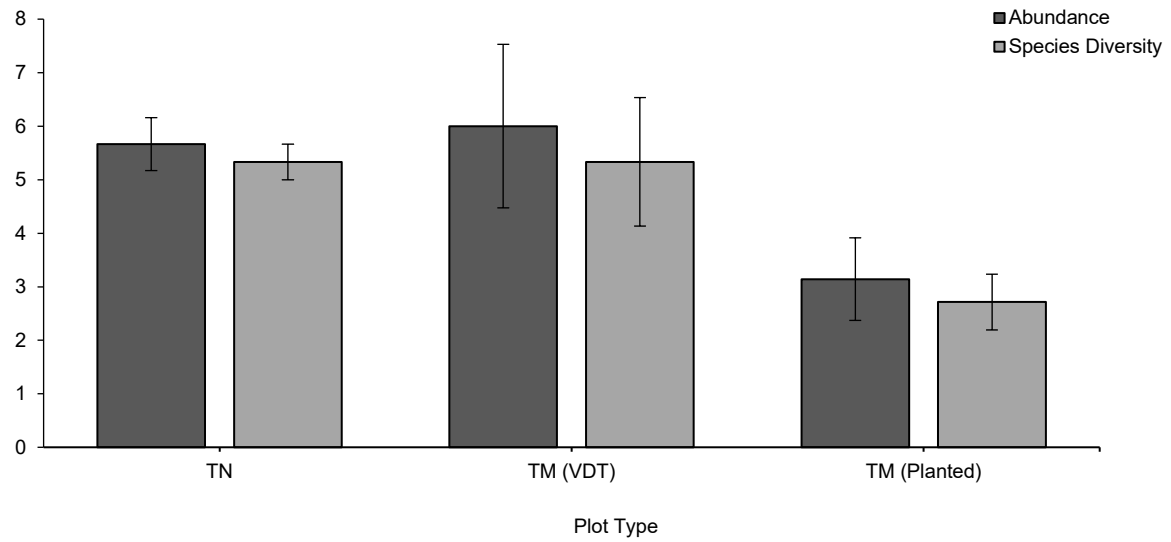


Figure 31: Average soil-dwelling invertebrate abundance and species diversity (± SE) at natural (TN) and constructed tarns (TM).

5.3.4 *Powelliphanta* Snails

Lloyd (2024) confirmed that *Powelliphanta patrickensis* snails survive and maintain viable populations in areas rehabilitated using VDT. Snail density estimates from the two capture-recapture plots in VDT habitat at McCabe's (established in 2020) were within the range of those in undisturbed habitat using the same capture-recapture plot survey method. Comparisons of the size distributions of snails before and 12 months after transfer at the two VDT plots showed the proportion of larger snails had increased after transfer. Snail condition indices were also higher in the population after transfer. However, the lack of snail recruitment in the 16-month period following establishment of the VDT indicates that eggs or recently hatched snails may not have survived the habitat translocation process. Survey data from two capture-recapture plots established in 2009 and 2011 at Mt Frederick indicate that the population of snails has remained stable there, with only minor fluctuations between the first and second surveys (Lloyd 2023). More recent results from nocturnal transects have found similar encounter rates for snails in VDT and nearby undisturbed habitat at Mt Fredrick (Lloyd 2024).

Capture-recapture monitoring of *Powelliphanta augusta* has confirmed survival of snails in one VDT plot 13 years after placement (Grunner et al. 2021 in Lloyd 2024). Although Grunner (2021) suggested that the snail population in the VDT plot may be stable or recovering, population estimate results were not statistically significant (Lloyd 2024).

Nocturnal transect surveys in areas rehabilitated by planting and seeding have indicated that these habitats have failed to support snail populations, in some cases even 20 years after rehabilitation (Lloyd, 2024). However, there has been a lack of survey effort in planted and seeded areas relative to VDT areas, with the 2024 survey being the first to provide such data. The only live snails found in these rehabilitated areas were clustered along a short (45m) section of transect, even though nearby undisturbed areas contained relatively high numbers of snails. Previous rehabilitation records indicated that this location was rehabilitated using transfer of stripped overburden with fresh slash (i.e., 'jumble dumping' of fresh soils, woody debris and associated vegetation) and/or mānuka fascining, so snails found at this location may have been present in the material transferred there and the survivors have persisted since then (Lloyd 2024).

5.3.5 Surface Dwelling Invertebrates

5.3.5.1 Invertebrate Taxa

Overall, 194 distinct invertebrate taxa were identified. Over 80% of specimens could not be identified to species level for a variety of reasons, including damage to specimens, lack of adults for identification, being undescribed or poorly described species and a lack of available taxonomic expertise. Many taxa were only identified to the genus, family or even order levels. In cases where taxa could not be identified to a high enough level to assume they were native or exotic (i.e., a family that contains both exotic and native species) these were recorded as 'unknown'.

There were also issues with sample preservation and trapping which degraded the condition and availability of several specimens. In particular, specimens from several malaise traps were damaged. For these reasons, the number and diversity of terrestrial invertebrate species present will be much higher, and diversity of flying insects in particular will have been underestimated here.

There were high numbers of native taxa compared with exotic, with most of these being consistent with the biota of the north-western South Island. Spiders (Aranae), beetles (Coleoptera), true bugs (Hempitera), and bees, wasps and ants (Hymenoptera) were well represented in their diversity, which is typical for most invertebrate sampling in New Zealand.

5.3.5.2 Rehabilitated vegetation

Across all rehabilitation treatments (planted, non-remediated, VDT), there were more native terrestrial invertebrate taxa captured than exotic taxa ($F = 87.440$, $p < 0.0001$) as shown in Figure 32. VDT sites had the highest overall native invertebrate taxa richness, with 51 taxa recorded at one site. However, the two-way ANOVA showed no evidence of a significant interaction between native/exotic invertebrate presence and rehabilitation method ($F = 1.473$, $p = 0.223$) or a significant overall effect of rehabilitation method itself ($F=1.294$, $p=0.282$). This may indicate recolonising by native invertebrates (rather than exotic invertebrates) following disturbance, or alternatively that certain terrestrial invertebrate biodiversity "hotspots" are maintained by VDT that would be lost by other methods of rehabilitation, even if the average levels of taxa richness is similar. By comparison, invertebrate taxa richness in planted sites had relatively low variation, possibly indicating homogenisation of invertebrate taxa at planted sites, as opposed to the higher variation in diversity seen on VDT sites. This may reflect the variation in vegetation types and more complex structural architecture of VDT plots, as well as the lack of leaf litter layers, soil humus layers, and ponded water typical at planted plots.

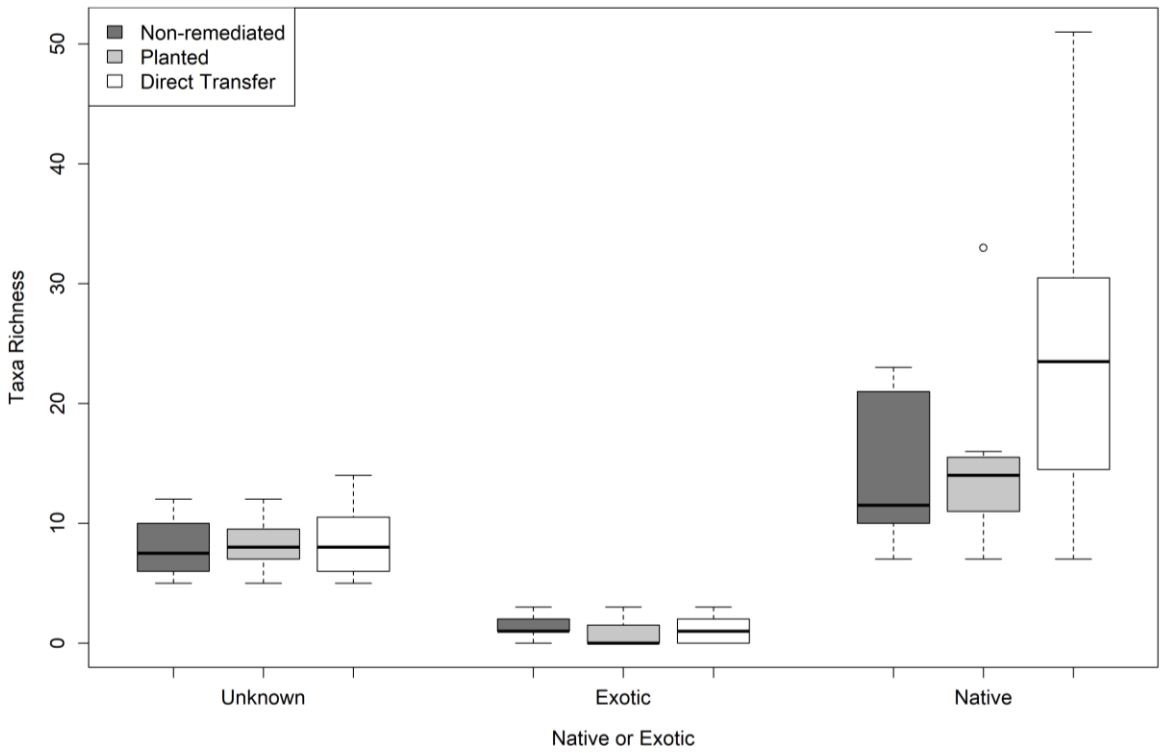


Figure 32: Number of distinct taxa at native, exotic and unknown terrestrial invertebrates across rehabilitated vegetation.

Of particular note is the presence of the invasive Australian copper-bellied ant (*Ochetellus glaber*), which was found in one planted site and several direct transfer sites. Whilst this species has become more common in the Nelson region recently, it is typically associated with warm and dry urban habitats, making its presence at Stockton surprising. In rural habitats *O. glaber* seems to show a strong preference for exploiting the margin between forest and shrubland[3]. It's impact in native habitats remains unknown, although since it is an arboreal species, it will likely occupy very different habitats from native ant species, none of which nest above the ground.

Common money spiders (*Diplocephalus cristatus*) were also found at planted sites and non-remediated sites, though none were found in VDT sites. These spiders are a threat to native ecosystems, due to their invasive ability in native habitats and apparent ability to displace similar native species (Paquin et al. 2010). This makes their presence at Stockton concerning, despite their current absence from direct transfer sites. In general, money spiders (Linyphiidae) were abundant in the samples across most habitat types and included invasive *D. cristatus*, at least one unidentified species with a distinctive horn and what were most likely native *Haplinis* sp. Malumbres-Olarte (2010) observed that *Haplinis* are difficult to identify and whilst a definitive identification could not be reached for this/these species, it is unlikely to be any of the 'At Risk' species. Linyphiidae are known to perform well in disturbed habitats in New Zealand due to their high dispersal ability (Malumbres-Olarte 2010, Topping and Lovei 1997, Vink et al. 2004).

Three gorse seed weevils (*Exapion ulicis*) were found at a non-remediated site where gorse was present. These are a deliberately introduced biocontrol agent for gorse.

[3] https://www.landcareresearch.co.nz/discover-our-research/biodiversity-biosecurity/plants-invertebrates-fungi-and-bacteria/invertebrate-systematics/ants-wasps-and-bees/ants-of-new-zealand/ochetellus-glaber/ Accessed 12 March 2025.

Notable native fauna included a ground beetle (Carabidae) that is a member of the tribe Zolini, but could not be assigned to any of the known species, and may therefore represent a new species (Ian Millar pers.comm.). Two beetle species, *Mecodema ducale* and *Heterotyles argentatus* typically associated with forest were recorded in a planted and direct transfer site respectively. The presence of *Mecodema ducale* is particularly notable, given members of this genus are flightless. This species has been collected from the Buller Plateaux before, however, only from tall forest areas near Stockton. *Heterotyles argentatus* has been previously recorded near Mount Rochfort, and is typically associated with podocarp forests.

Ground beetle richness and diversity was highest at VDT plots. Only four specimens were found at non-remediated sites, and only two were found at planted sites. This is compared to 40 specimens across nine taxa in VDT plots. Cave wētā (Rhaphidophoridae) were also more common at VDT plots. This is consistent with the identified benefits of direct transfer for species with large bodied species with limited dispersal ability (Rogers et al. 2011). A smaller wētā species, *Anderus maculifrons*, was more common in planted plots.

5.3.5.3 Tarns

The number of native invertebrate taxa collected near tarns was significantly higher than the number of exotic species collected ($F = 31.773$, $p < 0.0001$). There was no effect of tarn-type on overall diversity ($F = 0.209$, $p = 0.650$) or the diversity of native vs exotic species ($F = 0.892$, $p = 0.417$). Constructed tarns appeared to emulate natural tarns well in terms of terrestrial invertebrate diversity, with the species diversity at each tarn type being very similar as shown in Figure 33.

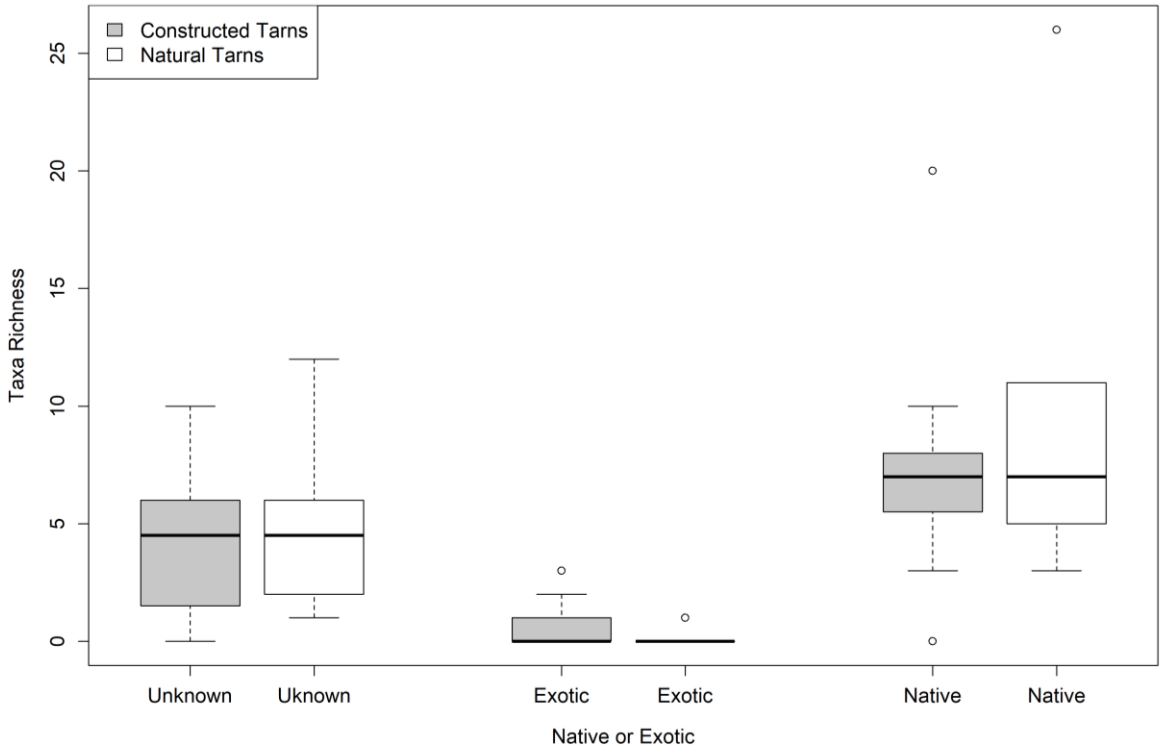


Figure 33: Number of distinct taxa of native, exotic and 'unknown' terrestrial invertebrates at natural and constructed tarns.

Several exotic terrestrial invertebrate species were collected in association with constructed tarns. Australian cognate sweat bee (*Lasioglossum cognatum*) was found at constructed

tarn TM10 and may be new to the region. This species is similar to native *Lasioglossum* spp. also found on the plateaux, making discriminating between the species difficult. Two giant willow aphids (*Tuberolachnus salignus*) were also collected from vegetation surrounding constructed tarns. Given that these aphids were collected in their adult, winged, form, these were likely individuals on dispersal flights from other habitats that were coincidentally intercepted by our sampling. Other exotic species collected near constructed tarns were potato mirid bug (*Closterotomus norvegicus*), European meadow spittle bug (*Philaenus spumarius*), and small grass fly (*Lonchoptera bifurcata*). These exotic species may have blown up from lowland areas or be resident in areas of exotic grassland nearby, such as biosolid treated areas.

The constructed tarns also had high numbers of Dolomedidae spiders (likely *Dolomedes minor*). Whilst native, this common species thrives in human-modified shrubby habitats (Vink and Dupérré 2010). Their relative abundance at constructed tarns, as well as the presence of several other exotic species there, may indicate that the constructed tarns (1 – 20 years post construction) do not fully emulate the habitat structure of the natural tarns. This is consistent with our observations on plant community composition around tarn edges.

5.3.6 Aquatic Fauna

Watson et al (2024) surveyed the same tarns described here and concluded that many of the constructed tarns provide new and important habitat that was statistically indistinguishable from natural tarns in terms of aquatic invertebrate communities. The year in which tarns were constructed was not a significant determinant of community structure, which suggests that manmade tarns can provide suitable habitat and be colonised quickly by aquatic species (Watson et al, 2024).

A total of 36 different macroinvertebrate genera were collected across all of the tarn sites. Total richness ranged between six at site TM6 and 19 at site TN2. Macroinvertebrate abundance ranged between 222 and 7,955 at TM6 and TM3 respectively. None of the macroinvertebrate community metrics for constructed and natural tarns were statistically different, based on Kruskal-Wallis tests ($p > 0.05$).

Dominant taxa included chironomid (*Tanytarsus funebris*), *Chironomus zealandicus, Polypedilum* spp., *Tanypodinae* sp.,) and Ceratopogonidae midges. Other common taxa included damselflies (*Austrolestes* sp. and *Xanthocnemis* sp.), nematodes, mites, and hemipterans (e.g., water boatman—*Sigara* sp., and the semi-aquatic hemipteran *Microvelia macgregori*. Oligochaete worms were the only taxa found at all sites.

Watson et al. (2024) did not find any species of conservation interest during their survey, but two taxa were collected that had insufficient data to be evaluated. These taxa were *Dasyhelea,* a genus of biting midge (Ceratopogonidae) which was discovered in an artificial pond in Northland in 2019, and Syncarida, which is a group of freshwater crustaceans, which can occur in open water, but the majority are found in groundwaters and have been identified as potential indicators of water quality (Gordon 2013).

Watson et al. (2024) recorded one kōura (*Paranephrops planifrons*) in a natural tarn (TN1) and a claw in another natural tarn (TN2), but none were detected in constructed tarns. NIWA also noted that there were signs birds, frogs, deer, and terrestrial invertebrates were using the tarns, except TM6 and TM10.

6.0 Use of Rehabilitated Areas by Fauna

6.1 Avifauna

6.1.1 Five-minute Bird Counts

Rehabilitation of mining sites at Stockton has provided habitat for species, such as New Zealand pipit and Paradise shelduck (the latter only recorded in rehabilitated areas). Pipit and non-native passerines were most often encountered in planted areas and least often in natural areas. This is likely due to the openness of the planted areas since pipit are not forest-dwelling species, and food sources provided for passerines (e.g., seeds of exotic grasses and weeds).

Several species were only recorded at natural sites, including tūī (*Prosthemadera novaeseelandiae*), brown creeper, grey warbler (*Gerygone igata*) and South Island fantail (*Rhipidura fuliginosa fuliginosa*). This is likely due to the mature vegetation at natural sites providing a dense canopy with multiple ecological niches available for different species to fill relative to the simpler planted communities. The rehabilitated areas at Stockton are expected to provide an increasing range of niches over time as the plant communities develop. Mountain flax, which provides nectar sources for tui and bellbird when flowering, is a common component of the vegetation at planted sites and maybe providing seasonal habitat which was not detected due to the timing of our surveys.

6.1.2 Great Spotted Kiwi

Great spotted kiwi are known to inhabit the mature beech forest surrounding Stockton Mine. Signs of great spotted kiwi were found in several rehabilitated areas, including R5, R6, Ross dump, MF16 and Mt Frederick Tarn Trial as shown in Figure 29. Of these, the Mt Frederick Tarn Trial comprises only planted vegetation, whilst the other areas include VDT. All are contiguous with natural habitats outside the mine footprint. Signs of kiwi activity included probe holes and scent indications from the certified conservation dog(s). Burrows and roosts were evident in the older, more established VDT areas (R5 and R6).

Within R6 there was a mixture of established vegetation and newly planted or VDT areas. Whilst it is likely that kiwi use the R6 area for foraging and roosting, it is unlikely they would be resident solely within the R6 area. The close proximity of the R6 area to undisturbed forest habitat likely plays a factor in supporting kiwi activity.

It is highly likely that great spotted kiwi travel into Mt Frederick Quarry and MF16 to forage given the close proximity to mature forest, however burrows are probably not present in the Quarry area. Rehabilitated areas could be improved for fauna, including great spotted kiwi, more quickly if attention was given to providing suitable roosting/retreat habitats for them, e.g. designing dry burrows when VDT is placed or including cavities prior to planting using boulders, stumps and logs with strategic planting. Even if roosts are provided, development of leaf litter and communities of soil dwelling invertebrates will still be required to provide food sources for kiwi using rehabilitated areas. It is expected that over time as the leaf litter develops, rehabilitated areas will be able to support kiwi for more of the time.

6.2 Herpetofauna

VDT provides suitable habitat for forest gecko and Newman's speckled skink as confirmed by their presence. However, it remains unknown whether lizards were present in VDT habitats because they had survived transfer or because they had colonised from surrounding areas or both.

It remains unknown whether VDT provides suitable habitat for West Coast Green gecko.

6.3 *Powelliphanta* Snails

Populations of *Powelliphanta patrickensis* snails can survive and remain viable in areas rehabilitated by VDT at similar densities to populations in undisturbed habitats (Lloyd 2024). Earthworms are a key component in the diet of snails and VDT habitats are likely to have earthworm biomass and species richness comparable to that of undisturbed habitats (Lloyd 2024; Boyer et al. 2011). Both snails and earthworms have poor dispersal abilities, so the ability for VDT to retain existing populations likely makes it the best rehabilitation method for maintaining these species. Although non-native earthworms are present in planted areas, their value as food for rōroa and snails remains unknown.

Snails have not been detected in areas rehabilitated by planting or seeding, suggesting that they either fail to colonise or survive in these areas (Lloyd 2024). Earthworm survival is also known to often be low in planted areas because of the unfavourable conditions created in lower parts of soil stockpiles (Boyer et al. 2011), however earthworm numbers in the surface of soil stockpiles were similar to the lower range of VDT as shown in Figure 34.

In addition, the number of exotic worms in planted areas may reach relatively high numbers relatively quickly (within 10–15 years at fertile sites, B. Walker, BT Mining, pers. comm. 2024). Although captive *Powelliphanta* snails eat non-native earthworms. it remains unknown if free living *Powelliphanta* snails will eat exotic worms, but the lack of deep leaf litter and other retreats is likely a limiting factor for snails using rehabilitated sites, at least initially. The only live snails found in planted areas were clustered along a short (45m) section of transect, where vegetation was taller, more complex than in surrounding areas, and had evidence of slash (Lloyd 2024). This observation of snails at one planted location suggests that planting or seeding methods could be improved to provide habitat for snails (Lloyd 2024). Planted habitats may also become suitable over time, but the available data suggests that quite a long time is required at 'typical' sites and recolonisation rates by snails are likely to be very slow.

6.4 Soil-dwelling Invertebrates

Very few of the specimens collected could be identified to species level, with the majority being identified to order or class. It is therefore unlikely that the results reported here accurately reflect the level of soil fauna diversity at rehabilitated sites.

The soil used as substrate in planted areas is typically from soil stockpiles of varying age. The surface layers of soil stockpiles contain earthworms, but the deeper layers contain few, if any, earthworms (Boyer et al. 2011). Spreading of soils onto rehabilitated areas further reduces earthworms in newly spread soils (due to physical damage), particularly soils that are conventionally spread rather than back-dumped without spreading. Natural colonisation to conventionally spread soils therefore relies almost exclusively on fauna dispersing from adjacent areas (Boyer et al. 2011). Many sample sites were located in isolated patches away from natural ecosystems, likely preventing rapid recolonisation from adjacent areas. Such isolation may explain the lack of abundance and diversity encountered in the samples collected. It can take up to 30 years for soil macrofauna, particularly earthworm, communities to return to their pre-disturbance biomass in the United Kingdom and Europe (Scullion et al. 1988, Hüttl & Weber 2001). The age of rehabilitated areas sampled at Stockton Mine ranged from pre-2005 (e.g., PL1) to as recently as 2023 (e.g., VDT3) so few sites are likely to have been regenerating long enough to develop a mature soil macrofauna.

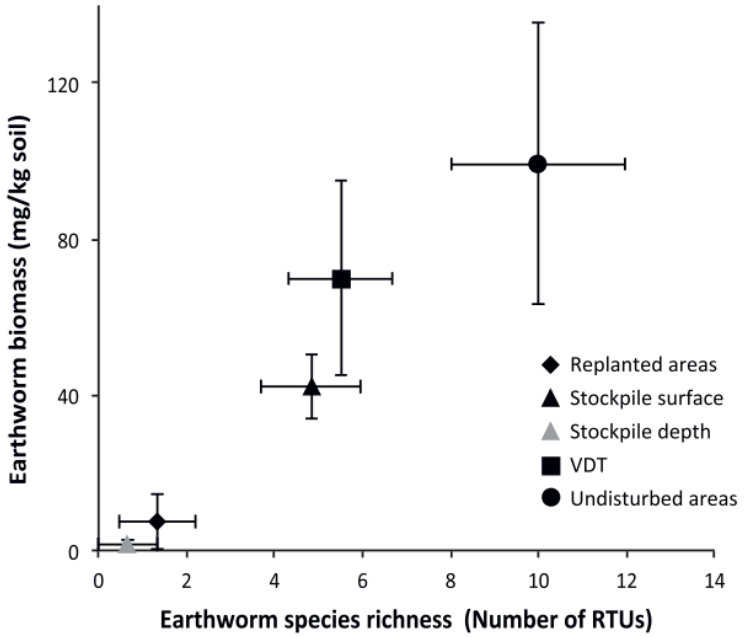


Figure 34: Relationship between earthworm diversity and earthworm biomass at different rehabilitation sites (means ± SE) (from Boyer et al. 2011).

6.5 Other Terrestrial Invertebrates

On average, VDT plots were comparable with planted and non-remediated plots in terms of their terrestrial invertebrate diversity, however some VDT samples had very high diversity. Common money spiders (*Diplocephalus cristatus*) were also absent from VDT plots, indicating that these habitats are less disturbed and potentially more resilient to invasion than planted sites. Whilst now well established in New Zealand, *D. cristatus* is a new detection on the Buller Plateaux (Malumbres-Olarte 2010, R Toft, Entecol Consulting Entomologists, pers. comm. 2024).

Simcock et al. (1999) surveyed terrestrial invertebrates at W6C following a trial to compare conventional rehabilitation (i.e., planting into mixed soil) with VDT. Surveys were undertaken between three and eight months post-rehabilitation. Two control areas were also surveyed and included an area of bare, flat top overburden dump ('bare control'), and an area of undisturbed vegetation and soil ('vegetated control'). Invertebrates were sampled using malaise and pitfall traps. Moths (Lepidoptera), beetles (Coleoptera), wētā (Orthoptera), bristle flies (Tachnidiae) and crane flies (Tipulidae) were of particular interest.

In general, Simcock et al. (1999) found invertebrates were most diverse and abundant in the vegetated control plots. However, VDT plots were not significantly different from the vegetated control plots in six of the eight parameters measured. VDT plots had significantly more species of beetles, moths, crane flies and bristle flies than mixed soil planted plots, and a greater abundance of moths and crane flies. The bare control plots had significantly fewer individuals and species than the VDT plots.

Of particular interest was the presence of wētā, which were found in all of Simcock et al's (recent) VDT plots and two vegetated control plots. Additionally, ground beetles (Carabidae) were numerous in vegetated control plots and less common in VDT plots, but completely absent from bare control plots. Large, flightless invertebrates are likely to have difficulty colonising sites revegetated by conventional methods, particularly isolated sites, unless some form of ecological corridor is provided (Simcock et al. 1999a). We found wētā to be most common in VDT plots, followed by planted plots. *Anderus maculifrons* (a small,

nocturnal wētā) was present in planted plots surveyed here. This is consistent with Simcock's (1999) finding that flightless invertebrates are favoured by VDT.

6.6 Aquatic Fauna

Macroinvertebrate communities were similar in richness, abundance and structure at both constructed and natural tarns, indicating that the distance to similar habitats is not a barrier to their dispersal (Watson et al. 2024). It appears that constructed tarns can be colonised relatively quickly since the year of construction was not a determinant of macroinvertebrate community composition. A total of 36 different macroinvertebrate genera were collected across all of the tarn sites, with Oligochaete worms the most common taxa and midges the dominant taxa. Some of the most abundant taxa in tarns are characterised as widespread common dispersers (e.g., *Liodessus*) or widespread haphazard dispersers (i.e., no spatiotemporal patterns of aerial dispersal), such as *Chironomus*. Kōura, a poorly-dispersing species, were only rarely observed, even at natural tarns suggesting that these spatially isolated habitats are not easily colonisable by kōura. Brown tree frog (*Rawlinsonia ewingii*) tadpoles, an Australian species, were observed in almost all surveyed tarns. In general, the presence of frogs in an ecosystem is an indicator of environmental health and clean water, because they possess highly permeable skin that absorbs water and contaminants directly from their surroundings. Brown tree frog tadpoles are omnivorous, feeding on algae, detritus and bacteria, whilst adults are insectivorous eating small freshwater invertebrates, and terrestrial insects, spiders, and other small invertebrates. Their presence in constructed tarns suggests that the aquatic and terrestrial communities are sufficient to sustain them there. There are no extant native frogs in the South Island.

7.0 Discussion

7.1 General Considerations

This survey is limited by the small sample sizes which reduce statistical power, increasing the risk of both Type II errors (missing real effects) and Type I errors (false positives due to noise). Small sample sizes also increase the margin of error, making results less reliable, harder to generalize, and often unable to detect small, meaningful effects. Sample sizes were necessarily small for this study because of the continuous improvement applied to rehabilitation techniques at Stockton Mine (limiting the number of sites which have received similar treatment), the tendency of previous mine operators to "re-mine" rehabilitated sites when economic conditions change and the difficulty in recording and maintaining data about a particular site's history. Monitoring and inclusion of additional sites as rehabilitation proceeds would assist in increasing sample sizes, but there is also value in repeated monitoring at the sites identified here to assist in understanding longer term rehabilitation outcomes, despite the small number of sites.

7.2 Landscape Considerations

The topography and slopes of rehabilitated landforms are more regular and less variable than natural landforms at both the macro- (individual ridges and slopes) and micro- (within slope) scale. Providing as much variation in slope, exposure, topography and drainage as possible is required to underpin variation in habitats which will enable a diversity of species to establish and persist at rehabilitated sites. Inclusion of gullies, as occurs naturally at Stockton, would contribute sheltered, humid microsites with deeper soils and good drainage and assist in increasing the variety and type of microsites present in post rehabilitation landscapes. In natural vegetation, gullies act as corridors across the plateaux and the ecotones between gullies and adjoining plateaux habitats provide important habitats for fauna, including lizards.

As shown in Figure 1, VDT has historically often been located near the edge of mined areas. This is helpful for buffering adjoining vegetation, but is a lost opportunity for providing corridors of more intact vegetation throughout rehabilitated areas and therefore sources of propagules to assist in facilitating revegetation from VDT into adjoining planted areas. Distributing VDT more strategically across any future mined areas would assist in decreasing the distance between planted areas and natural seed sources available in VDT vegetation, as well as reducing the travel distance for animals moving between patches of suitable habitat. Incorporating VDT in this way could speed up native species dispersal and improve ecological function of rehabilitated sites.

7.3 Vegetation Direct Transfer

7.3.1 Vegetation

VDT allows some vegetation and its respective microhabitats and elements of the fauna to remain intact immediately following transfer and persist over time. Short-stature vegetation including red tussock, mānuka shrubland and low forest communities have been successfully transferred using VDT and resemble natural communities of flora and fauna much more quickly than planted communities. These relocated communities have now been shown to persist for more than 10 years (Ecological Solutions Limited 2025, this study). Taller-stature vegetation is more challenging to transfer and involves felling of larger trees prior to transfer. VDT sites had higher vegetation cover, including native vegetation cover, than planted sites. Vegetation direct transfer sites also better reflect natural coal measures communities than planted or non-remediated sites. VDT sites had higher vascular plant ground cover and total vegetation cover compared to other rehabilitation types. There was no significant difference in the proportion of PCI species between natural and rehabilitated sites using VDT.

Within VDT sites, poorly-dispersing species such as beeches (*Fuscospora* spp., *Lophozonia menziesii*), podocarps (*Lepidothamnus* spp., *Halocarpus* spp.) and herbaceous species (*Astelia* spp., cushion plants) persisted through the VDT process. In contrast, there is little evidence of regeneration of these species within 10 years from seed bank or via natural dispersal at planted sites.

With respect to exotic species, heath rush (*Juncus squarrosus*) was the most prevalent in terms of cover at all VDT sites. One site (DT06) had 20% cover of heath rush, with the remaining sites having 6% or less. This species colonises open, disturbed areas and forms tight, low-growing mats that prevent establishment of small native herbs (except some orchids which can germinate and grow within the centre of large patches) and smother a range of species, including wire-rush (Simcock 2011). At fertile sites it can also smother shorter plants and exclude tussocks (Simcock 2011). The presence of heath rush may indicate either poor VDT technique at that particular location (e.g., gaps between sods, damage to sods), dispersal of seeds via machinery or people (i.e., insufficient biosecurity either during or after placement of sods) or existing heath rush plants and/or seed bank in stockpiled soil beneath the VDT or within the VDT itself. Other exotic species present at VDT sites included wind dispersed grasses (*Agrostis capillaris* and *Holcus lanatus*) and catsear (*Hypochaeris radicata*) and other species dispersed by wind, water or animals (the rushes *Juncus bufonius* and *J. effusus*), or via explosive propulsion (gorse). These exotic species comprised less than 1% of the total vegetation cover at VDT sites. Compared to the other rehabilitation methods, VDT was the most effective at creating vegetation that is likely to be self-sustaining (as defined in Section 1.1) particularly with respect to resisting weed invasion. Non-remediated sites were the weediest (i.e., contained the highest cover of exotic species).

7.3.2 Bryophytes

A total of 40 liverworts and 38 mosses were recorded from VDT plots, similar to the number of species recorded by Terry (2017). VDT plots contained the highest proportion of mean indicator taxa (27% ± 4.4 SE). The presence of >25% of the indicator taxa at VDT sites and constructed tarns with VDT confirms that VDT is the best method to maintain bryophyte communities as well as vascular vegetation as part of site rehabilitation, including near tarns.

7.3.3 Fauna

Terrestrial invertebrate diversity at VDT and non-VDT sites was comparable, although VDT sites had a much higher maximum diversity. This likely reflects the ability of VDT to preserve microhabitats which are important for a diverse invertebrate ecosystem and the creation of new microhabitats via disturbance. Orthoptera, including wētā, and poorly mobile beetles were maintained by VDT. This is advantageous due to their flightlessness and slow natural dispersal to new habitats within mine sites. VDT sites may have also resisted invasion by the money spider *Diplocephalus cristatus*, possibly indicating a more resilient invertebrate community in VDT sites. Invasive copper bellied ants were present at VDT sites.

The typically small size of VDT sites (up to a few hectares) and low, open structure typical of pākihi and tussockland vegetation most commonly transferred, probably makes these habitats less attractive to forest birds, particularly where they are surrounded by open planted rehabilitation, rather than adjacent to intact forest or shrubland. South Island fernbird, South Island robin and South Island tomtit were more commonly recorded at VDT sites and bird numbers may be increasing at rehabilitated sites over time. This increase over time could be due to the specialist habitat requirements of some species, which takes time to develop. By way of example, South Island fernbird prefer dense (often mānuka) shrubland and South Island robin and tomtit prefer forested areas, both of these habitat types are likely to become denser and more complex following placement of VDT, particularly if the initial placement was not ideal. South Island robin might venture into the VDT sites near forest edges to forage or as part of a range that includes intact forests nearby. Recent 1080 operations in the surrounding forested areas may also contribute to the apparent increases in bird numbers.

Given that VDT is successful in maintaining vegetation cover and retaining soil fauna, it is unsurprising that this rehabilitation type is able to support and maintain viable populations of *Powelliphanta patrickensis* snails comparable to that of undisturbed habitat. Snails and their eggs require moist soil and a humid environment, in addition to deep and moist leaf litter to support their key prey item, earthworms (Walker et al. 2024).

7.4 Planted Sites

7.4.1 Vegetation

Vegetation cover has been established at planted sites, and microhabitat conditions have been created which favour the colonisation of other native plant species typical of the area, for example *Celmisia* spp. and *Drosera* spp. Despite there being more rock, bare ground and non-vascular vegetation cover at planted sites than at either VDT or natural sites, native species diversity was comparable to VDT and natural sites. This may reflect historic use of wilding transplants in some planted areas. However, native vegetation cover was significantly lower at planted sites than natural sites. The higher proportion of rock cover is not necessarily an undesirable outcome, provided that it contributes to the vegetation being resistant to weed invasion. The typology of rock is also important – rock in recent VDT areas is added as large ‘habitat enrichment boulders’ (at least 0.5m diameter), whereas

most rock in planted areas is small.

In general, species composition of planted sites was typical of shrubland and low forest vegetation types appropriate for the better-drained, higher slope angle landforms, but was not representative of, or similar to, natural vegetation. Plantings were dominated by tussock species (particularly *Chionochloa conspicua*), flax (*Phormium* spp.), mānuka, mountain tauhinu (*Ozothamnus vauvilliersii*), toetoe, hebes (*Veronica* spp.) and Southern rātā. This combination of species does not occur in natural communities at Stockton. Colonisation by non-vascular vegetation and species with a good dispersal ability (particularly small herbs such as *Celmisia*, *Forstera*, orchids) was evident across planted sites, although seeds of these species may have been introduced during transplants of wild native plants. Six of the seven planted sites contained wire rush, an important component of coal measures vegetation which was planted at some sites as 'hitchhikers' with wilding transplants, but has not been grown and deliberately planted to date. It is also able to survive in clumps through soil stripping and spreading processes (and was present on the surface of some stockpiles). It is unknown whether wire rush seed can survive stockpiling as a seed bank, or how far seed can spread in wind or water. Although present at low densities, this species can be expected to spread and facilitate colonisation of other coal measures species. Wire rush is an 'ecosystem engineer' which directly or indirectly modulates the availability of resources (other than themselves) to other species, by causing physical state changes in biotic and abiotic materials (including soil formation and water retention) thereby influencing community development and succession (Hodges and Rapson 2010).

Planted sites had the highest average number of PCI compared to the other two rehabilitation methods, but the average was lower than natural sites. This may be explained by the use in plantings of 'At Risk' species including coal measures tussock and *Dracophyllum densum*. Again, both were also introduced as wilding transplants, with coal measures tussock deliberately targeted given its high survival rates

Propagation and repatriation, or individual hand transfer, of some species of significance ('SOS') plants such as the two *Sticherus* spp. identified as priorities for protection at Escarpment Mine, is achievable and is a viable method of maintaining some species of conservation interest or increasing their populations beyond the pre-mining level. Other SOS plants, for example Parkinson's rātā (*Metrosideros parkinsonii*), have been able to be propagated, but have had high mortality when small numbers have been reintroduced suggesting that additional effort in establishing these species is required (Ecological Solutions Limited 2024).

By their very nature, planted areas will take longer to reach a self-sustaining ecosystem compared to VDT. One of the planted sites (PL02) was approximately eight years old and had less than 50% vegetation cover in the ground layer, of which 80% was native species. The majority of the ground cover in that plot was rock and bare ground. In contrast, PL04 was 20 years old and had > 140% vegetation cover, and 137% native vegetation cover, demonstrating that planting can be effective at achieving canopy cover in the medium term.

A high proportion of rock and bare ground is not an undesirable rehabilitation outcome per se, as long as the community is resistant to weeds and the bare soil does not lead to sediment mobilisation, however the relatively high cover of bare ground at planted sites, at least initially, can make them susceptible to weed invasion, particularly by heath rush which was present at all planted sites. At one site (PL06), heath rush comprised more than half of the vegetation cover. Plants are typically slow growing at Stockton, so most planted areas are not expected to produce a high proportion of vegetation cover quickly. Native plant cover is best achieved where native plants don't have to compete with exotic grasses and herbs, long-lived precocious species (i.e., those which reproduce early e.g., mānuka) are used and 'hitchhiker' plants are common.

Boulderfields of acidic rock are one of the naturally uncommon ecosystems found across

the Buller Plateaux. If this ecosystem were to be replicated for rehabilitation purposes, planting may be the most suitable option to establish a natural vegetation community due to boulderfields having naturally sparse vegetation.

7.4.2 Bryophytes

Planted sites had low proportion of mean indicator taxa (20.7% ± 2.8 SE) with a higher moss to liverwort ratio than the other rehabilitated sites surveyed. The presence of one 'At Risk' liverwort, *Cryptolophocolea tuberculata* and multiple 'indicator taxa' at PL-04, suggests that bryophyte communities can establish a trajectory towards establishing 'mature' communities typical of the area in the short-medium term where conditions are suitable. PL-04 was approximately 18 years old, with the oldest remediated site sampled being approximately 20-years old (PL-01).

PL-04 supported high vascular vegetation cover (80%), a relatively open-canopy (20% cover) and the second highest vascular species richness (39 native species) among the planted plots, surpassed only by PL-07 (42 native vascular species). The vegetation at PL-04 comprised mānuka-tussock-mountain flax shrubland and was situated on a southeast-facing hillside with a gentle 3°slope at an evaluation of 874m asl. The substrate consisted of shallow soils c. (252.5mm) with moderate drainage, and low levels of bedrock, broken rock, and surface rock.

While liverworts such as *Schistochila* (Schistochilaceae) which mostly occur in forests were absent from all the remediated sites we surveyed, PL-04 did support another species associated with forest habitats, *Gottschea pinnatifolia* (Schistochilaceae), which was growing amongst *C. tuberculata*. This suggests that some forest liverworts may begin to re-establish before forest vegetation is present if conditions are suitable.

Specific methods to enhance/preserve 'Threatened' and 'At Risk' bryophytes such as ex situ propagation and repatriation to terrestrial rehabilitated habitats have not been attempted at Stockton before, but could assist in maintaining bryophyte species of particular conservation concern. Habitat enrichment by adding boulders and wood to planted areas may also assist in creating humid microsites and allowing bryophytes to establish and persist.

7.4.3 Fauna

Indigenous birds, including New Zealand pipit and Western weka use planted areas. Planted sites where fernbirds were detected were close (c. < 50 m) to VDT sites which are likely to provide more suitable habitat (mānuka-dominant low stature shrubland). The presence of dense coal measures vegetation within the home range of fernbird may be a key influence on their presence in rehabilitated sites, as for some forest birds. As planted areas develop, the increase in the extent of suitable habitats across the site is expected to encourage species, including forest-dwellers such as South Island robin and pākihi specialists such as fernbird, to expand their home range to include adjoining planted areas more frequently and encourage dispersal of juveniles.

No planted areas are considered able support *Powelliphanta* snails or soil fauna comparable to that of VDT and undisturbed habitats. Key limitations are the absence of a deep, moist leaf litter, lower soil organic matter and lower vegetation cover which together reduce humidity. Over time, as the plantings grow and organic matter builds up, features such as a deep litter layer develop and plants such as flax and Astelia mature and provide suitable retreats/refugia for snails. Over time earthworm numbers also increase in the soil and these factors together create more favourable conditions for *Powelliphanta* snails to recolonise and persist. This process is likely to take many decades without either direct management to improve outcomes or a change in rehabilitation stripping and placement practices. Snail recolonisation is dependent on snails persisting in the habitats nearby and their productivity in those habitats being such that snails are available to colonise the

adjoining rehabilitated areas. Given the ongoing decline of snails reported by Lloyd (2024) neither of these prerequisites are likely to be operating at present.

Planted sites had high numbers of money spiders (*D. cristatus*), indicating a more disturbed state than the VDT sites. Copper-bellied ants (*O. glaber*) were also present at planted sites. The most likely source of these invaders is nursery-raised plants. Whilst average invertebrate species richness at planted sites was comparable to VDT sites, VDT sites demonstrated the most diverse invertebrate communities. A reliance on planted sites alone is likely to lead to homogenisation of terrestrial invertebrate biodiversity. The potential invertebrate diversity in planted sites is most likely lower due to the absence of leaf litter layers, lower plant species diversity and the absence of microhabitats that are found in more structurally complex VDT associated with mature plants.

7.5 Tarns

7.5.1 Vegetation

Natural tarns had significantly higher native vegetation cover than both constructed tarn types, although overall vegetation cover and number of PCI were not significantly different.

Natural tarns were surrounded by low pākihi communities typical of sandstone pavement, whereas the constructed planted tarns included species typical of shrubland or forest communities. Heath rush was present at all constructed tarns, but only at two of six natural tarns. Some constructed tarns had soil conditions supporting natural tarn vegetation, evidenced by the presence of wire rush, red tussock and coal measures tussock. The use of wire rush in plantings is required to enable constructed and planted tarns to support more natural coal measures vegetation in future.

7.5.2 Bryophytes

Natural tarns (TN) and constructed tarns (TM) with VDT had the most mature bryophyte communities, with the proportion of indicator taxa exceeding 25%. Species richness at constructed tarns with VDT (38 species) and constructed tarns with planting (47 species) were higher than at natural tarns (44 species), but natural tarns had the highest proportion of indicator taxa (45%).

Tarns typically have a lower bryophyte diversity than forested habitats within the Buller Plateaux (Glenny 2012). Liverworts dominated the bryophyte communities at natural tarns, while mosses were more prevalent at constructed VDT and planted tarns. This suggests that VDT and planted constructed sites may not yet provide sufficient shade and moisture to support a wider range of liverworts, preventing them from drying out.

7.5.3 Fauna

Constructed tarns supported aquatic macroinvertebrate communities similar to those found in natural tarns, and are able to be colonised relatively quickly due to the good dispersal ability of many of the macroinvertebrate species (Watson et al. 2024). Additionally, the presence of sediments provides habitat for zooplankton resting eggs or live individuals to provide a food source for colonising species.

Diversity of terrestrial invertebrates at constructed and natural tarns was similar. An abundance of common species (particularly Dolomedidae) and several exotics at both types of rehabilitated tarns, but not at natural tarns, suggests the habitat structure differs between tarn types. Constructed tarns were typically surrounded by rehabilitated areas (either planted or VDT or both) and the influence of this surrounding vegetation may also be important in determining the local fauna community at each particular tarn.

7.6 Non-Remediated sites

7.6.1 Vegetation

Disturbed and subsequently non-remediated sites had lower total vegetation cover than natural and VDT sites, but were similar to planted sites. Non-remediated sites adjoining forested areas had higher percentage vegetation cover and taller vegetation than non-remediated sites within an active mining environment. Exotic species were a common component of the vegetation at all non-remediated sites despite, in most cases, being several decades post-disturbance.

Gorse (*Ulex europaeus*) dominated the vegetation at the older non-remediated sites (i.e., Escarpment Mine, Cedar Creek Road, Sullivan Mine). Exotic grasses and exotic rushes dominated the vegetation at more recently non-remediated sites at Stockton. Heath rush was present at all non-remediated sites, and exotic grasses such as browntop (*Agrostis capillaris*) were also abundant.

In general, gorse is expected to be shaded out and replaced by native forest over time at the Escarpment mine and Cedar Creek Road areas.

7.6.2 Bryophytes

Bryophyte communities at non-remediated sites were highly diverse (84 species), but included a low proportion of mean indicator taxa (15.5 % ± 3.5 SE), so the communities were not yet mature. The non-remediated site DS-04, a kāmahi-mānuka-red beech/flax shrubland left to regenerate naturally for approximately 42 years, supported the richest liverwort assemblage of the non-remediated sites (36 species), including *Schistochila glaucescens,* and *Riccardia furtiva* ('At Risk – Naturally Uncommon').

7.6.3 Fauna

Terrestrial invertebrate diversity and general community structure at non-remediated sites was comparable to planted sites, and similar to VDT sites. These sites also had high numbers of native wolf spiders (*Anoteropsis adumbrata*) which are often common in alpine habitats (Vink 2002). Wolf spiders in New Zealand primarily disperse as spiderlings (young spiders) through a passive aerial mechanism known as ballooning, which allows them to cover distances ranging from a few metres to several kilometres or more. Adult wolf spiders are also active hunters and are highly nomadic, moving on the ground to find new hunting grounds, mates, or shelter. The presence of wolf spiders, which are a predator, indicates that there are sufficient lower trophic order species available to sustain them at non-remediated sites.

7.7 Drill sites

There is no evidence that exploration drilling sites are generally prone to developing weedy vegetation over either the short or long term. Results from 32 drill sites across the Buller Plateaux indicate that drilling activities generally do not promote weed invasion, with most (78%) plots having no exotic species recorded. Because drill sites are not generally weedy, they are not expected to be a source of weed spread into adjacent undisturbed habitats.

The most common exotic species was heath rush, and sites with the highest number of exotic species (i.e., >2 per plot) were associated with drill sites that were established between 1997–2009, mainly in the Cypress area. Vegetation communities at drill sites were generally indistinguishable from surrounding natural vegetation communities in terms of vegetation composition, particularly where those communities were low stature or naturally sparsely vegetated. Weeds are likely to persist in four out of the seven drill sites that contained weeds due to their location in open areas with low vegetation, whereas the

remaining three may have weeds gradually outcompeted due to growth of forest vegetation. Drill sites close to mining areas and tracks are more at risk to due to higher traffic and proximity to wind-dispersed weeds, particularly exotic grasses and rushes.

8.0 Recommendations

8.1 Introduction

Recommendations to improve rehabilitation outcomes for future mining areas on the Buller Plateaux based on the findings set out above are summarised below.

8.2 Landscape-scale Considerations

- Development of a strategy to vary future rehabilitation outcomes across the site as appropriate based on VDT and planting methods is recommended.
- Site-wide rehabilitation planning to create and account for ecological gradients and local habitat variation would improve overall outcomes. Vegetation types are naturally limited by altitude, drainage, aspect, slope angle and soil depth, so using plants or VDT sods that are suited to local site conditions on more variable engineered landforms will be more likely to maintain indigenous species replicating a natural ecosystem in the longer term. To achieve and maintain the most similarity to undisturbed habitats, rehabilitation planning should identify and consider the final ecosystem type achievable taking into account these elements. For example, a reasonable soil depth, good drainage and steeper slope angle will likely produce a forest ecosystem, whereas shallow soil on flat areas will likely produce rushland wetland ecosystems. Mimicking undisturbed vegetation types (e.g., forests) by using species both typical of and distinctive to these types should be prioritised.
- The location of final VDT placement should be planned to provide for ecological connections with surrounding habitats as well as to provide ecological connection across sites (e.g., via gullies or similar) and ‘islands’ of habitat to act as a source of seeds/propagules for surrounding planted areas.
- Creation of small areas of variable habitat with a large amount of edge should be prioritised over creation of large areas of homogenous vegetation where achievable.

8.3 VDT

- Vegetation Direct Transfer should be used to the maximum extent practicable, especially for low-growing vegetation communities. To date approximately 17% of rehabilitated sites have been achieved via VDT. Key determinants of a good outcome with VDT are competent substrate with even depth (particularly managing water and underlying soils), good biosecurity and minimising the extent and duration of bare soil. The best VDT outcomes have been achieved where particular operators have been dedicated to this task, allowed to specialise in this role and improve their skills over time, using specialised VDT cutting and transportation machines (buckets and truck decks).
- Provision of habitat for specific fauna and for bryophytes within or adjoining VDT. These include:
    - Boulder ‘outcrops’.
    - Rubble piles.

  - Replaced wood (vertical and part buried) including root plates.
  - Tarns.
  - Burrows.
  - 'Roost' plants (e.g., for *Powelliphanta*).
  - 'Habitat' plants (e.g., *Gahnia*, for forest ringlet butterfly, *Liparophyllum* for the avatar moth).
- VDT of forested areas still has value, because even if large trees and shrubs are felled and removed, sods contain tree stumps with attached root plates and woody debris that provide habitat for fauna together with some minimally-disturbed soils containing seedlings and seed bank, mycorrhizae and soil microbiome retained in sods. These accelerate rehabilitation and can be supplemented with planting nursery-raised seedlings if required.
- Storage of VDT on existing vegetation should be avoided unless the VDT is an irreplaceable vegetation community and the storage area is very low value vegetation which does not support threatened species or naturally uncommon ecosystems.

8.4 Soils and Root Zones

- Planting sites should be prepared using appropriate soil, ideally minimally handled soils of sufficient depth to allow for root establishment of target plants. Minimising structural breakdown of soils by using methods of stripping and placement that minimise handling (i.e., 'jumble dump') is preferred over using stockpiled soil. The use of excavators rather than bulldozers, and avoiding excessive smoothing of landforms is recommended.
- Topsoil separation at stripping should be prioritised to prevent contamination of topsoil with acidic overburden material.
- Soil stockpiles for subsequent plant establishment should ideally be low (i.e. < 3 m), short term and created using minimal disturbance techniques that maintain soil structure and living attached plants, not compacted or smoothed. These practices assist wire-rush and soil invertebrate communities survive the stockpiling process and colonise rehabilitated areas when topsoil is spread. Use of fresh soils should be prioritised.
- Soil stockpiles should be managed to firstly stabilise soils against erosion, and secondly to maintain soil fauna via maximising native plant regrowth and introducing additional native plants if necessary to promote soil fauna. This approach could also provide established plant material for transfer. This may require development of specific methods for short-term erosion control that provide for native regrowth and weed management.
- Methods to manage short-term erosion control so as to deliver the primary goal while also facilitating establishment of native species should be developed.
- Soils known to contain *J. squarrosus* should be used for rehabilitating taller shrublands and forest only, since these communities will eventually shade out and supress this weed.
- Fertiliser should be used strategically to support vegetation establishment at targeted locations. Widespread application of fertiliser or biosolids at high rates is not recommended.

8.5 Surface Micro-habitats

Creation of a range of microhabitats helps underpin diversity of outcome at rehabilitated sites. Methods to create microhabitats include:

- Jumble dumping to retain surface roughness and create sheltered microsites. Jumble dumping also retains some elements of the vegetation and much of the soil vitality.
- The addition of microhabitat features such as logs and boulders to assist in providing microhabitats for plants and, if properly designed and implemented, habitat for fauna as well.
- Variability in soil depth and slope and the provision of sub-surface crevices and cavities (e.g. armoured by boulders).

8.6 Planting

- The pool of planting species should be expanded to include other local species typical of the Buller Plateaux. Coal measures species that are amenable to nursery propagation, either as seedlings, cuttings or divisions should be prioritised for use in plantings.
- Identify methods to propagate, introduce and accelerate growth of wire rush in planted areas. This should be included as part of the applied research program.
- Review the potential for individual wilding transplants, particularly for species that are not amenable to nursery production or are difficult to establish using potted plants. Retention of species' microbiome may be required for success of wilding transplants.
- Planting should be done in a way to facilitate succession towards the appropriate vegetation community (forest, shrubland, tussockland etc). This may involve staged planting with key ecosystem engineer species (e.g., wire rush, mānuka) used initially to set the trajectory for the intended ecosystem type followed by supplementary planting in following years once microhabitats are established.
- Vegetation types should be able to transition towards natural local coal measures vegetation. Wire rush should be prioritised due to its ability to spread and establish ground cover, protect soils and create favourable growing conditions for other species – this will require control of species that are able to smother it, notably *Juncus squarrosus*. Mānuka should be similarly prioritised because of its relative abundance in most pre-mining vegetation communities. Mānuka can be used strategically as a 'nusery crop' to develop favourable conditions over time for sensitive, later-successional forest species.
- The use of species not typical of the local coal measures ecosystem should be reduced to discrete areas. This includes bush and snow tussocks (*Chionochloa conspicua*, *C. flavescens*), koromiko (*Veronica salicifolia, V. stricta*), broadleaf (*Griselinia littoralis*), mountain akeake (*Olearia aviceniifolia*), toetoe. Broadleaf species such as koromiko and broadleaf should be restricted to lower altitude sites transitioning to forest, and bush and snow tussocks restricted to higher elevation rocky sites such as the upper slopes of Mt Frederick.
- Post-planting surveys should remove harekeke (*Phormium tenax*), kānuka (*Kunzea robusta*) *V. stricta* and northern rātā (*Metrosideros robusta*) where appropriate since they are are likely to have been introduced as inadvertent contaminants within nursery plantings.

- Develop methods to transition newly rehabilitated areas dominated by non-native species (pasture grasses) and non-coal measures species to coal measures vegetation.

8.7 Weed Management

- Weeds have the potential to smother native plants, reduce habitat quality for invertebrates, and prevent closure criteria being achieved. Within rehabilitated areas, priority should be given to preventing weed incursions into new areas and supressing weeds in VDT and managing known weed sources, particularly those that occur at the top of a catchment.
- Weed control needs to be addressed on a site wide basis and prioritised to prevent the establishment and spread of heath rush and other weed species into natural communities. Biosecurity measures such as boot washes at the entrances to sensitive rehabilitated areas would assist in reducing weed invasion, particularly for *Juncus* which is more likely to be spread on footwear and other equipment than by wind or animals.

8.8 Fauna

- Microhabitat and macrohabitat features provide important refuges for native fauna such as lizards and kiwi. Provision of fauna habitat should be planned as part of rehabilitation through the creation of microhabitat features (e.g., wood stacks, boulders), and macrohabitat features (e.g., logs with holes). This is particularly important for planted areas where it takes a long time (decades – centuries) for natural refuges to develop. The provision of fauna habitat will also have the added benefit of reducing the area of bare ground available for weed colonisation, providing microsites to enable plant establishment, assisting with erosion control and providing nutrients for plants through decomposition.
- Lloyd (2024) suggested that where possible, topsoil and subsoil be kept separate during the rehabilitation process and soil compaction by heavy machinery be avoided to provide favourable conditions for earthworms and *Powelliphanta* snails.
- The use of fascining/slash in addition to planting and seeding should be explored further to determine how the outcome of non-VDT rehabilitation can be improved for snails (Lloyd 2024).
- Ensuring that VDT sites are ecologically connected to natural habitats and in proximity to gully habitat complexes to support lizard survival.
- Using optimally sized buckets to minimise loss of individual lizards and snails during the VDT process.
- Attention to both nursery and site biosecurity will be required to prevent future invasions of ‘new’ invertebrate taxa.

8.9 Tarns

Constructed tarns provide habitat for aquatic invertebrates almost immediately and when combined with VDT also have value for vegetation and terrestrial invertebrates. Watson et al. (2024) recommended the following actions to improve rehabilitation outcomes:

- Tarns should be constructed on gently sloping banks and create semi-natural hydrologic regimes to support diverse plant communities.

- Soft substrates and emergent vegetation are important for the colonisation of many invertebrates, particularly for oviposition and emergence locations.
- Large woody debris and/or root wads and enrichment edge planting of constructed tarns is likely to enhance the cover / refuge that is required for species such as kōura.
- Constructed tarns with a sediment base over rock/gravel floor more closely resemble natural tarns. Minimise areas with a sand, gravel, or coal floor sediment base as these are associated with low macrophyte cover and poorer water quality. Therefore, constructed tarns should seek to be over a sediment base of rock/gravel
- VDT be used around tarns where achievable.

8.10 Bryophytes

The most successful rehabilitation method for retaining ecological values is VDT. VDT supports a wide range of in situ biodiversity, including 'Threatened' and 'At Risk' bryophytes and lichens. The following should be included in the design for bryophyte rehabilitation:

- Use VDT across a range of vegetation communities.
- Create humid microsites, and a variety of hydrological conditions, including tarns.
- Vary geological substrates –salvaged sandstone boulders, low fertility soils and an organic soil layer. Include wood.
- Exclude and control heath rush.

Specific attention to rehabilitation of bryophyte habitats would assist in maintaining the 'Threatened' and 'At Risk' species throughout their natural range. This includes steep, damp rock faces, boulder fields with sheltered cavities and a range of suitable vegetation types (pākihi, red tussock grassland, low forest).

8.11 Applied research

The development and implementation of scientifically robust research and monitoring programme(s) would assist in developing methods before they are required to be implemented at scale, including (but not limited to):

- Investigation of methods of propagation (e.g., particularly for wire rush, bryophytes, podocarps).
- Confirm the benefits of VDT for lizards via radio-tracking lizards.
- Methods to minimise the use of exotic species (e.g., for soil stabilisation).
- Methods to accelerate habitat suitability for snails.
- Use of artificial habitat by great spotted kiwi.

9.0 Summary

Rehabilitation across the Buller Plateaux, and particularly at Stockton Mine, has developed a range of rehabilitation methods since the early 1990s. The most successful of these in terms of retaining ecological values is VDT, which achieves habitat which closely mimics natural ecosystems in the shortest possible time. This type of rehabilitation minimises

structural damage to both vegetation and soils and maintains an unknown proportion of animals with reduced mobility (i.e., snails, lizards, soil invertebrates). VDT produces a higher vegetation cover with a higher proportion of native species (including bryophytes), retains PCI and provides better fauna habitat, particularly for invertebrates, when compared to other rehabilitation methods. VDT should be maximised to the extent practicable so as to minimise and remediate adverse ecological effects.

The value of VDT for fauna can be enhanced by including microhabitat features such as logs and boulders to provide roosts/refugia and by effective biosecurity and weed management. Planted sites had more exotic species than VDT sites which is likely attributable to the higher proportion of bare ground present and in some cases the use of erosion stabilising methods that facilitate exotic species colonisation. Weed presence, and in some cases dominance, is a feature of rehabilitated sites which has the potential to prevent mine closure and reduce ecological values in the long term.

Low numbers of indigenous birds, including kiwi, use rehabilitated habitats at Stockton where they are available and suitable. Bird diversity and abundance were similar at VDT and planted sites, although sample sizes were small. Species with specific habitat requirements were only found at rehabilitated sites that were similar to their natural habitat, e.g. South Island fernbird were recorded at pākihi sites, whilst pipit and non-native passerines were recorded in planted areas. South Island robins were recorded near tall forest and weka were recorded throughout. The survey methods used were not appropriate to discriminate seasonal use of rehabilitated areas by birds, but it is likely that the presence of seasonal resources would attract birds to rehabilitated areas e.g, flax nectar for tūī and korimako. Attention to creation of specific habitats for fauna including lizards, kiwi and snails, would likely improve outcomes for fauna, particularly at planted sites, where development of natural habitats could be expected to take decades – centuries.

Terrestrial invertebrate diversity was comparable at non-remediated, planted, and VDT sites, as well as natural and man-made tarns, though there was larger range of diversity at VDT sites. There were also several invasive/exotic species recorded for the first time, although the risk these pose remains mostly unknown. Native and exotic money spiders (Linyphiidae) were present in all rehabilitated habitats, and these are typical invaders of disturbed New Zealand ecosystems. Future management of the site and other sites should include planning and biosecurity to prevent invasion of exotic species (where practicable).

Constructed tarns are statistically similar to natural tarns with respect to macroinvertebrate richness, abundance and structure. However, vegetated margins of planted constructed tarns had lower percentage cover than natural tarns, and percentage of bare ground was higher. It is likely that, much like planted sites, bare ground influences exotic species colonisation. Soil fauna diversity was highest at natural tarns and VDT tarns and lowest at planted tarns.

VDT, including in association with constructed tarns, is the most effective rehabilitation approach for sustaining bryophyte communities, supporting mature bryophyte communities (≥ 25% indicator taxa), as well as species of conservation concern. In contrast, planted sites had a lower proportion of indicator taxa (20.7% ± 2.8 SE). Where conditions and habitat are suitable, bryophyte communities in planted habitats may develop a mature bryophyte community within the medium term (approximately 18–20 years).

Drill sites were mostly free of weeds and are not prone to weed invasion over the short or long term, regardless of access type. The composition of vegetation communities at drill sites was indistinguishable from surrounding natural vegetation communities. Exotic species, especially heath rush, pose a threat to all rehabilitated vegetation types except taller shrubland and forest. Exotic invertebrates may also pose a threat, although the nature and extent of any threat remain largely unknown.

To improve rehabilitation outcomes at Stockton and other sites, it is recommended that a

range of methods, at a range of scales from microhabitat to landscape be adopted. Consideration of rehabilitation at the landscape-scale, including creation of variation in the landform, extent and location of VDT and planted sites, proximity to undisturbed habitat, ecological connectivity and a target final ecosystem type will help in creating rehabilitation that retains key local elements, including 'Threatened' and 'At Risk' and locally important species and is contiguous with the surrounding landscape. Maximising the use of VDT, combined with specific topsoil and soil stockpile management and soil spreading methods to minimise physical damage as well as maintaining separate topsoil and subsoils and increasing soil fertility at targeted locations, will assist in creating conditions which deliver high organic matter inputs (leaves and roots) and enable the more rapid build-up of leaf litter and humus, which will improve outcomes for fauna dependent on soil invertebrates and will contribute to the long-term viability of vegetation placed on such soils.

Planting mixes should prioritise local coal measures species which are appropriate to the target ecosystem. Adding microhabitat features to rehabilitated sites, especially planted sites, will improve rehabilitation outcomes for a range of fauna. Finally, it is recommended effective biosecurity practices be developed and a strategy to improve rehabilitation outcomes be devised and implemented via a site-wide Rehabilitation Management Plan.

10.0 References

Bell, J. (2005). The soil hydrology of the Plynlimon catchments. Centre for Ecology and Hydrology.

Boyer, S., Wratten, S. D., Weber, P., & Pizey, M. (2011). Mining rehabilitation and soil fauna: endemic earthworms at a New Zealand opencast coal mine site. Pedobiologia, 54, S99-S102.

Clarkson, B.R., Fitzgerald, N.B., Champion, P.D., Forester, L., Rance, B.D. (2021). New Zealand wetland plant list 2021. Contract Report: LC3975. Manaaki Whenua – Landcare Research. Prepared for Hawke's Bay Regional Council.

Craig, R. (2008). Soils and Indicative Land Rehabilitation, Escarpment Mine Project, Denniston Plateau, Buller. Landcare Research Contract Report: LC0809/020. Prepared for L&M Coal Ltd & Resource and Environment Management Nelson Ltd.

Dawson, D.G. & Bull, P.C. (1975). Counting birds in New Zealand forests. Notornis 22: 101–109.

de Lange, P.J., Glenny, D., Frogley, K., Renner, M.A.M., von Konrat, M., Engel, J.J., Reeb, C., and Rolfe, J.R. (2020). Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31. Department of Conservation, Wellington. 30 pp.

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. (2024). Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

de Lange, P., Blanchon, D., Knight, A., Elix, J., Lucking, R., Frogley, K., Harris, A., Cooper, J. and Rolfe, J. (2018). Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27. Department of Conservation, Wellington. 64 pp.

EcoLogical Solutions Limited. (2024a). Buller Plateaux Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited. Kāeo, Northland. October 2024. 91 pages + appendices.

EcoLogical Solutions Limited. (2024b). Cypress Mining Area VDT Storage Transects Annual Monitoring Report 2024. Unpublished report prepared for Bathurst Resources Ltd by EcoLogical Solutions Limited. Kāeo. 39pp.

EcoLogical Solutions Limited. (2024c). Buller Plateaux Vegetation Mapping. Unpublished report for Bathurst Resources Ltd by EcoLogical Solutions Limited. Kāeo. 65pp.

EcoLogical Solutions Limited. (2024d). Repatriation of Species of Significance Plants from Escarpment Mine. Unpublished report prepared for Bathurst Resources Ltd by EcoLogical Solutions Limited. Kāeo. 41pp.

Engel, J.J., and Glenny, D. (2019). A Flora of the Liverworts and Hornworts of New Zealand. Vol. 2. Monographs in Systematic Botany from the Missouri Botanical Garden. Vol. 134. Missouri Botanical Garden, St. Louis.

Fife, A.J. (2015). Flora of New Zealand [electronic resource]: mosses. Fascicle 25, Pleurophascaceae. Lincoln, N.Z.: Manaaki Whenua Press 2015.

Fife, A.J. (2017). Flora of New Zealand [electronic resource]: mosses. Fascicle 32, Pulchrinodaceae. Lincoln, N.Z.: Manaaki Whenua Press, 2017.

Gibb, E.S., Wilton, A.D., Schönberger, I., Fife, A.J., Glenny, D., Beever, J.E., Boardman, K.F., Breitwieser, I., de Pauw, B., Ford, K.A., Greer, P.A., Heenan, P.B., Maule, H.G., Novis, P.M., Prebble, J.M., Smissen, R.D., and Tawiri, K. (2022). Checklist of the New Zealand Flora – Hornworts, Liverworts and Mosses. Lincoln, Manaaki Whenua-Landcare Research. http://dx.doi.org/10.26065/1hqx-n922.

Glenny, D. (1999). Bryophyte survey at Stockton Plateau: Happy Valley tussock-land and surrounding areas. Landcare Research Contract Report LC9899/050. Prepared for Solid Energy Ltd.

Glenny, D. (2002). Terrestrial bryophytes – survey (2003 revision). Landcare Research Ltd. Prepared for Solid Energy New Zealand Ltd.

Glenny, D. (2007). Bryophytes and lichens in forests on Mount Frederick ridge, Stockton Plateau. Landcare Research Contract Report: LC0708/034. Prepared for Solid Energy Ltd.

Glenny, D. (2012). Bryophytes and lichens in the proposed Escarpment Mine area, Denniston Plateau. Landcare Research Contract Report: LC1131. Prepared for Buller Coal Ltd. October 2012.

Glenny, D. and Dawson, M. (2011). Bryophyte survey of northern Mt William Range. Landcare Research Contract Report: LC281. Prepared for Solid Energy New Zealand Ltd. November 2011.

Glenny, D. and Fife, A.J. (2001). Bryophyte survey at Te Kuha Ridge. Landcare Research Contract Report LC0001/82. Prepared for Michell Partnerships Ltd.

Gordon, D. P. (2013). New Zealand's genetic diversity. *In:* Dymond JR ed. Ecosystem services in New Zealand – conditions and trends. Manaaki Whenua Press, Lincoln, New Zealand.

Gruner, I., Walker, K., Anderson, F., Phillips, R., Flanagan, L., Matini, S., Weston, K., Marshall, J. (2021). *Powelliphanta augusta* Recovery Strategy 2021–2031. Retrieved from DOC, Hokitika. *In:* Lloyd, B. (2024). Surveys for *Powelliphanta patrickensis* snails in areas rehabilitated after mining. Unpublished report for Bathurst Resources Limited by Lloyd's Ecological Consulting. 31pp.

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson G.B., Reardon J.T., van Winkel, D., Makan, T., and Michel, P. 2026. Conservation status of reptiles in Aotearoa New Zealand, 2025. New Zealand Threat Classification Series 50.

Department of Conservation, Wellington. 32 pp.

Hodges, T. & Rapson, G. (2010). Is *Empodisma minus* the ecosystem engineer of the FBT (fen–bog transition zone) in New Zealand? Journal of the Royal Society of New Zealand, 40(3–4), 181–207. https://doi.org/10.1080/03036758.2010.503564

Hoffmann, Lara, Martin Palt, Lucas Mignien, Johannes Uhler, Peter Haase, Jörg Müller, and Stefan Stoll. (2025). "Effects of Species Traits on the Catchability of Butterflies with Different Types of Malaise Traps and Implications for Total Catch Biomass." *Journal of Insect Conservation* 29(1):8. doi: 10.1007/s10841-024-00645-5.

Holdaway, R. J., Wiser, S. K., & Williams, P. A. (2012). Status assessment of New Zealand's naturally uncommon ecosystems. *Conservation Biology, 26*(4), 619-629.

Hurst, J. M., Allen, R. B. & Fergus, A. J. (2022). The Recce method for describing New Zealand vegetation – expanded manual.

Hüttl, R.F., Weber, E. (2001). Forest ecosystem development in post-mining landscapes: a case study of the Lusatian lignite district. Naturwiss. 88, 322–329.

Kingsbury, M. (2007). Revegetation of the Stockton Coal Mine, Buller. Combined Proceedings International Plant Propagators' Society, 57, 114 – 119.

Knightbridge et al. (2002). Comparison of the vegetation of Te Kuha with the vegetation surveyed for the Ngakawau Protected Natural Areas report. Internal Department of Conservation report. Hokitika.

Leathwick, J. R., Morgan, F., Wilson, G., Rutledge, D., McLeod, M., Johnston, K. (2002). Land Environments of New Zealand: A Technical Guide. Ministry for the Environment and Landcare Research.

Lettink M, Monks J. (2012). Introduction to herpetofauna monitoring. Version 1.0. In: Greene T, McNutt K, editors. Biodiversity inventory and monitoring toolbox. Wellington: Department of Conservation; p. 1–10.

Lloyd, B. (2024). Surveys for *Powelliphanta patrickensis* snails in areas rehabilitated after mining. Unpublished report for Bathurst Resources Limited by Lloyd's Ecological Consulting. 31pp.

Malumbres-Olarte, J. (2010). Spider diversity and ecology in native tussock grasslands of the South Island, New Zealand. Lincoln University.

MBC Environmental. (2024). Results of a rapid worm survey of planted rehabilitation areas of Stockton mine. Unpublished report prepared for Bathurst Resources Limited.

McEwen, W.M. (1987). Ecological Regions and Districts of New Zealand. Third revised edition in four 1:500 000 Maps. New Zealand Biological Resources Centre, Department of Conservation, Wellington.

McLennan, J. (2012). Fauna of the Denniston CML 37-161, Denniston Plateau. Unpublished report for Solid Energy New Zealand Limited, Environmental Services Limited, Havelock North. July 2012. 27pp.

Michel, P., deRegnier, R., Emmitt, T., Ford, M., Perrie, L., Pritchard, A.S.E. (2026). Conservation status of mosses in Aotearoa New Zealand, 2025. Report 1155. Department of Conservation, Wellington. New Zealand Threat Classification System Series 49.

Nathan, S., Rattenbury, M.S., Suggate, R.P. (compilers) (2002). Geology of the Greymouth area. Institute of Geological and Nuclear Sciences 1:250 000 geological map 12. 1 sheet and 58 p. Lower Hutt. New Zealand: Institute of Geological and Nuclear Sciences Ltd.

Overmars, F.B., Kilvington, M.J., Gibson, R.S., Newell, C.L., Rhodes, T.J. (1998). Ngakawau Ecological District: Survey report for the Protected Natural Areas Programme. Department of Conservation, Hokitika. 178 pp.

Paquin, P., Vink, C.J., Dupérré, N. (2010). Spiders of New Zealand: Annotated family key & species list. Manaaki Whenua Press

Rattenbury, M.S., Cooper, R.A., Johnston, M.R. (compilers) (1998). Geology of the Nelson area. Institute of Geological and Nuclear Sciences 1:250 000 geological map 9. 1 sheet and 67 p. Lower Hutt. New Zealand: Institute of Geological and Nuclear Sciences Ltd.

Rodgers, D., Bartlett, R., Simcock, R., Wratten, S., Boyer, S. (2011). Benefits of vegetation direct transfer as an innovative mine rehabilitation tool. Australian Mine Restoration Conference.

Robertson, H.A., Baird, K.A., Elliott, G.P., Hitchmough, R.A., McArthur, N.J., Makan, T.D., Miskelly, C.M., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A., Michel, P. (2021) Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 p.

Ross, C. (2008). Soils and indicative land rehabilitation, Escarpment Mine Project, Denniston Plateau, Buller. Prepared for L&M Coal Ltd and Resource and Environmental Management Nelson Ltd. Landcare Research Contract Report: LC0809/020.

Ross, C. & Simcock, R. (2004). Appendix 6: Summary of hydroseeding and nursery trials with mosses and other colonising species at Stockton Mine, 2001 to 2004. *In*: Rehabilitation at Stockton Mine and implications for the Proposed Cypress Mine. December 2004.

Schuster, R.M. (2021). Austral Hepaticae. Part III. Beihefte, zur Nova Hedwigia 120.

Scullion, J., Mohammed, A.R.A., Ramshaw, G.A. (1988). Changes in earthworm populations following cultivation of undisturbed and former opencast coal-mining land. Agric., Ecosyst. Environ. 20, 289–302.

Simcock, R. (1999). W6C operational scale direct transfer trial, 1998.

Simcock, R. (2011). Rehabilitation of the proposed Mt William North mining area, Buller District. Landcare Research Contract Report: LC629. Prepared for Solid Energy New Zealand Ltd.

Simcock, R., Toft, R., Ross, C., Flynn, S. (1999). A case study of the cost and effectiveness of a new technology for accelerating rehabilitation of native ecosystems. pp 234-251 *In:* Minerals Council of Australia 24th Annual Environmental Workshop, Townsville.

Simcock, R. & Ross, C. (2014). Guidelines for mine rehabilitation in Westland. Landcare Research Contract Report LC 1201.

Simcock, R., Ross, C., Pizey, M. (2004). Rehabilitation of alluvial gold and open-cast coal mines: 1904 to 2004. *In:* Australasian Institute of Mining and Metallurgy Branch, Nelson, New Zealand.

Solid Energy New Zealand Limited. (2004). Rehabilitation at Stockton mine and implications for the proposed Cypress Mine.

Solid Energy New Zealand Limited. (2010). Cypress Mine Rehabilitation Management Plan: First Revision.

Taylor, N.H., & Pohlen, I.J. (1979). Soil Survey Method. A New Zealand handbook for the field study of soils. 3rd edition. Department of Scientific and Industrial Research, Wellington.

Terry, J.A. (2017). Bryophyte and lichen survey of rehabilitated sites at Stockton Coal Mine, near Westport, New Zealand. Unpublished report prepared by Jon Terry Ecology. Limited for Stevenson Group Limited, August 2017. Jon Terry Ecology Limited, Wellington. 16pp.

Theinhardt, N.I. (2003). Plant restoration at an open cast coal mine, West Coast, New Zealand. Masters of Forestry Science Thesis, Canterbury University. 104 p.

Topping, C. J., and G. L. Lovei. (1997). Spider density and diversity in relation to disturbance in Agroecosystems in New Zealand, with a Comparison to England. *New Zealand Journal of Ecology* 21(2):121–28.

Vink, C.J. (2002). Lycosidae (Arachnida: Araneae). Lincoln, Canterbury: Manaaki Whenua Press.

Vink, C.J., and Dupérré, N. (2010). Pisauridae: Arachnida: Araneae. Lincoln: Manaaki Whenua Press.

Vink, C.J., Teulon, D.A J., Mclachlan, A.R.G. and Stufkens, M.A.W. (2004). Spiders (Araneae) and Harvestmen (Opiliones) in arable crops and grasses in Canterbury, New Zealand. *New Zealand Journal of Zoology* 31(2):149–59. doi: 10.1080/03014223.2004.9518368.

Walker, K., Walton, K., Edwards, E., Hitchmough, R., Payton, I., Barker, G., Michel, P. (2024). Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and snails) Part 3. Rhytididae (carnivorous snails): 2022. Retrieved from DOC, Wellington, NZ.

Waterhouse, B. R., Boyer, S., Adair, K. L., & Wratten, S. D. (2014). Using municipal biosolids in ecological restoration: What is good for plants and soil may not be good for endemic earthworms. *Ecological engineering, 70*, 414-421.

Watson, K. (2009). Escarpment Mine Project: an archaeological assessment. Unpublished report for L&M Coal Ltd. Underground Overground Archaeology Ltd.

Watson, A., Rose, A., Lambert, P. and Hogsden, K. (2024). Assessment of tarn rehabilitation success across the Stockton Mine. Prepared for Bathurst Resources Limited, May 2024. National Institute of Water & Atmosphere Research Ltd.

Zhang, Y., Peng, S., Chen, X., & Chen, H.Y. (2022). Plant diversity increases the abundance and diversity of soil fauna: A meta-analysis. Geoderma,411, 115694.

APPENDIX A

Sampling Sites

Non-remediated Sites

Site	NZTM Easting	NZTM Northing	Rehab type	Location	Time since disturbance
DS1	[redacted]		Non-remediated	[redacted]	Disturbed sometime between 1988 and 2003, so at least 21 years. Possibly associated with water infrastructure before becoming a topsoil stockpile area (Sam Taylor pers. comm).
DS2	[redacted]		Non-remediated	[redacted]	At least 21 years. An area of side-cast material from widening of the Mt Fred haul road prior to 2003 (Sam Taylor pers. comm).
DS3	[redacted]		Non-remediated	[redacted]	Approximately 18 years. Area is a soil dump formed in 2006 (Sam Taylor pers. comm).
DS4	[redacted]		Non-remediated	[redacted]	Approximately 42 years. Work in Escarpment Mine ceased around 1982 (Watson, 2009).
DS5	[redacted]		Non-remediated	[redacted]	Approximately 54 years. This area was managed by State Coal (Campbell Robertson pers. comm.)
DS6	[redacted]		Non-remediated	[redacted]	Approximately 40 years. This area likely closed when Sullivan West Mine developed in 1984 (Campbell Robertson pers. comm.)

Vegetation Direct Transfer Sites

Site	NZTM Easting	NZTM Northing	Rehab type	Location	Age of rehab
DT1	[redacted]	[redacted]	VDT	[redacted]	FY12
DT2	[redacted]	[redacted]	VDT	[redacted]	FY11
DT3	[redacted]	[redacted]	VDT	[redacted]	July 2023
DT4	[redacted]	[redacted]	VDT	[redacted]	FY12
DT5	[redacted]	[redacted]	VDT	[redacted]	FY11
DT6	[redacted]	[redacted]	VDT	[redacted]	RY06/07
DT7	[redacted]	[redacted]	VDT	[redacted]	RY07/08

DT8	[redacted]	[redacted]	VDT	[redacted]	RY07/08

Planted Sites

Site	NZTM Easting	NZTM Northing	Rehab type	Location	Age of rehab
PL1	[redacted]	[redacted]	Planted	[redacted]	Pre RY04/05
PL2	[redacted]	[redacted]	Planted	[redacted]	FY16
PL3	[redacted]	[redacted]	Planted	[redacted]	RY05/06
PL4	[redacted]	[redacted]	Planted	[redacted]	RY04/05
PL5	[redacted]	[redacted]	Planted	[redacted]	RY07/08
PL6	[redacted]	[redacted]	Planted	[redacted]	RY07/08?
PL7	[redacted]	[redacted]	Planted	[redacted]	RY05/06

Constructed Tarn Sites

Site	NZTM Easting	NZTM Northing	Rehab type	Location	Age of rehab	Notes
TM1	[redacted]	[redacted]	Planted tarn	[redacted]	Pre RY04/05	NIWA report states constructed 2005
TM2	[redacted]	[redacted]	Planted tarn	[redacted]	FY16	NIWA report states constructed 2013
TM3	[redacted]	[redacted]	VDT tarn	[redacted]	RY07/08	NIWA report states constructed 2002
TM4	[redacted]	[redacted]	VDT tarn	[redacted]	FY11	NIWA report states constructed 2007
TM5	[redacted]	[redacted]	Planted tarn	[redacted]	FY18	Not mentioned in NIWA report

TM6	[redacted]	[redacted]	Planted tarn	[redacted]	FY21	NIWA report states constructed 2006
TM7	[redacted]	[redacted]	Planted tarn	[redacted]	RY05/06	NIWA report states constructed 1997-98
TM8	[redacted]	[redacted]	VDT tarn	[redacted]	RY07/08	NIWA report states constructed 1998
TM9	[redacted]	[redacted]	Planted tarn	[redacted]	FY23	Not mentioned in NIWA report
TM10	[redacted]	[redacted]	Planted tarn	[redacted]	RY04/05	NIWA report states constructed 1998-99
TM11	[redacted]	[redacted]	Planted tarn	[redacted]	FY17	NIWA report states constructed 1997-98
TM12	[redacted]	[redacted]	Planted tarn	[redacted]	RY05/06	Not mentioned in NIWA report

Natural Tarn Sites

Site	NZTM Easting	NZTM Northing	Rehab type	Location	Age of rehab	Notes
TN1	[redacted]	[redacted]	Natural	[redacted]	Natural	-
TN2	[redacted]	[redacted]	Natural	[redacted]	Natural	[redacted]
TN3	[redacted]	[redacted]	Natural	[redacted]	Natural	-
TN4	[redacted]	[redacted]	Natural	[redacted]	Natural	-
TN5	[redacted]	[redacted]	Natural	[redacted]	Natural	-
TN6	[redacted]	[redacted]	Natural	[redacted]	Natural	-

Natural Sites

Site	NZTM Easting	NZTM Northing	Location
[redacted]			

Drill Sites

Site	NZTM Easting	NZTM Northing	Rehab type	Location	Date of establishment
[redacted]					



APPENDIX B

Vascular species list for planted sites

Rehabilitation Type	Species	Common Name	Naturally occurring on the Buller Plateaux
Planted	*Austroderia richardii*	Toetoe	yes
	Chionochloa conspicua	Broad leaved bush tussock	no
	Chionochloa juncea	Coal measures tussock	yes
	Chionochloa rubra	Red tussock	yes
	Dracophyllum densum		yes
	Dracophyllum longifolium	Inaka	yes
	Dracophyllum rosmarinifolium	Inaka	yes
	Fuscospora cliffortioides	Mountain beech	yes
	Griselinia littoralis	Broadleaf; kāpuka	yes
	Lepidothamnus intermedius	Yellow-silver pine	yes
	Leptospermum scoparium	Mānuka	yes
	Metrosideros robusta	Northern rātā	no
	Metrosideros umbellata	Southern rātā	yes
	Olearia avicenniifolia	Mountain akeake	yes
	Ozothamnus vauvilliersii	Mountain tauhinu	yes
	Phormium cookianum	Mountain flax; whaririki	yes
	Phormium tenax	Flax; lowland flax	no
	Veronica mooreae		yes
	Veronica salicifolia	Koromiko	no
Naturalised	*Agrostis capillaris**	Browntop; browntop bent	no
	Anaphalioides bellidioides	Hells bells	yes
	Androstoma empetrifolium	Bog mingimingi	yes
	Aporostylis bifolia	Odd-leaved orchid	yes
	Brachyglottis bellidioides		yes
	Bulbinella species	Bulbinella; Māori onion	yes
	Carex gaudichaudiana	Gaudichaud's sedge	yes
	Celmisia dallii	Dall's mountain daisy	yes
	Celmisia dubia	Mountain daisy	yes
	Celmisia lateralis		yes
	Centella uniflora	Centella	yes
	Centrolepis ciliata		yes
	Chionochloa australis	Carpet grass	yes
	Coprosma cuneata		yes
	Coprosma dumosa		yes
	Coprosma linariifolia	Mikimiki; Yellow wood;	yes
	Corybas species	Spider orchid;	yes
	Cyathea colensoi	Mountain tree fern	yes
	Diphasium scariosum	Creeping clubmoss	yes
	Donatia novae-zelandiae	Cushion plant	yes
	Drosera spatulata	Sundew	yes
	Drosera stenopetala	Sundew	yes
	Elaeocarpus hookerianus	Pōkākā	yes
	Empodisma minus	Wire rush	yes
	Epacris alpina	Nehenehe	yes
	Epilobium brunnescens subsp. brunnescens		yes
	Epilobium melanocaulon		yes
	Epilobium pernitens		yes
	Forstera mackayi		yes
	Gahnia procera	Mountain gahnia; giant sedge	yes
	Gaultheria antipoda	Bush snowberry; fools beech	yes
	Gaultheria macrostigma	Prostrate snowberry	yes

	Gunnera monoica		yes
	Histiopteris incisa	Water fern; mātātā	yes
	Hydrocotyle moschata	Hairy pennywort	yes
	*Hypochaeris radicata**	Castear	no
	Isolepis aucklandica		yes
	*Juncus squarrosus**	Heath rush	no
	Kelleria dieffenbachii		yes
	*Leontodon saxatilis**	Hawkbit	no
	Leptecophylla juniperina	Prickly mingimingi	yes
	Leucopogon fasciculatus	Soft mingimingi; tall mingimingi	yes
	Liparophyllum gunnii		yes
	Lobelia angulata	Pratia	yes
	Lomaria discolor	Crown fern	yes
	Luzula rufa	Red woodrush	yes
Naturalised contd.	*Luzula species*	Woodrush	-
	Neomyrtus pedunculata	Rōhutu	yes
	Nertera balfouriana		yes
	Nertera depressa	Bead plant; fruiting duckweed	yes
	Paesia scaberula	Ring fern; hard fern	yes
	Parablechnum montanum	Mountain kiokio	yes
	Parablechnum novae-zelandiae	Kiokio	yes
	Parablechnum procerum	Small kiokio	yes
	Pentachondra pumila		yes
	Phyllocladus alpinus	Mountain toatoa; mountain celery pine	yes
	Polystichum vestitum	Prickly shield fern	yes
	Prasophyllum colensoi	Leek orchid	yes
	Pterophylla racemosa	Kāmahi	yes
	Pterostylis species	Greenhood orchid	yes
	Quintinia serrata	Quintinia	yes
	Rytidosperma gracile		yes
	Rytidosperma nigricans		yes

APPENDIX C

Vegetation types for natural, VDT and drill site plots

Plot type	Plot ID	Vegetation description
VDT	DT01	Silver-mountain beech forest
	DT02	Archeria/mountain beech forest
	DT03	Red tussock/wire rush shrubland
	DT04	Yellow-silver pine-mānuka shrubland
	DT05	Mānuka-flax rushland
	DT06	Southern rātā/mānuka-flax-Gahnia shrubland
	DT07	Mānuka-tussock/wire rush shrubland
	DT08	Mānuka-red tussock/wire rush shrubland
Natural (NT)	N01	Mānuka-tussock/wire rush shrubland
	N02	Southern rātā-mountain beech forest
	N03	Mānuka-mountain beech forest
	N04	Mānuka-*Chionochloa juncea*/wire rush shrubland
	N05	Mānuka-mountain beech forest
	N06	Silver beech/leatherwood shrubland
	N07	Red tussock-tangle fern shrub-rushland
	N08	Mountain flax-red tussock/tangle fern-wire rush shrubland
	N09	Silver beech-mountain beech/Archeria-podocarp forest
	N10	Mānuka-mountain flax/wire rush shrubland
Non-remediated	DS01	Heath rush grassland
	DS02	Toetoe/heath rush tussock-shrubland
	DS03	Southern rata/heath rush-wire rush shrubland
	DS04	Kāmahi-manuka-red beech/flax shrubland
	DS05	Manuka-kamahi shrubland
	DS06	Toetoe/mānuka-heath rush shrubland
Drill Sites (DS)	DC007	Mānuka-wire rush-tussock shrubland
	DC1187	Mānuka/herbfield shrubland (sandstone pavement)
	DC16	Mānuka-tussock/wire rush shrubland
	DC17	Mānuka/wire rush shrubland
	DC18	Mānuka/tussock shrub-rushland
	DC19	Southern rātā/mānuka-tussock shrubland (sandstone pavement)
	DEN120	Mānuka/podocarp-beech low forest
	DEN153	Mānuka-tussock/wire rush shrubland
	DEN156	Tussock/mānuka-wire rush shrubland
	DEN187	Tussock/mānuka-wire rush shrubland
	DEN188	Mānuka-tussock/wire rush shrubland
	DEN190	Tussock-wire rush/mānuka shrubland
	DEN191	Gahnia/mānuka-tussock shrubland
	DEN200	Square sedge-tussock shrub-rushland
	DEN202	Mānuka-tussock/wire rush shrubland
	DEN204	Square sedge/mānuka-wire rush rushland
	DEN206	Mānuka-square sedge shrub-rushland
	DEN209	Mānuka-tussock/wire rush shrubland
	DEN211	Square sedge-pakihi rush/mānuka rushland
	DEN246	Red tussock-tanglefern shrub-rushland
	DEN256	Mānuka/tussock-wire rush shrubland
	DEN257	Mānuka/tussock-wire rush shrubland
	DEN34	Mānuka-tussock/wire rush shrubland
	DEN49	Mānuka-Dracophyllum/wire rush shrubland
	DEN65	Mānuka/podocarp-beech low forest
	DEN99	Mānuka-tussock/square sedge rushland
	STK1520	Silver beech-mountain toatoa/sedge-rushland
	STK1523	Mānuka/tussock-wire rush shrubland
	STK1526	Mānuka/tangle fern-wire rush shrubland

STK3058	Mānuka/tussock-wire rush shrubland
STK3792	Mixed beech-mountain toatoa/Gahnia shrubland
STK5592	Mānuka-tussock grassland

APPENDIX D

Bryophyte species recorded

Species of conservation concern are marked in bold (de Lange et al. 2020, Michel et al. 2026).
Species of conservation interest are marked by an asterisk (*).

Location: [redacted]
Plot ID: **DT-01**
Cultural: VDT (Vegetation Direct Transfer)
Grid reference (NZTM): [redacted]
Date measured: 31/10/2023
Altitude: 915 m asl
Area: 5 x 5 m
Plot description: Silver-mountain beech forest

Bryophytes:

Acrobolbus epiphytus
Acromastigum anisostomum
Acromastigum marginatum
Bazzania adnexa
Cuspidatula monodon
Dicranoloma billardierei
Dicranoloma sp.
Dicranoweisia sp.
Dinckleria fruticella
Distichophyllum pulchellum
Frullania rostrata
Herbertus oldfieldianus
Heteroscyphus sp.
Kurzia hippuroides
Lepidogyna hodgsoniae
Lepicolea attenuata
Mniodendron colensoi
Neolepidozia patentissima
Ptychomnion aciculare
Riccardia crassa
Sphagnum falcatulum
Sphagnum squarrosum.

Location: [redacted]
Plot ID: **DT-02**
Cultural: VDT (Vegetation Direct Transfer)
Grid reference (NZTM): [redacted]
Date measured: 2/11/2023
Altitude: 1,004 m asl
Area: 5 x 5 m
Plot description: Archeria/mountain beech forest

Bryophytes:

Acrobolbus concinnus
Acrobolbus epiphytus
Acromastigum anisostomum
Bazzania adnexa
Bazzania involuta
Calomnion brownseyi
Campylopus clavatus
Campylopus introflexus
Dicranoloma billardierei
Dicranoloma sp.

Distichophyllum pulchellum
Gottschea pinnatifolia
Herbertus oldfieldianus
Heteroscyphus sp.
Lepicolea attenuata
Lepicolea scolopendra
Lepidogyna hodgsoniae
Lepidozia ulothrix
Macromitrium longipes
Plagiothecium sp.
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Polytrichadelphus magellanicus
Ptychomnion aciculare
Sphagnum falcatulum
Wijkia extenuata.

Location: [redacted]
Plot ID: **DT-03**
Cultural: VDT (Vegetation Direct Transfer)
Grid reference (NZTM): [redacted]
Date measured: 2/11/2023
Altitude: 710 m asl
Area: 5 x 5 m
Plot description: Red tussock/wire rush shrubland

Bryophytes:

Camptochaete sp.
Campylopus clavatus
Campylopus introflexus
Campylopus sp.
Dicranella sp.
Isotachis montana
Kurzia hippuroides
Pallavicinia connivens
Philonotis sp.
Wijkia extenuata.

Location: [redacted]
Plot ID: **DT-04**
Cultural: VDT (Vegetation Direct Transfer)
Grid reference (NZTM): [redacted]
Date measured: 2/11/2023
Altitude: 726 m asl
Area: 5 x 5 m
Plot description: Yellow-silver pine–mānuka shrubland

Bryophytes:

Bazzania involuta
Campylopus introflexus
Campylopus sp.
Conostomum sp.
Dicranoloma billardierei
Distichophyllum pulchellum
Isotachis montana
Kurzia hippuroides

Lembidium nutans
Lepidozia concinna
Lepidozia sp.
Leucobryum javense
Pallavicinia sp.
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Riccardia sp.
Telaranea herzogii.

Location: [redacted]
Plot ID: **DT-05**
Cultural: VDT (Vegetation Direct Transfer)
Grid reference (NZTM): [redacted]
Date measured: 2/11/2023
Altitude: 888 m asl
Area: 5 x 5 m
Plot description: Mānuka-flax rushland

Bryophytes:

Bazzania novae-zelandiae
Campylopus clavatus
Campylopus introflexus
Dicranoloma ?fasciatum
Dicranoloma sp.
Kurzia hippuroides
Lembidium nutans
Riccardia spp.
Wijkia extenuata.

Location: [redacted]
Plot ID: **DT-06**
Cultural: VDT (Vegetation Direct Transfer)
Grid reference (NZTM): [redacted]
Date measured: 16/11/2023
Altitude: 818 m asl
Area: 5 x 5 m
Plot description: Southern rātā/mānuka-flax-Gahnia shrubland

Bryophytes:

Adelanthus occlusus
Bazzania adnexa
Brachythecium paradoxum
Breutelia elongata
Campylopus introflexus
Cuspidatula monodon
Dicranoloma billardierei
Isotachis montana
Kurzia ?helophila
Kurzia hippuroides
Lepidozia laevifolia
Lepidozia sp.
Lepidozia ulothrix
Lobatiriccardia alterniloba
Polytrichadelphus magellanicus
Ptychomnion aciculare
Radula sp.

Riccardia sp.
Sphagnum squarrosum
Telaranea herzogii
Telaranea sp.
Wijkia extenuata.

Location: [redacted]
Plot ID: **DT-07**
Cultural: VDT (Vegetation Direct Transfer)
Grid reference (NZTM): [redacted]
Date measured: 16/11/2023
Altitude: 865 m asl
Area: 5 x 5 m
Plot description: Mānuka-tussock/wire rush shrubland

Bryophytes:

Brachythecium allisonii
Breutelia elongata
Campylopus clavatus
Campylopus purpureocaulis
Dicranoloma billardierei
Heteroscyphus allodontus
Kurzia hippuroides
Lepidozia sp.
Oligotrichum sp.
Riccardia spp.
Solenostoma inundatum
Wijkia extenuata.

Location: [redacted]
Plot ID: **DT-08**
Cultural: VDT (Vegetation Direct Transfer)
Grid reference (NZTM): [redacted]
Date measured: 21/11/2023
Altitude: 879 m asl
Area: 5 x 5 m
Plot description: Mānuka-red tussock/wire rush shrubland

Bryophytes:

Bazzania adnexa
Calyptrochaeta apiculata
Campylopus clavatus
Dicranoloma dicarpum
Drepanolejeunea sp.
Frullania ptychantha
Frullania rostrata
Isotachis montana
Kurzia hippuroides
Leucobryum javense
Macromitrium sp.
Meesia uliginosa
Neolepidozia patentissima
Philonotis tenuis
Pseudotaxiphyllum falcifolium
Racomitrium sp.

Rhacocarpus purpurascens
Riccardia spp.
Telaranea sp.
Tortula muralis
Zoopsis setulosa.

Location: [redacted]
Plot ID: **TN-01**
Cultural: Tarn Natural
Grid reference (NZTM): [redacted]
Date measured: 1/11/2023
Altitude: 843 m asl
Area: 5 x 5 m
Plot description: Red tussock / wire rush shrubland

Bryophytes:

Acromastigum anisostomum
Breutelia pendula
Campylopus introflexus
Campylopus sp.
Cryptochila nigrescens
Dicranoloma billardierei
Isotachis lyallii
Kurzia hippuroides
Ptychomnion aciculare
Riccardia aequicellularis
Riccardia furtiva – ***'At Risk – Naturally Uncommon'***
Syzygiella colorata
Telaranea herzogii
Wijkia extenuata
Zoopsis setulosa.

Location: [redacted]
Plot ID: **TN-02**
Cultural: Tarn Natural
Grid reference (NZTM): [redacted]
Date measured: 1/11/2023
Altitude: 740 m asl
Area: 5 x 5 m
Plot description: Mānuka–tussock / tangle fern-wire rush shrubland

Bryophytes:

Campylopus clavatus
Campylopus purpureocaulis
*Pulchrinodus inflatus**
Riccardia spp.

Location: [redacted]
Plot ID: **TN-03**
Cultural: Tarn Natural
Grid reference (NZTM): [redacted]

Date measured: 15/11/2023
Altitude: 747 m asl
Area: 5 x 5 m
Plot description: Podocarp / tussock-wire rush shrubland

Bryophytes:

Campylopus clavatus
Campylopus introflexus
Cuspidatula monodon
Dicranoloma sp.
Dicranoweisia antarctica
Goebeliella cornigera
Kurzia hippuroides
Lepidozia concinna
*Pulchrinodus inflatus**
Riccardia cochleata
Riccardia crassa
Riccardia sp.
Wijkia extenuata.

Location: [redacted]
Plot ID: **TN-04**
Cultural: Tarn Natural
Grid reference (NZTM): [redacted]
Date measured: 18/11/2023
Altitude: 805 m asl
Area: 5 x 5 m
Plot description: Mānuka–tussock / wire rush shrubland

Bryophytes:

Acromastigum anisostomum
Campylopus clavatus
Cladomnion ericoides
Kurzia hippuroides
Neolepidozia patentissima
Pallavicinia sp.
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Polytrichum commune
Ptychomnion aciculare
Riccardia crassa
Telaranea sp.
Wijkia extenuata.

Location: [redacted]
Plot ID: **TN-05**
Cultural: Tarn Natural
Grid reference (NZTM): [redacted]
Date measured: 18/11/2023
Altitude: 812 m asl
Area: 5 x 5 m
Plot description: Mānuka–tussock / tangle fern-wire rush shrubland

Bryophytes:

Campylopus clavatus
Dicranoloma sp.
Fallaciella robusta
Frullania rostrata
Kurzia hippuroides
Lejeunea sp.
Lepidozia sp.
Leucobryum javense
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Polytrichadelphus magellanicus
Ptychomnion aciculare
Radula sp.
Telaranea herzogii
Telaranea sp.
Wijkia extenuata.

Location: [redacted]
Plot ID: TN-06
Cultural: Tarn Natural
Grid reference (NZTM): [redacted]
Date measured: 18/11/2023
Altitude: 770 m asl
Area: 5 x 5 m
Plot description: Mānuka–tussock / wire rush shrubland

Bryophytes:

Campylopus introflexus
Dicranoloma billardierei
Dicranoloma sp.
Frullania rostrata
Kurzia ?compacta
Kurzia hippuroides
Kurzia quinquespina
Lepidozia attenuata
Neolepidozia patentissima
Pleurophascum ovalifolium – ***'At Risk – Naturally Uncommon'***
Radula sp.
Riccardia spp.
Sphagnum sp.
Telaranea herzogii
Weymouthia cochlearifolia
Wijkia extenuata.

Location: [redacted]
Plot ID: **PL-01**
Cultural: Planted
Grid reference (NZTM): [redacted]
Date measured: 31/10/2023
Altitude: 928 m asl
Area: 5 x 5 m
Plot description: Mānuka–mountain flax–broadleaf / tussock open-shrubland

Bryophytes:

Andreaea ?amblyophylla
Campylopus clavatus
Campylopus introflexus
Cryphaea tenella
Cryptolophocolea mitteniana
Dicranoloma billardierei
Dicranoloma sp.
Isotachis montana
Kurzia hippuroides
Macromitrium longirostre
Pohlia ?tenuifolia
Polytrichadelphus magellanicus
Riccardia cochleata.

Location: [redacted]
Plot ID: **PL-02**
Cultural: Planted
Grid reference (NZTM): [redacted]
Date measured: 1/11/2023
Altitude: 1,107 m asl
Area: 5 x 5 m
Plot description: Tussock mixed-shrubland

Bryophytes:

Andreaea sp.
Campylopus clavatus
Campylopus introflexus
Campylopus sp.
Conostomum sp.
Ditrichum sp.
Heteroscyphus ?cuneistipulus
Isotachis montana
Polytrichadelphus magellanicus
Ptychomnion aciculare
Telaranea sp.

Location: [redacted]
Plot ID: **PL-03**
Cultural: Planted
Grid reference (NZTM): [redacted]
Date measured: 2/11/2023
Altitude: 893 m asl
Area: 5 x 5 m
Plot description: Mixed-mānuka shrubland

Bryophytes:

?Plagiothecium sp.
Adelanthus occlusus
Bazzania involuta
Campylopus clavatus
Campylopus sp.
Dicranoloma dicarpum

Dicranoloma menziesii
Gackstroemia alpina
Isotachis montana
Lepidozia concinna
Lepidozia ?novae-zelandiae
Macromitrium sp.
Philonotis tenuis
Polytrichadelphus magellanicus
Racomitrium sp.
Rhacocarpus purpurascens
Riccardia aequicellularis
Riccardia bipinnatifida
Riccardia sp.
Sphagnum squarrosum
Wijkia extenuata.

Location: [redacted]
Plot ID: **PL-04**
Cultural: Planted
Grid reference (NZTM):[redacted]
Date measured: 15/11/2023
Altitude: 874 m asl
Area: 5 x 5 m
Plot description: Mānuka-tussock shrubland

Bryophytes:

Adelanthus falcatus
Adelanthus occlusus
Bartramia sp.
Bazzania involuta
Brachythecium sp.
Campylopus clavatus
Campylopus purpureocaulis
Campylopus sp.
Cryptolophocolea mitteniana
Cryptolophocolea tuberculata – ***'At Risk – Naturally Uncommon'***
Cuspidatula monodon
Dicranoloma menziesii
Dicranoloma sp.
Gottschea pinnatifolia
Heteroscyphus billardierei
Isotachis lyallii
Isotachis montana
Kurzia hippuroides
Lepidozia concinna
Lepidozia laevifolia
Lepidozia sp.
Lepidozia ulothrix
Lobatiriccardia alterniloba
Pohlia sp.
Polytrichum commune
Ptychomnion aciculare
Racomitrium crispulum
Racomitrium sp.
Rhacocarpus purpurascens
Syzygiella colorata
Telaranea sp.

Wijkia extenuata.

Location: [redacted]
Plot ID: **PL-05**
Cultural: Planted
Grid reference (NZTM): [redacted]
Date measured: 15/11/2023
Altitude: 836 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Andreaea ?mutabilis
Bryum sp.
Campylopus clavatus
Campylopus sp.
Cryptolophocolea mitteniana
Cuspidatula monodon
Cyrtopus setosus
Dicranoloma sp.
Dicranoloma fasciatum
Distichophyllum pulchellum
Fossombronia ?australis
Heteroscyphus ?cuneistipulus
Heteroscyphus deceptifrons
Isotachis montana
Kurzia hippuroides
Lepidozia concinna
Lepidozia sp.
Macromitrium sp.
Neolepidozia patentissima
Philonotis ?scabrifolia
Pleuridium nervosum
Ptychomnion aciculare
Riccardia sp.
Syzygiella colorata
Telaranea herzogii
Tortella fragilis
Wijkia extenuata.

Location: [redacted]
Plot ID: **PL-06**
Cultural: Planted
Grid reference (NZTM): [redacted]
Date measured: 16/11/2023
Altitude: 861 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Campylopus clavatus
Campylopus introflexus

Campylopus sp.
Ditrichum ?buchananii
Ditrichum sp.
Isotachis montana
Kurzia hippuroides
Macromitrium sp.
Metzgeria leptoneura
Ptychomnion aciculare
Racomitrium pruinosum
Riccardia aequicellularis
Riccardia bipinnatifida
Telaranea sp.
Tricholepidozia lindenbergii.

Location: [redacted]
Plot ID: **PL-07**
Cultural: Planted
Grid reference (NZTM): [redacted]
Date measured: 16/11/2023
Altitude: 770 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Bazzania adnexa
Brachythecium sp.
Campylopus sp.
Campylopus clavatus
Cheilolejeunea sp.
Dicranoloma billardierei
Kurzia hippuroides
Lepidozia concinna
Lobatiriccardia alterniloba
Metzgeria leptoneura
Pohlia annotina
Polytrichum commune
Ptychomnion aciculare
Wijkia extenuata
Isotachis montana
Drepanolejeunea sp.
Cuspidatula monodon
Lepidozia sp.
Radula sp.

Location:[redacted]
Plot ID: **TM-01**
Cultural: Constructed tarn (planted)
Grid reference (NZTM): [redacted]
Date measured: 31/10/2023
Altitude: 908 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Campylopus clavatus
Dicranoloma billardierei
Isotachis montana
Isotachis sp.
Kurzia hippuroides
Lepidozia sp.
Macromitrium sp.
Neolepidozia praenitens
Polytrichadelphus magellanicus
Ptychomnion aciculare
Sphagnum falcatulum.

Location: [redacted]
Plot ID: **TM-02**
Cultural: Constructed tarn (planted)
Grid reference (NZTM): [redacted]
Date measured: 1/11/2023
Altitude: 1,077 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Racomitrium sp.
Isotachis montana
?Scorpidium cossonii
Polytrichum juniperinum
Racomitrium ?crumianum
Riccardia sp.
Campylopus sp.

Location: [redacted]
Plot ID: **TM-03**
Cultural: Constructed tarn (VDT)
Grid reference (NZTM): [redacted]
Date measured: 21/11/2023
Altitude: 849 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Adelanthus occlusus
Andreaea mutabilis
Brachythecium sp.
Breutelia ?pendula
Breutelia elongata
Campylopus clavatus
Campylopus introflexus
Cryptolophocolea mitteniana
Isotachis montana
Lobatiriccardia alterniloba
Macromitrium longipes
Metzgeria leptoneura

Neolepidozia patentissima
Neolepidozia tetrapila
Polytrichadelphus magellanicus
Ptychomnion aciculare
Rhacocarpus purpurascens
Sphagnum subnitens
Tricholepidozia lindenbergii.

Location: [redacted]
Plot ID: **TM-04**
Cultural: Constructed tarn (VDT)
Grid reference (NZTM): [redacted]
Date measured: 15/11/2023
Altitude: 886 m asl
Area: 5 x 5 m
Plot description: Square sedge-mānuka shrubland

Bryophytes:

?Bartramia sp.
?Conostomum sp.
Campylopus clavatus
Campylopus introflexus
Ceratodon purpureus
Isotachis montana
Kurzia hippuroides
Lepidozia hirta
Racomitrium sp.
Riccardia aequicellularis
Riccardia crassa.

Location: [redacted]
Plot ID: **TM-05**
Cultural: Constructed tarn (planted)
Grid reference (NZTM): [redacted]
Date measured: 20/11/2023
Altitude: 943 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Campylopus clavatus
Fossombronia ?australis
Heteroscyphus sp.
Lobatiriccardia alterniloba
Metzgeria leptoneura
Ptychomnion aciculare
Riccardia aequicellularis
Solenostoma inundatum.

Location: [redacted]
Plot ID: **TM-06**

Cultural: Constructed tarn (planted)
Grid reference (NZTM): [redacted]
Date measured: 20/11/2023
Altitude: 943 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Bartramia sp.
Campylopus clavatus
Campylopus introflexus
Ceratodon purpureus
Chiloscyphus lentus
Dicranoloma billardierei
Ditrichum sp.
Isotachis montana
Marchantia berteroana
Polytrichadelphus magellanicus
Polytrichum commune
Polytrichum juniperinum.

Location: [redacted]
Plot ID: **TM-07**
Cultural: Constructed tarn (planted)
Grid reference (NZTM): [redacted]
Date measured: 21/11/2023
Altitude: 816 m asl
Area: 5 x 5 m
Plot description: Mānuka shrubland

Bryophytes:

Bazzania involuta
Campylopus clavatus
Campylopus introflexus
Dicranoloma billardierei
Drepanolejeunea aucklandica
Isotachis montana
Kurzia hippuroides
Lepidozia ulothrix
Macromitrium sp.
Metzgeria leptoneura
Polytrichadelphus magellanicus
Ptychomnion aciculare
Riccardia aequicellularis.

Location: [redacted]
Plot ID: **TM-08**
Cultural: Constructed tarn (VDT)
Grid reference (NZTM): [redacted]
Date measured: 21/11/2023
Altitude: 882 m asl
Area: 5 x 5 m
Plot description: Mānuka shrubland

Bryophytes:

?Cryphaea sp.
Campylopus clavatus
Campylopus sp.
Cryptolophocolea mitteniana
Dicranoloma menziesii
Dicranoloma sp.
Isotachis lyallii
Isotachis montana
Lepidozia laevifolia
Lepidozia sp.
Macromitrium longipes
Polytrichadelphus magellanicus
Racopilum sp.
Sphagnum falcatulum
Sphagnum squarrosum
Telaranea sp.

Location: [redacted]
Plot ID: **TM-09**
Cultural: Constructed tarn (planted)
Grid reference (NZTM): [redacted]
Date measured: 21/11/2023
Altitude: 866 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Bryum laevigatum
Campylopus clavatus
Funaria hygrometrica
Marchantia polymorpha
Philonotis pyriformis
Polytrichastrum alpinum
Wijkia extenuata.

Location: [redacted]
Plot ID: **TM-10**
Cultural: Constructed tarn (planted)
Grid reference (NZTM): [redacted]
Date measured: 22/11/2023
Altitude: 900 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Andreaea sp.
Bazzania involuta
Campylopus clavatus
Campylopus introflexus
Campylopus sp.
Cryptochila grandiflora
Dicranoloma billardierei

Dicranoloma sp.
Ditrichum sp.
Isotachis montana
Kurzia hippuroides
Neolepidozia praenitens
Oligotrichum tenuirostre
Polytrichadelphus magellanicus
Ptychomnion aciculare
Sphagnum falcatulum
Wijkia extenuata.

Location: [redacted]
Plot ID: **TM-11**
Cultural: Constructed tarn (planted)
Grid reference (NZTM): [redacted]
Date measured: 22/11/2023
Altitude: 901 m asl
Area: 5 x 5 m
Plot description: Heath rush grassland

Bryophytes:

Bartramia sp.
Campylopus clavatus
Campylopus sp.
Isotachis lyallii
Isotachis montana
Lobatiriccardia alterniloba
Macromitrium sp.
Meesia uliginosa
Polytrichum juniperinum
Racomitrium sp.
Solenostoma inundatum
Thuidiopsis furfurosa.

Location:[redacted]
Plot ID: **TM-12**
Cultural: Constructed tarn (planted)
Grid reference (NZTM): [redacted]
Date measured: 22/11/2023
Altitude: 821 m asl
Area: 5 x 5 m
Plot description: Mixed shrubland

Bryophytes:

Andreaea sp.
Bartramia sp.
Campylopus clavatus
Heteroscyphus fissistipus
Isotachis montana
Polytrichadelphus magellanicus.

Location: [redacted]
Plot ID: **DS-01**
Cultural: Non-remediated
Grid reference (NZTM): [redacted]
Date measured: 20/11/2023
Altitude: 799 m asl
Area: 5 x 5 m
Plot description: Heath rush grassland

Bryophytes:

Bartramia sp.
Brachythecium paradoxum
Campylopus clavatus
Campylopus purpureocaulis
Campylopus sp.
Isotachis lyallii
Isotachis montana
Leptobryum pyriforme
Polytrichum commune
Polytrichum juniperinum
*Pulchrinodus inflatus**

Location: [redacted]
Plot ID: **DS-02**
Cultural: Non-remediated
Grid reference (NZTM): [redacted]
Date measured: 20/11/2023
Altitude: 917 m asl
Area: 5 x 5 m
Plot description: Toetoe/heath rush tussock-shrubland

Bryophytes:

Andreaea sp.
Campylopus ?bicolor
Campylopus clavatus
Campylopus introflexus
Campylopus sp.
Dicranoloma sp.
Distichophyllum pulchellum
Ditrichum sp.
Heteroscyphus ?cuneistipulus
Isotachis montana
Lobatiriccardia alterniloba
Lophozia sp.
Macromitrium microstomum
Philonotis tenuis
Polytrichadelphus magellanicus
Ptychomnion aciculare
Rhizogonium novae-hollandiae
Riccardia sp.
Solenostoma inundatum
Solenostoma totipapillosum
Wijkia extenuata.

Location: [redacted]

Plot ID: **DS-03**
Cultural: Non-remediated
Grid reference (NZTM): [redacted]
Date measured: 21/11/2023
Altitude: 788 m asl
Area: 5 x 5 m
Plot description: Southern rātā/heath rush-wire rush shrubland

Bryophytes:

Bartramia sp.
Brachythecium paradoxum
Campylopus introflexus
Campylopus sp.
Chiloscyphus sp.
Cryptochila grandiflora
Cryptolophocolea mitteniana
Dicranoloma billardierei
Dicranoloma sp.
Ditrichum cylindricarpum
Grimmia sp.
Heteroscyphus ?cuneistipulus
Isotachis montana
Kurzia hippuroides
Macromitrium sp.
Metzgeria leptoneura
Pohlia sp.
Polytrichadelphus magellanicus
Riccardia bipinnatifida
Saccogynidium australe
Neolepidozia praenitens.

Location: [redacted]
Plot ID: **DS-04**
Cultural: Non-remediated
Grid reference (NZTM): [redacted]
Date measured: 23/11/2023
Altitude: 688 m asl
Area: 5 x 5 m
Plot description: Kāmahi-mānuka-red beech/flax shrubland

Bryophytes:

Achrophyllum quadrifarium
Acrobolbus sp.
Bazzania adnexa
Campylopus introflexus
Dicranoloma billardierei
Dicranoloma sp.
Frullania rostrata
Frullania sp.
Heteroscyphus deceptifrons

Heteroscyphus fissistipus
Kurzia ?helophila
Kurzia hippuroides
Kurzia quinquespina
Lembidium nutans
Lepidolaena palpebrifolia
Lepidolaena sp.
Lepidozia sp.
Lobatiriccardia alterniloba
Macromitrium microstomum
Macromitrium sp.
Neolepidozia patentissima
Pohlia cruda / nutans
Pohlia sp.
Radula physoloba
Radula sp.
Riccardia crassa
Riccardia furtiva – ***'At Risk – Naturally Uncommon'***
Rosulabryum billardierei
Saccogynidium australe
Schistochila glaucescens
Sphagnum cristatum
Syntrichia rubra
Telaranea herzogii
Tricholepidozia lindenbergii
Wijkia extenuata
Zoopsis setulosa.

Location: [redacted]
Plot ID: **DS-05**
Cultural: Non-remediated
Grid reference [redacted]
Date measured: 23/11/2023
Altitude: 535 m asl
Area: 5 x 5 m
Plot description: Mānuka-kāmahi shrubland

Bryophytes:

Bazzania adnexa
Brachythecium paradoxum
Brachythecium sp.
Campylopus introflexus
Cuspidatula monodon
Cyathophorum bulbosum
Dicranoloma billardierei
Dicranoloma sp.
Frullania rostrata
Lepidolaena taylorii
Lepidozia sp.
Leucobryum javense
Macromitrium longipes
Pallavicinia tenuinervis
Polytrichadelphus magellanicus
Porella elegantula
Ptychomnion aciculare
Rhizogonium distichum
Riccardia sp.

Solenostoma inundatum
Sphagnum cristatum
Symphyogyna / Pallavicinia
Telaranea herzogii
Neolepidozia praenitens
Kurzia quinquespina
Telaranea sp.
Wijkia extenuata.

Location: Sullivan [redacted]

Plot ID: **DS-06**

Cultural: Non-remediated

Grid reference (NZTM): [redacted]

Date measured: 23/11/2023

Altitude: 675 m asl

Area: 5 x 5 m

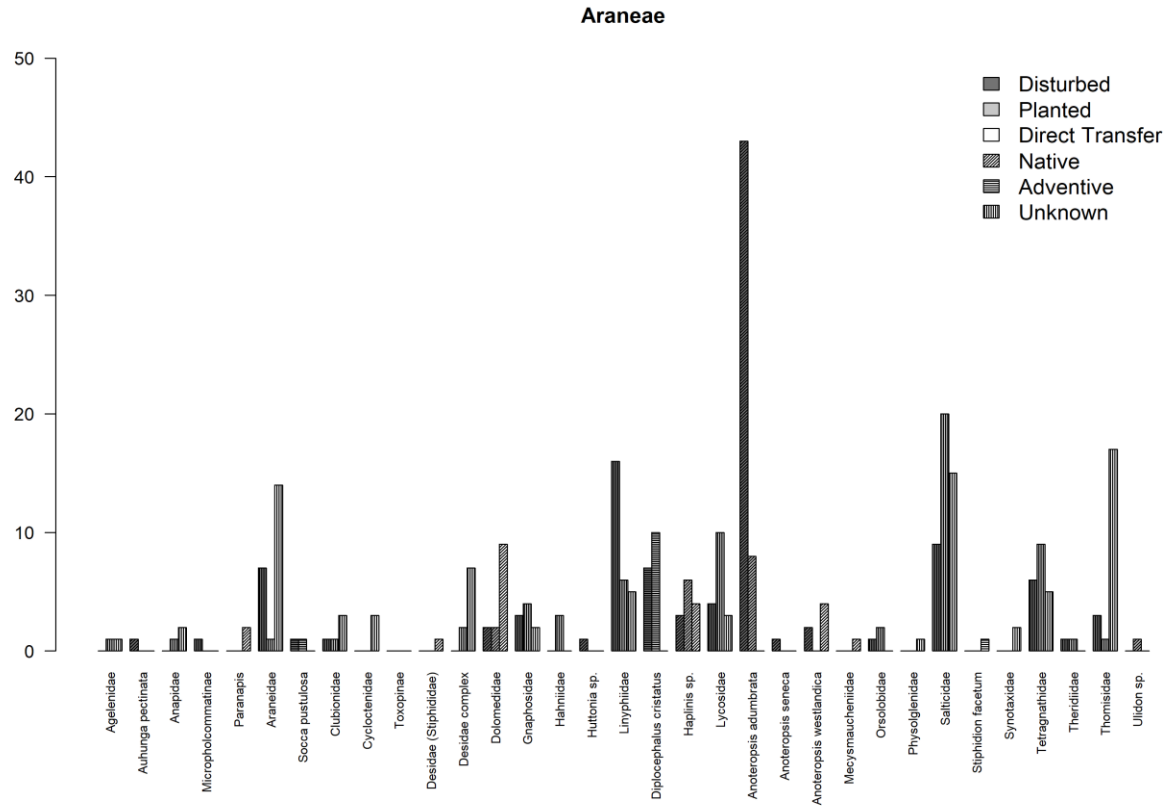
Plot description: Toetoe/mānuka-heath rush shrubland

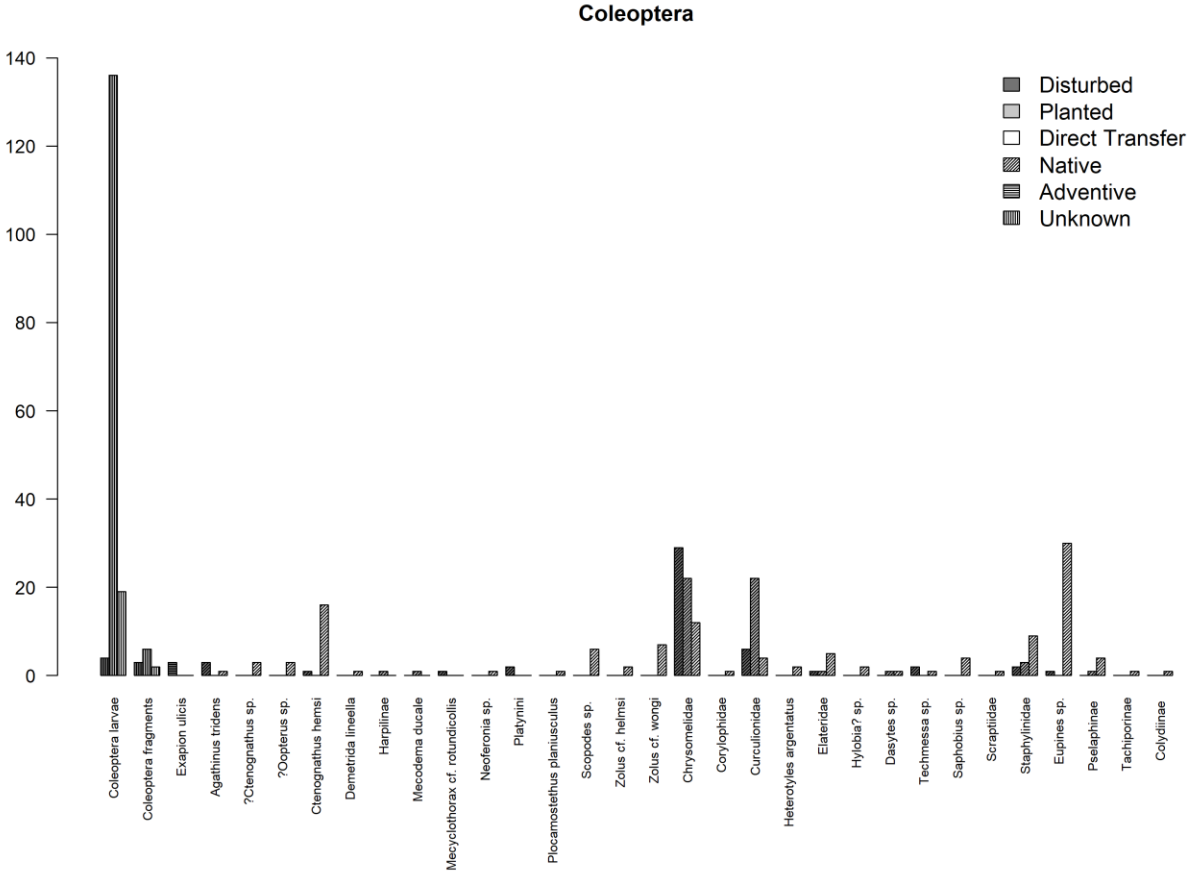
Bryophytes:

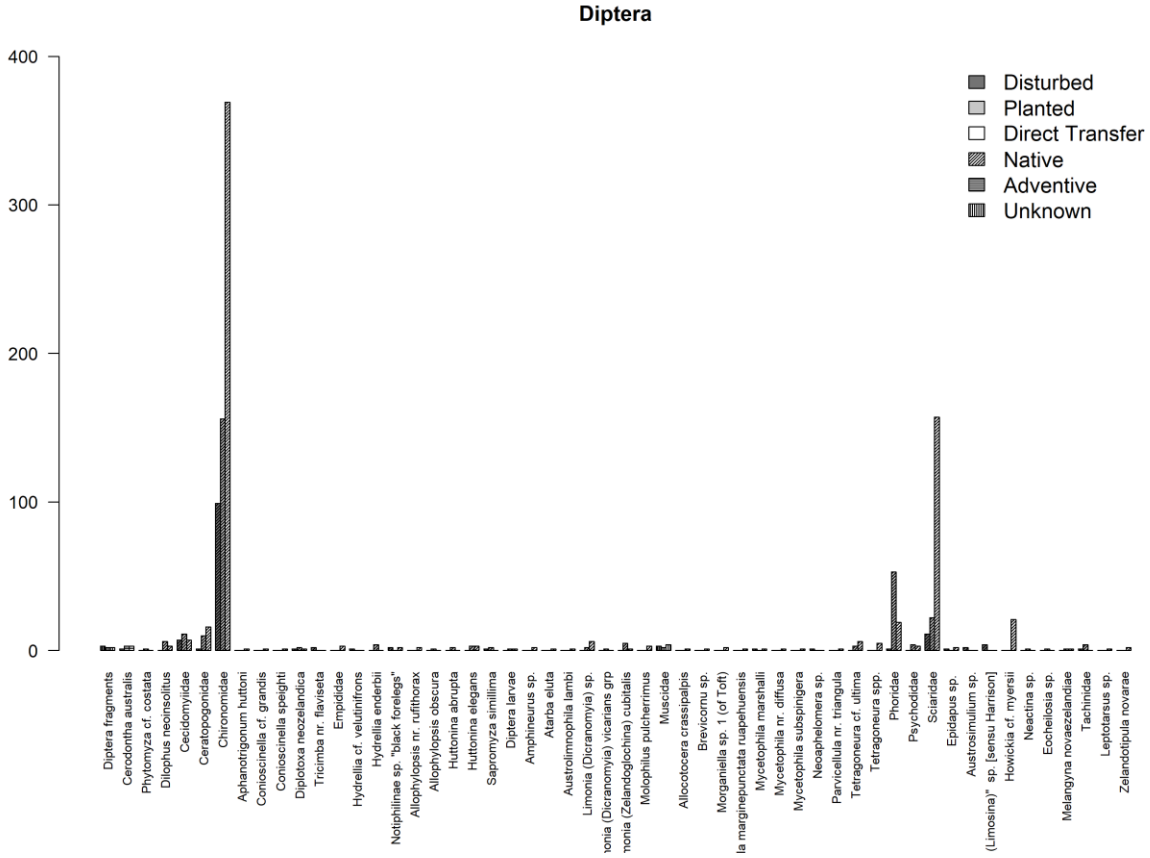
Brachythecium paradoxum
Breutelia pendula
Campylopus clavatus
Campylopus introflexus
Cryptolophocolea mitteniana
Dicranoloma dicarpum
Heteroscyphus sp.
Isotachis montana
Metzgeria leptoneura
Philonotis tenuis
Polytrichadelphus magellanicus
Ptychomnion aciculare
Riccardia sp.
Sphagnum sp.
Telaranea herzogii
Neolepidozia patentissima
Telaranea sp.

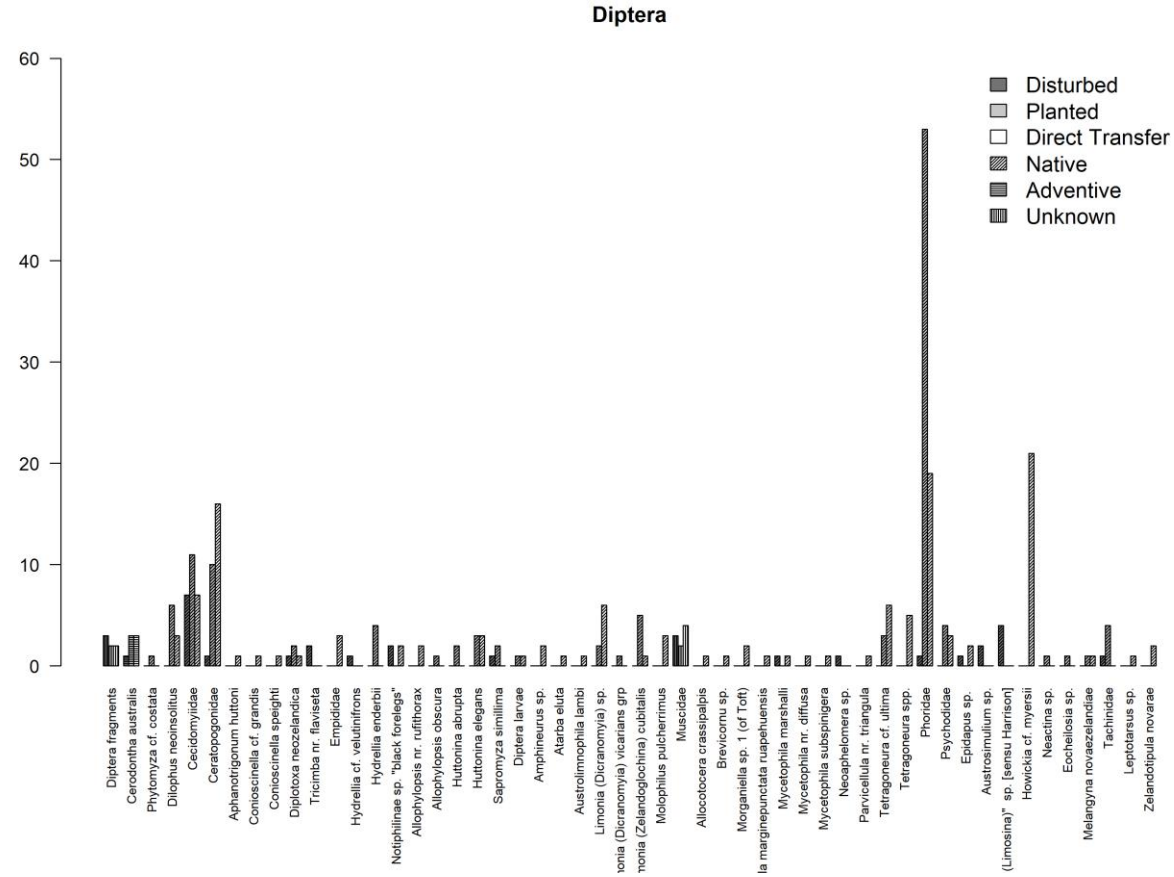
APPENDIX E

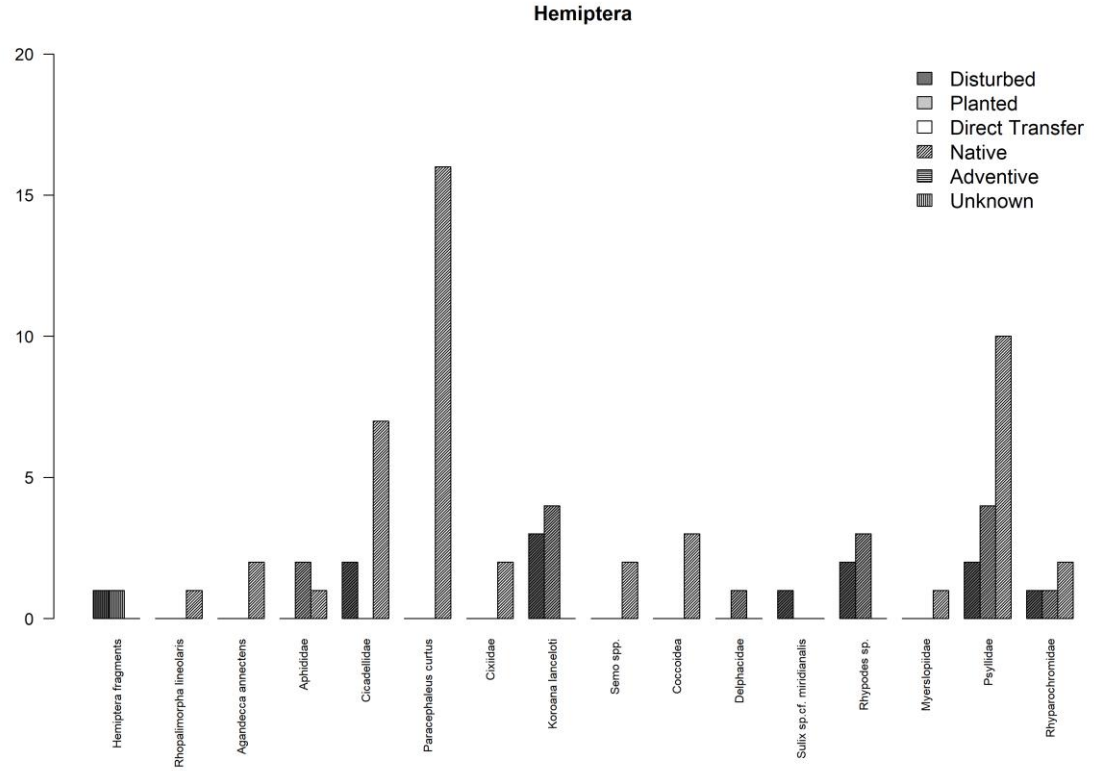
Summary of invertebrate communities

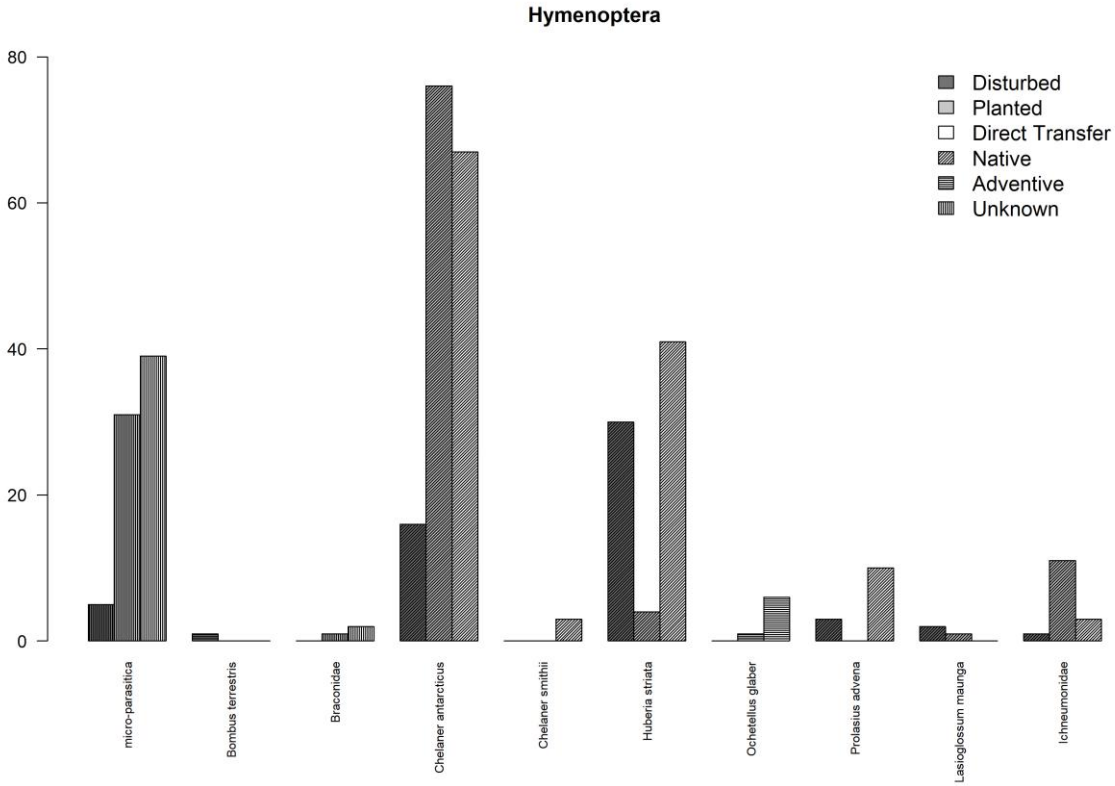

Araneae
Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown
50
40
30
20
10
0
Agelenidae
Auhunga pectinata
Anapidae
Microphotcommatinae
Paranapis
Araneidae
Socca pustulosa
Clubionidae
Cyclocteninae
Toxopinae
Desidae (Stiphidiae)
Desidae complex
Dolomedidae
Gnaphosidae
Hahniidae
Huttonia sp.
Linyphiidae
Diplocephalus cristatus
Haplinis sp.
Lycosidae
Anoteropsis adumbrata
Anoteropsis seneca
Anoteropsis westlandica
Mecysmaucheniidae
Oxyopidae
Physolglenidae
Salticidae
Stiphidion facetum
Synotaxidae
Tetragnathidae
Theridiidae
Thomisidae
Ulidon sp.

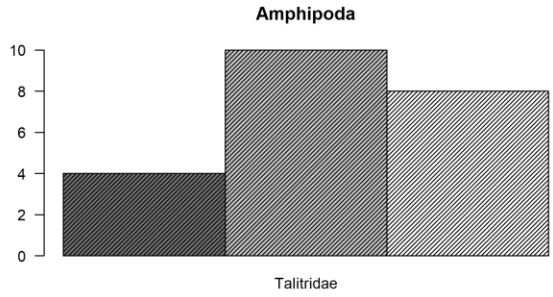

Coleoptera
Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown
140
120
100
80
60
40
20
0
Coleoptera larvae
Coleoptera fragments
Exapion ulicis
Agathinus tridens
?Ctenognathus sp.
?Oopterus sp.
Ctenognathus hemsi
Demetrida lineella
Harpilinae
Mecodema ducale
Mecyclothorax cf. rotundicollis
Neoferonia sp.
Platynini
Plocamostethus planiusculus
Scopodes sp.
Zolus cf. helmsi
Zolus cf. wongi
Chrysomelidae
Corylophidae
Curculionidae
Heterotyles argentatus
Elateridae
Hylobia? sp.
Dasytes sp.
Techmessa sp.
Saphobius sp.
Scraptiidae
Staphylinidae
Eupines sp.
Pselaphinae
Tachiporinae
Colydiinae

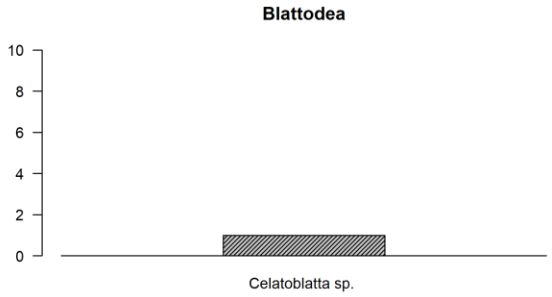

Diptera
Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown
400
300
200
100
0
Diptera fragments
Cerodontha australis
Phytomyza cf. costata
Dilophus neoinsolitus
Cecidomyiidae
Ceratopogonidae
Chironomidae
Aphanotrigonum huttoni
Conioscinella cf. grandis
Conioscinella speighti
Diplotoxa neozelandica
Tricimba nr. flaviseta
Empididae
Hydrellia cf. velutinifrons
Hydrellia enderbii
Notiphilinae sp. "black forelegs"
Allophylopsis nr. rufithorax
Allophylopsis obscura
Huttonina abrupta
Huttonina elegans
Sapromyza simillima
Diptera larvae
Amphineurus sp.
Atarba eluta
Austrolimnophila lambi
Limonia (Dicranomyia) sp.
onia (Dicranomyia) vicarians grp
onia (Zelandoglochina) cubitalis
Molophilus pulcherrimus
Muscidae
Allocotocera crassipalpis
Brevicornu sp.
Morganiella sp. 1 (of Toft)
la marginepunctata ruapehuensis
Mycetophila marshalli
Mycetophila nr. diffusa
Mycetophila subspinigera
Neoaphelomera sp.
Parvicellula nr. triangula
Tetragoneura cf. ultima
Tetragoneura spp.
Phoridae
Psychodidae
Sciaridae
Epidapus sp.
Austrosimulium sp.
(Limosina)* sp. [sensu Harrison]
Howickia cf. myersii
Neactina sp.
Eocheilosia sp.
Melangyna novaezelandiae
Tachinidae
Leptotarsus sp.
Zelandotipula novarae

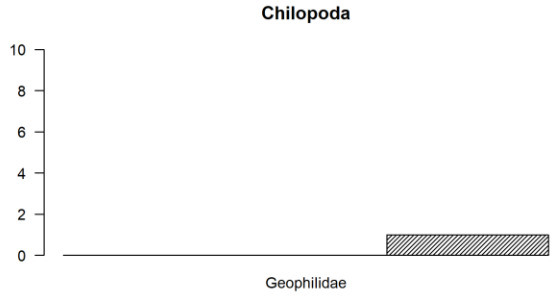

Diptera
Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown
60
50
40
30
20
10
0
Diptera fragments
Cerodontha australis
Phytomyza cf. costata
Dilophus neoinsolitus
Cecidomyiidae
Ceratopogonidae
Aphanotrigonum huttoni
Conioscinella cf. grandis
Conioscinella speighti
Diplotoxa neozelandica
Tricimba nr. flaviseta
Empididae
Hydrellia cf. velutinifrons
Hydrellia enderbii
Notiphilinae sp. "black forelegs"
Allophylopsis nr. rufithorax
Allophylopsis obscura
Huttonina abrupta
Huttonina elegans
Sapromyza simillima
Diptera larvae
Amphineurus sp.
Atarba eluta
Austrolimnophila lambi
Limonia (Dicranomyia) sp.
onia (Dicranomyia) vicarians grp
onia (Zelandoglochina) cubitalis
Molophilus pulcherrimus
Muscidae
Allocotocera crassipalpis
Brevicornu sp.
Morganiella sp. 1 (of Toft)
la marginepunctata ruapehuensis
Mycetophila marshalli
Mycetophila nr. diffusa
Mycetophila subspinigera
Neoaphelomera sp.
Parvicellula nr. triangula
Tetragoneura cf. ultima
Tetragoneura spp.
Phoridae
Psychodidae
Epidapus sp.
Austrosimulium sp.
(Limosina)* sp. [sensu Harrison]
Howickia cf. myersii
Neactina sp.
Eocheilosia sp.
Melangyna novaezelandiae
Tachinidae
Leptotarsus sp.
Zelandotipula novarae

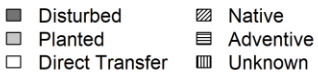

Hemiptera
20
15
10
5
0
Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown
Hemiptera fragments
Rhopalimorpha lineolaris
Agandecca annectens
Aphididae
Cicadellidae
Paracephaleus curtus
Cixiidae
Koroana lanceloti
Semo spp.
Coccoidea
Delphacidae
Sulix sp.cf. miridianalis
Rhypodes sp.
Myerslopiidae
Psyllidae
Rhyparochromidae

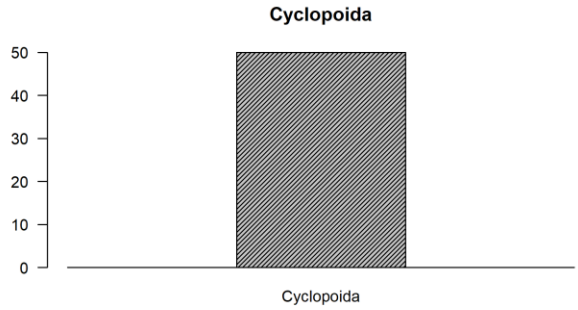

Hymenoptera
80
60
40
20
0
Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown
micro-parasitica
Bombus terrestris
Braconidae
Chelaner antarcticus
Chelaner smithii
Huberia striata
Ochetellus glaber
Prolasius advena
Lasioglossum maunga
Ichneumonidae

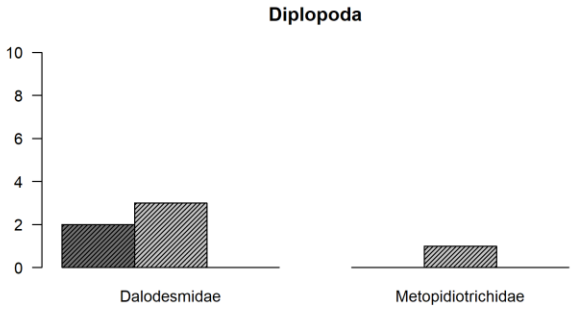

Amphipoda
10
8
6
4
2
0
Talitridae

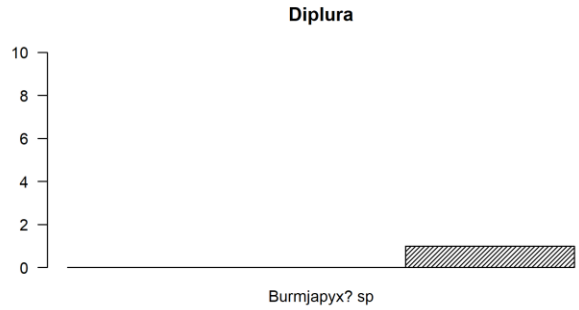

Blattodea
10
8
6
4
2
0
Celatoblatta sp.

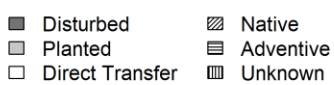

Chilopoda
10
8
6
4
2
0
Geophilidae

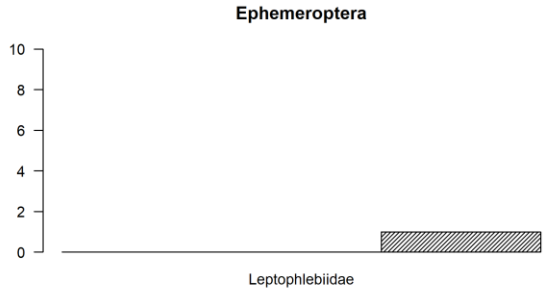

Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown

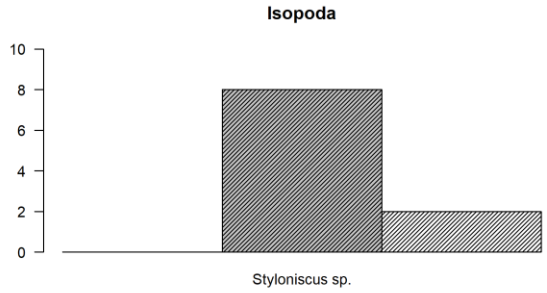

Cyclopoida
50
40
30
20
10
0
Cyclopoida

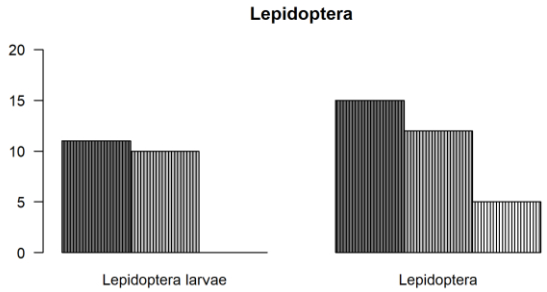

Diplopoda
10
8
6
4
2
0
Dalodesmidae
Metopidiotrichidae

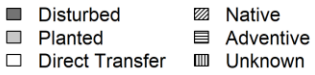

Diplura
10
8
6
4
2
0
Burmjapyx? sp

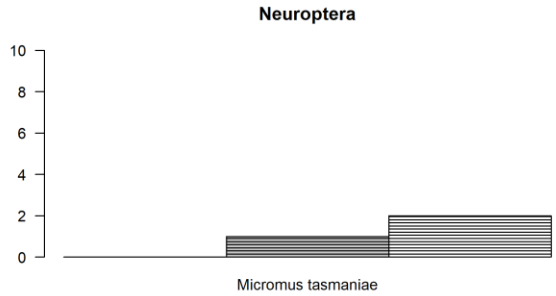

Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown

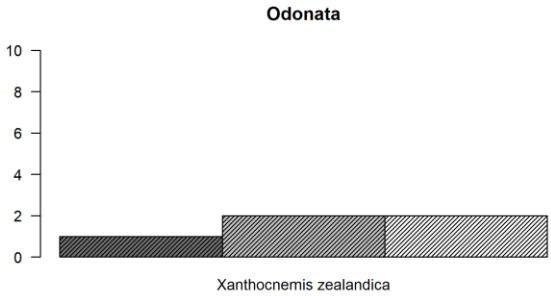

Ephemeroptera
10
8
6
4
2
0
Leptophlebiidae

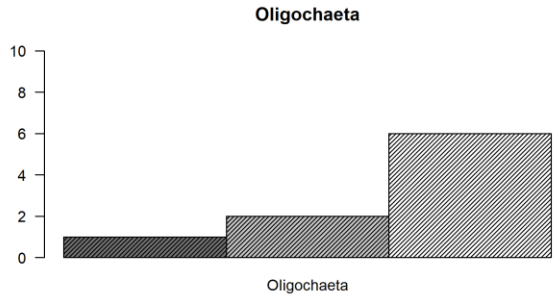

Isopoda
10
8
6
4
2
0
Styloniscus sp.

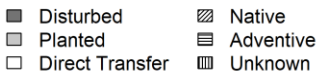

Lepidoptera
20
15
10
5
0
Lepidoptera larvae
Lepidoptera

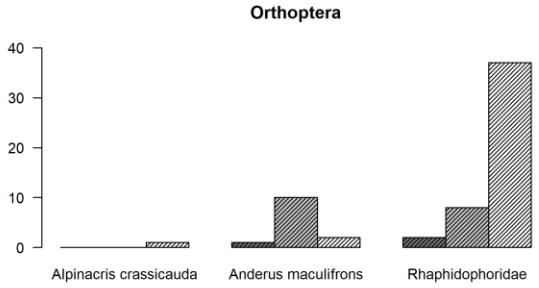

Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown

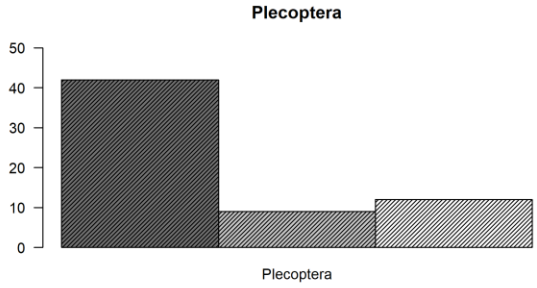

Neuroptera
10
8
6
4
2
0
Micromus tasmaniae

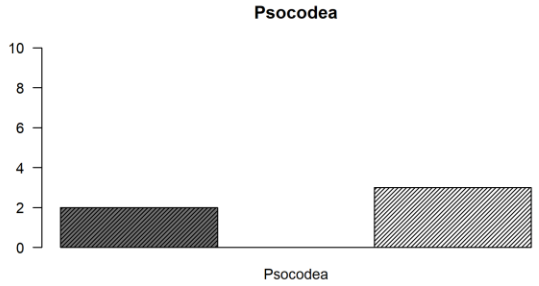

Odonata
10
8
6
4
2
0
Xanthocnemis zealandica

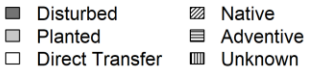

Oligochaeta
10
8
6
4
2
0
Oligochaeta

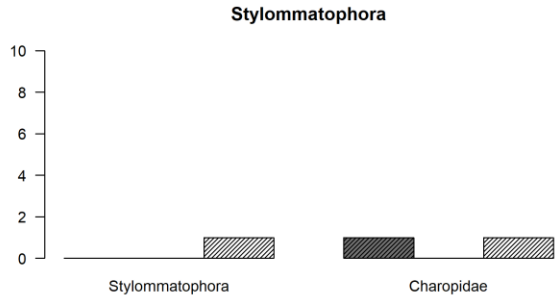

Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown

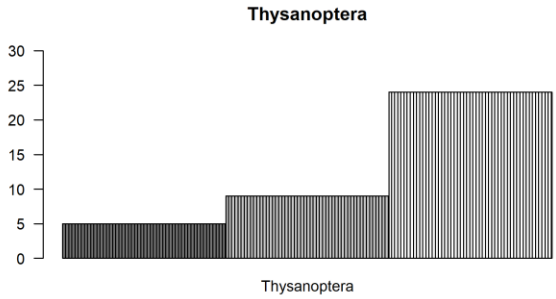

Orthoptera
40
30
20
10
0
Alpinacris crassicauda
Anderus maculifrons
Rhaphidophoridae

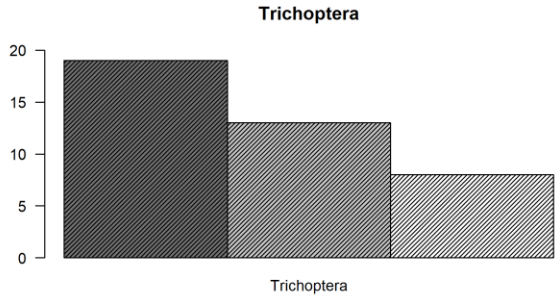

Plecoptera
50
40
30
20
10
0
Plecoptera

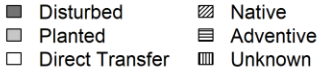

Psocodea
10
8
6
4
2
0
Psocodea

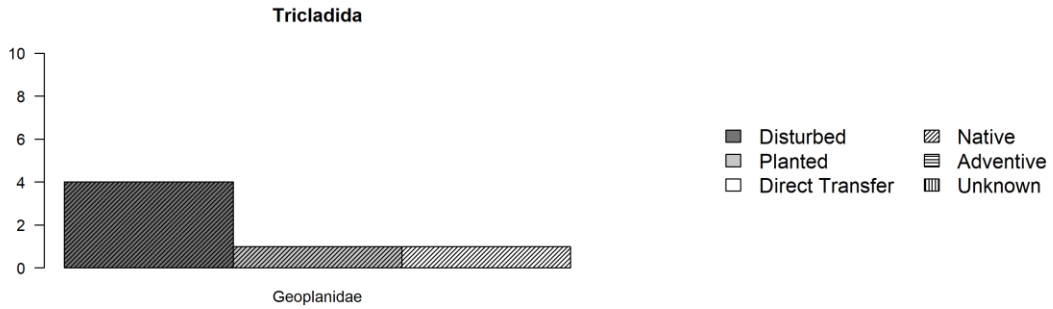

Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown

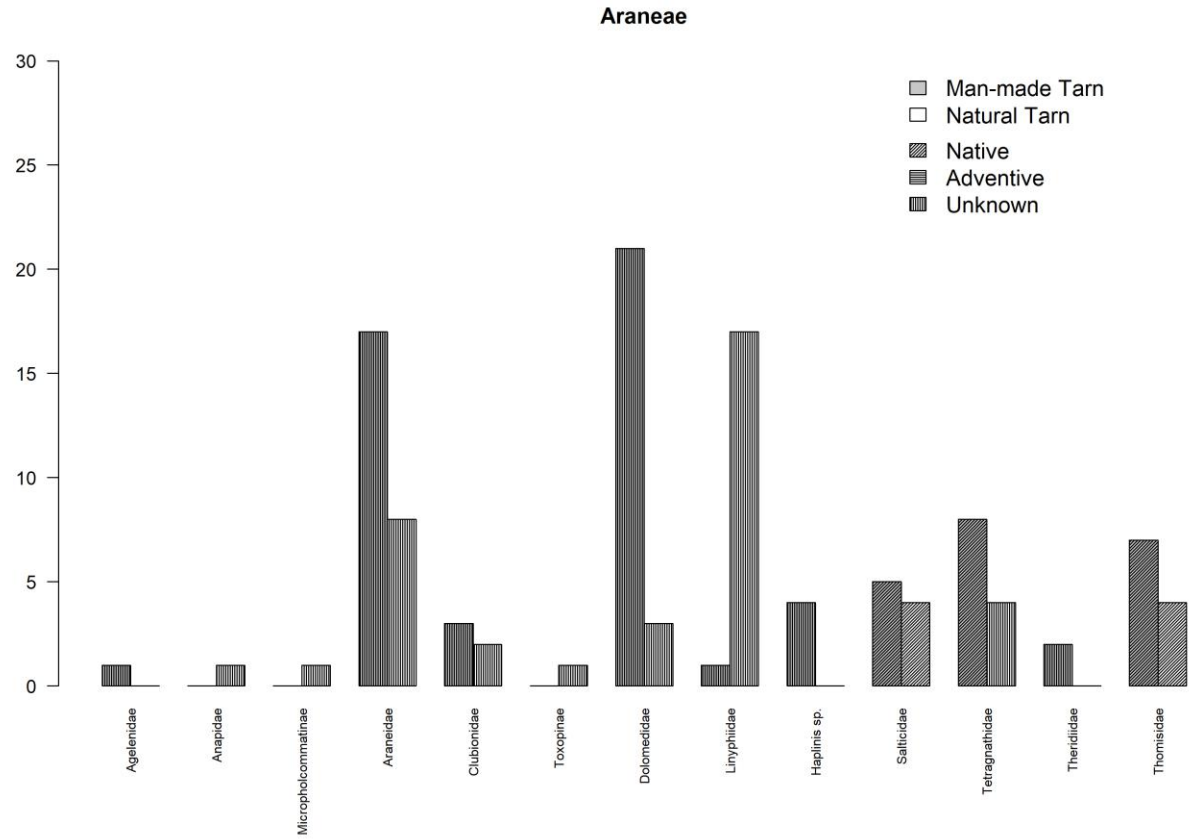

Stylommatophora
10
8
6
4
2
0
Stylommatophora
Charopidae

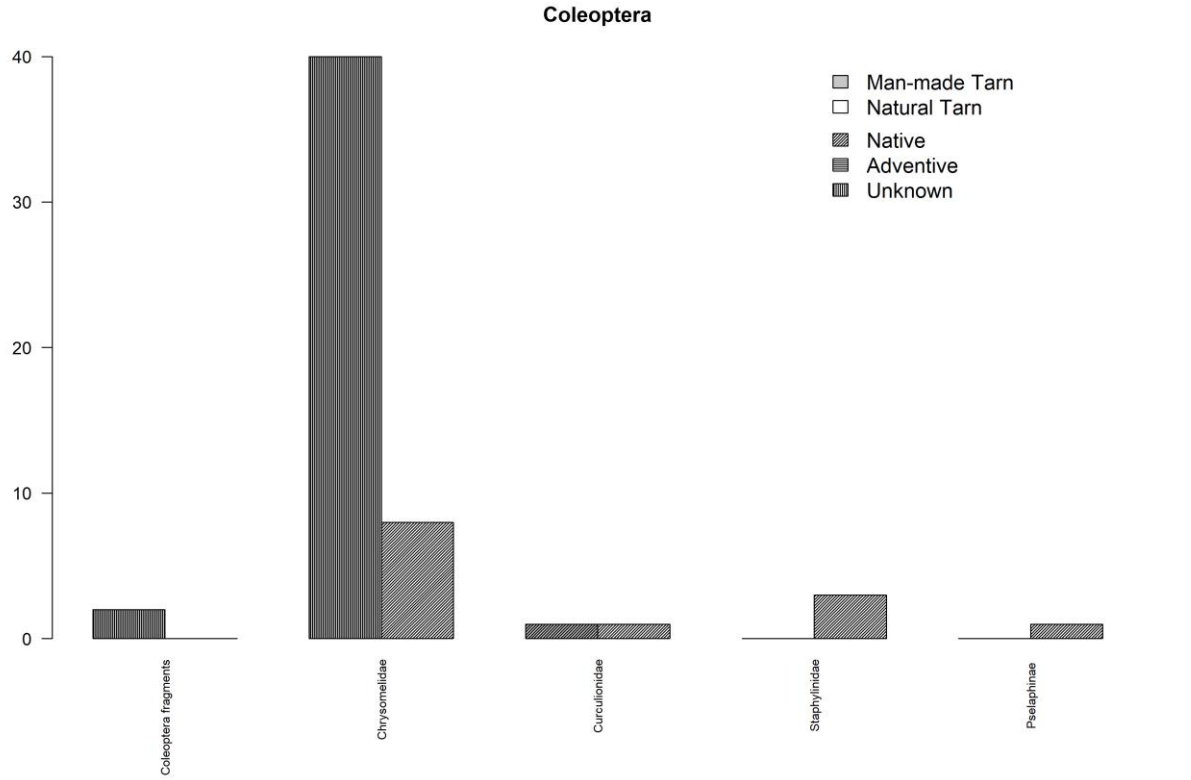

Thysanoptera
30
25
20
15
10
5
0
Thysanoptera

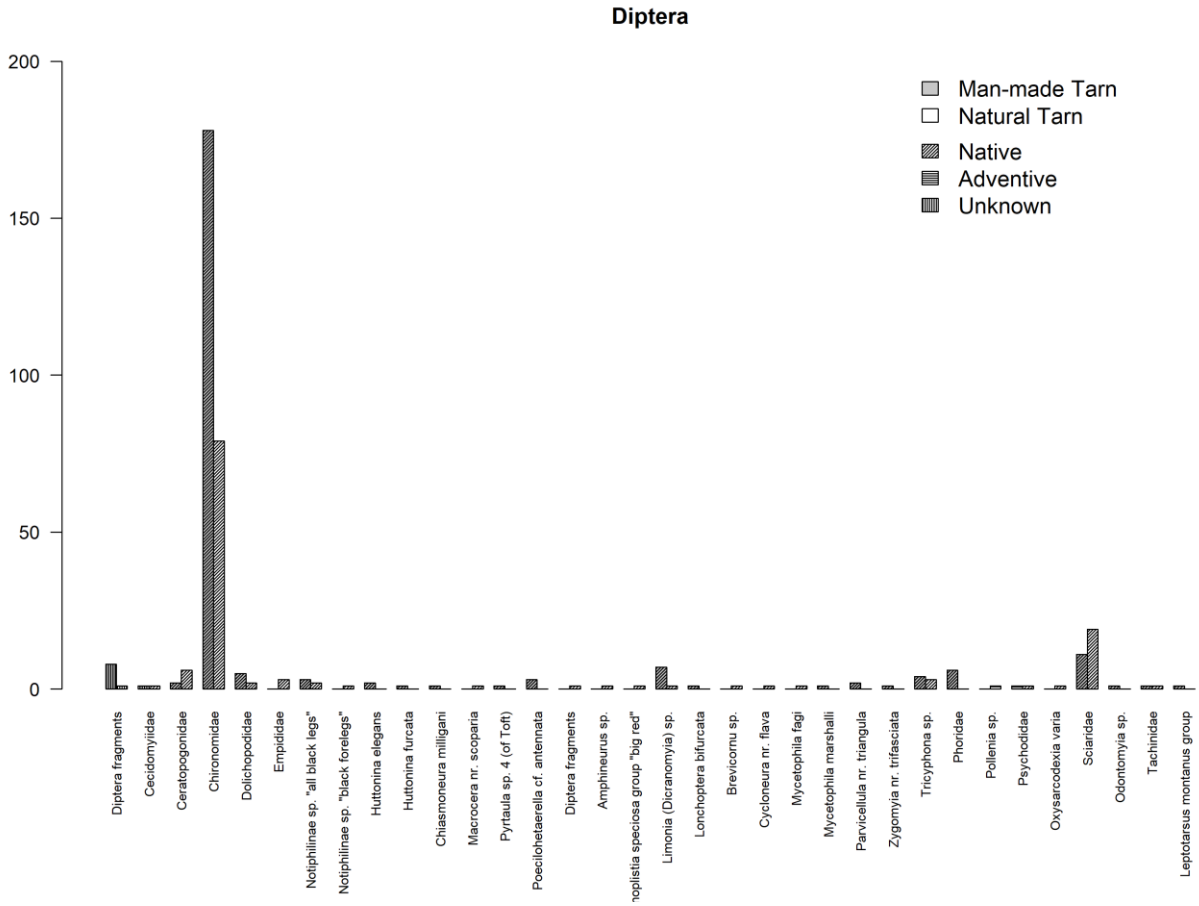

Trichoptera
20
15
10
5
0
Trichoptera

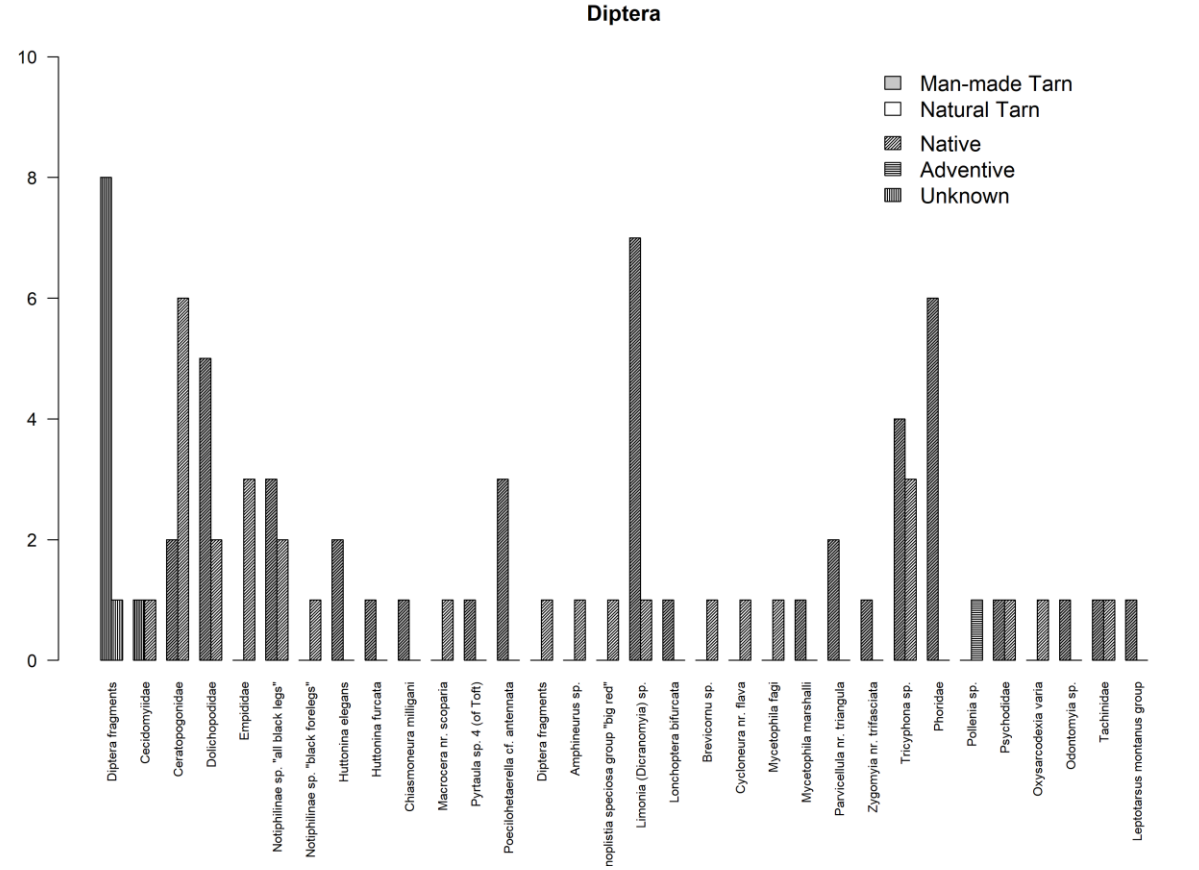

Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown

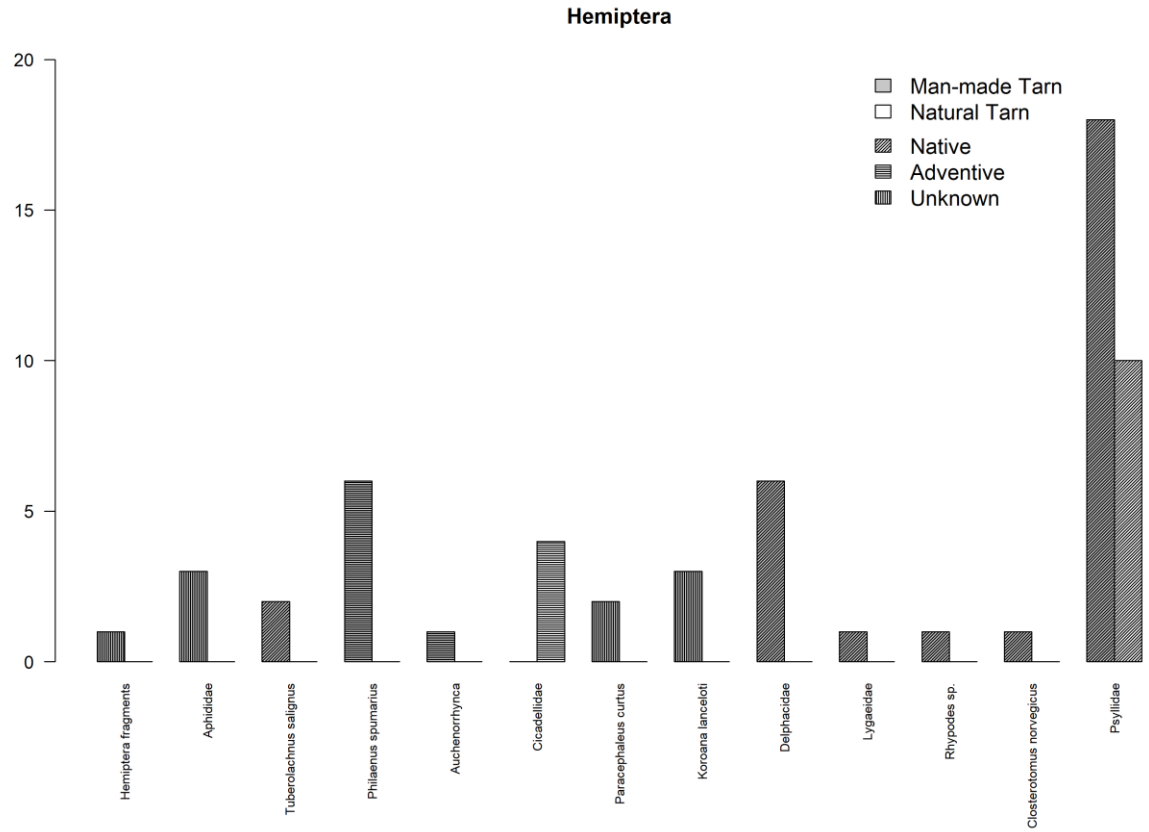

Tricladida
10
8
6
4
2
0
Geoplanidae
Disturbed
Planted
Direct Transfer
Native
Adventive
Unknown

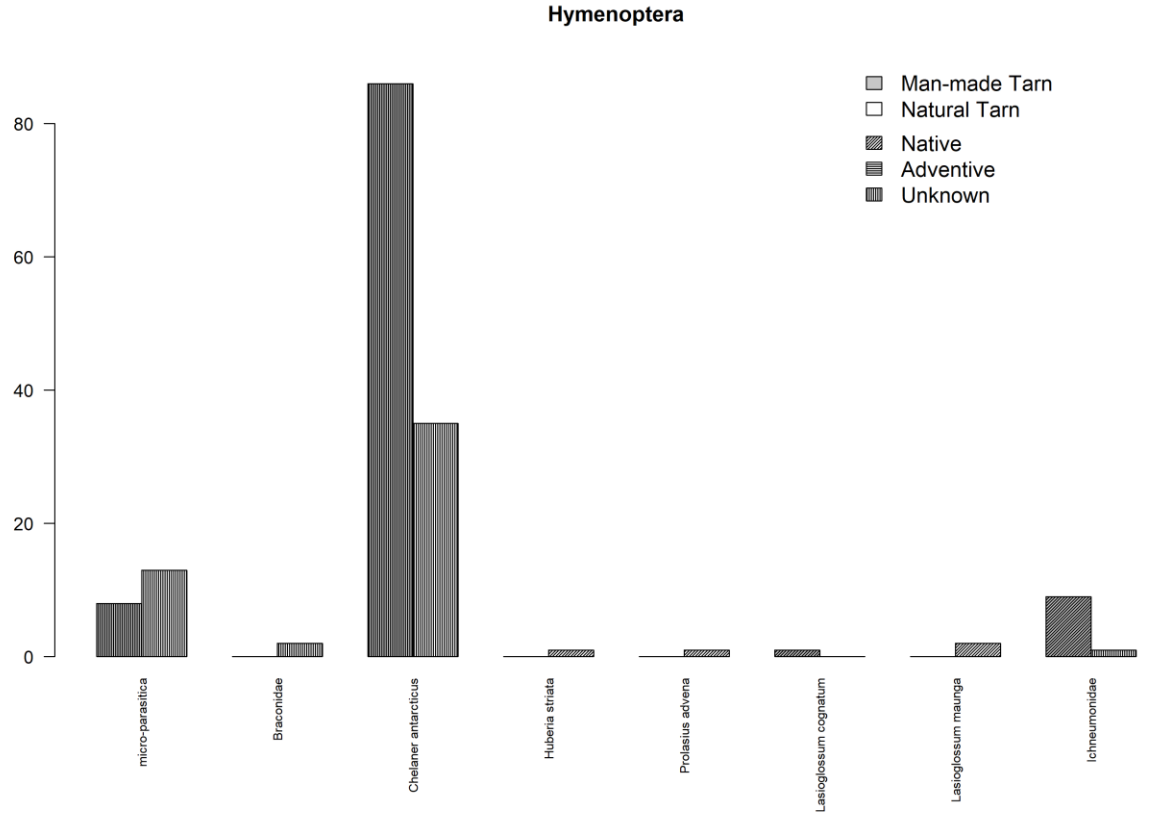

Araneae
30
25
20
15
10
5
0
Man-made Tarn
Natural Tarn
Native
Adventive
Unknown
Agelenidae
Anapidae
Micropholcommatinae
Araneidae
Clubionidae
Toxopinae
Dolomedidae
Linyphiidae
Haplinis sp.
Salticidae
Tetragnathidae
Theridiidae
Thomisidae


Coleoptera
40
30
20
10
0
Man-made Tarn
Natural Tarn
Native
Adventive
Unknown
Coleoptera fragments
Chrysomelidae
Curculionidae
Staphylinidae
Pselaphinae


Diptera
Man-made Tarn
Natural Tarn
Native
Adventive
Unknown
200
150
100
50
0
Diptera fragments
Cecidomyiidae
Ceratopogonidae
Chironomidae
Dolichopodidae
Empididae
Notiphilinae sp. "all black legs"
Notiphilinae sp. "black forelegs"
Huttonina elegans
Huttonina furcata
Chiasmoneura milliganii
Macrocera nr. scoparia
Pyrtaula sp. 4 (of Toft)
Poecilohetaerella cf. antennata
Diptera fragments
Amphineurus sp.
noplistia speciosa group "big red"
Limonia (Dicranomyia) sp.
Lonchoptera bifurcata
Brevicornu sp.
Cycloneura nr. flava
Mycetophila fagi
Mycetophila marshalli
Parvicellula nr. triangula
Zygomyia nr. trifasciata
Tricyphona sp.
Phoridae
Pollenia sp.
Psychodidae
Oxysarcodexia varia
Sciaridae
Odontomyia sp.
Tachinidae
Leptotarsus montanus group


Diptera
Man-made Tarn
Natural Tarn
Native
Adventive
Unknown
10
8
6
4
2
0
Diptera fragments
Cecidomyiidae
Ceratopogonidae
Dolichopodidae
Empididae
Notiphilinae sp. "all black legs"
Notiphilinae sp. "black forelegs"
Huttonina elegans
Huttonina furcata
Chiasmoneura milliganii
Macrocera nr. scoparia
Pyrtaula sp. 4 (of Toft)
Poecilohetaerella cf. antennata
Diptera fragments
Amphineurus sp.
noplistia speciosa group "big red"
Limonia (Dicranomyia) sp.
Lonchoptera bifurcata
Brevicornu sp.
Cycloneura nr. flava
Mycetophila fagi
Mycetophila marshalli
Parvicellula nr. triangula
Zygomyia nr. trifasciata
Tricyphona sp.
Phoridae
Pollenia sp.
Psychodidae
Oxysarcodexia varia
Odontomyia sp.
Tachinidae
Leptotarsus montanus group


Hemiptera
Man-made Tarn
Natural Tarn
Native
Adventive
Unknown
20
15
10
5
0
Hemiptera fragments
Aphididae
Tuberolachnus salignus
Philaenus spumarius
Auchenorrhynca
Cicadellidae
Paracephaleus curtus
Koroana lanceloti
Delphacidae
Lygaeidae
Rhypodes sp.
Closterotomus norvegicus
Psyllidae


Hymenoptera
Man-made Tarn
Natural Tarn
Native
Adventive
Unknown
80
60
40
20
0
micro-parasitica
Braconidae
Chelaner antarcticus
Huberia striata
Prolasius advena
Lasioglossum cognatum
Lasioglossum maunga
Ichneumonidae

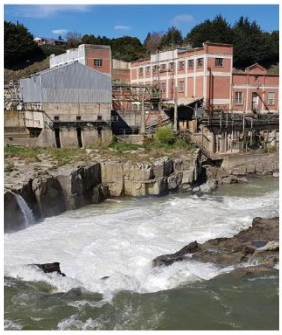
APPENDIX I

Upper Waimangaroa Haul Road Wildlife Mitigation – Literature Review (Ecological Solutions Limited 2026i)

ecoLogical Solutions

Environmental Consultants







December 2025

Upper Waimangaroa Haul Road Wildlife Mitigation – Literature Review

Submitted to:

Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by: [redacted]
Ecologist



Technical Review [redacted]
Senior Ecologist



Final Review and Signoff: [redacted]
Terrestrial Team Leader



Status: Finalv2 **Issued:** 17 December 2025

ecoLogical solutions

tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 2/195 main highway,
ellerslie, Auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

nelson office
p: 021 172 2091

www.ecoLogicalsolutions.co.nz

Table of Contents

1.0 Introduction 3
1.1 Background 3
1.2 Proposed Route 3
1.3 Scope 3
1.4 Ecological Context 5
2.0 Effects of Roads on Wildlife 6
2.1 Overview 6
2.2 Direct Effects 7
2.2.1 Construction Effects 7
2.2.2 Collision Mortality 7
2.3 Indirect Effects of Roads on Wildlife 14
2.3.1 Habitat loss 14
2.3.2 Fragmentation 14
2.4 Habitat Degradation 17
2.4.1 Overview 17
2.4.2 Noise and Vibration 17
2.4.3 Discharges 18
2.4.4 Artificial Lighting 18
2.4.5 Invasion by Exotic Plants, Pathogens and Animal Pests 19
2.4.6 Edge Effects 19
2.4.7 Mobilisation of Sediment and Water Runoff 20
3.0 Species that might be affected by the Upper Waimangaroa Haul Road 20
3.1 Context 20
3.2 Potentially Vulnerable Species 20
3.2.1 Introduction 20
3.2.2 Birds 23
3.2.3 Long-tailed Bats 23
3.2.4 Lizards 24
3.2.5 Snails 24
4.0 Recommendations 25
4.1 Introduction 25
4.2 Road Design 25
4.3 Construction Management 26
4.3.1 Species Management 26
4.3.2 Construction Elements 26

4.4 Operational Management 27
4.4.1 Vehicle speed 27
4.4.2 Noise 27
4.4.3 Dust 27
4.4.4 Lighting 27
4.4.5 Increased access for weeds and pests 28
4.4.6 Species Relocation 28
4.5 Monitoring 28
5.0 Summary 29
6.0 References 30

Index to Tables

Table 1: Species of conservation concern recorded in iNaturalist Roadkill Project (accessed 11 November 2024). 11
Table 2: Species known or likely to be present within the UWHR footprint and considered likely to be vulnerable to roading impacts. 21

Index to Figures

Figure 1: Proposed Upper Waimangaroa Haul Road including alternative route options. 4
Figure 2: Records of live snails and snail shells in relation to the UWHR route. 16

1.0 Introduction

1.1 Background

Bathurst Resources Limited (including its subsidiary companies BT Mining Ltd, Bathurst Coal Ltd, and Buller Coal Ltd) (collectively referred to here as 'Bathurst') are seeking approvals through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('BPCP', or the 'Project'). One component of the Project is the Upper Waimangaroa Haul Road ('UWHR'), which would be used to enable transportation of coal from the Extended Escarpment mining area ('ESE') on the Denniston Plateau to the Coal Handling and Processing Plant ('CHPP') at Stockton Mine as well as movement of plant and personnel between sites. During design of the UWHR, Bathurst commissioned this report to understand methods and measures which are most effective at reducing wildlife impacts from roads, based on existing research. This report also identifies potential impacts of the construction and operation of this road on wildlife, and recommends potential effects management actions that could be incorporated into the design in order to reduce effects.

The UWHR would be a gravel road used for mining activities only and would therefore carry a relatively low volume of vehicles at low speed when compared with public roads. The vehicles would be predominantly heavy, with long stopping distances. Post mine closure, parts of the road may be left in situ for recreational users. It is anticipated that post-mining traffic would be limited to low volumes of light vehicles similar to other areas on the Denniston Plateau.

1.2 Proposed Route

The UWHR road footprint would be 16.7m wide (including bunds on either side of the 8.6m wide road) and approximately 19km long. Construction would involve upgrading and extending existing low-use tracks in the Upper Waimangaroa Valley as well as approximately 7km of greenfield construction. The greenfield habitats include a mix of tall forest, shrubland, low pākihi, and bare rock. The majority of the UWHR footprint is crown owned land administered by Land Information New Zealand, with the remaining portion administered by the Department of Conservation.

The relative effects of two potential route options for the greenfield construction segment were considered in detail in Ecological Solutions Limited (2025a). The location of the proposed UWHR, including both options considered, in relation to the Waimangaroa River is shown in Figure 1.

1.3 Scope

Ecological Solutions Limited was engaged by Bathurst to review international and domestic literature about the effects of roads on wildlife and the effectiveness of mitigation measures designed to address these impacts. On the basis of that review, we were asked to recommend which, if any, methods might be appropriate to include in the design and construction of the UWHR and assess the expected effectiveness as management of potential effects on wildlife.

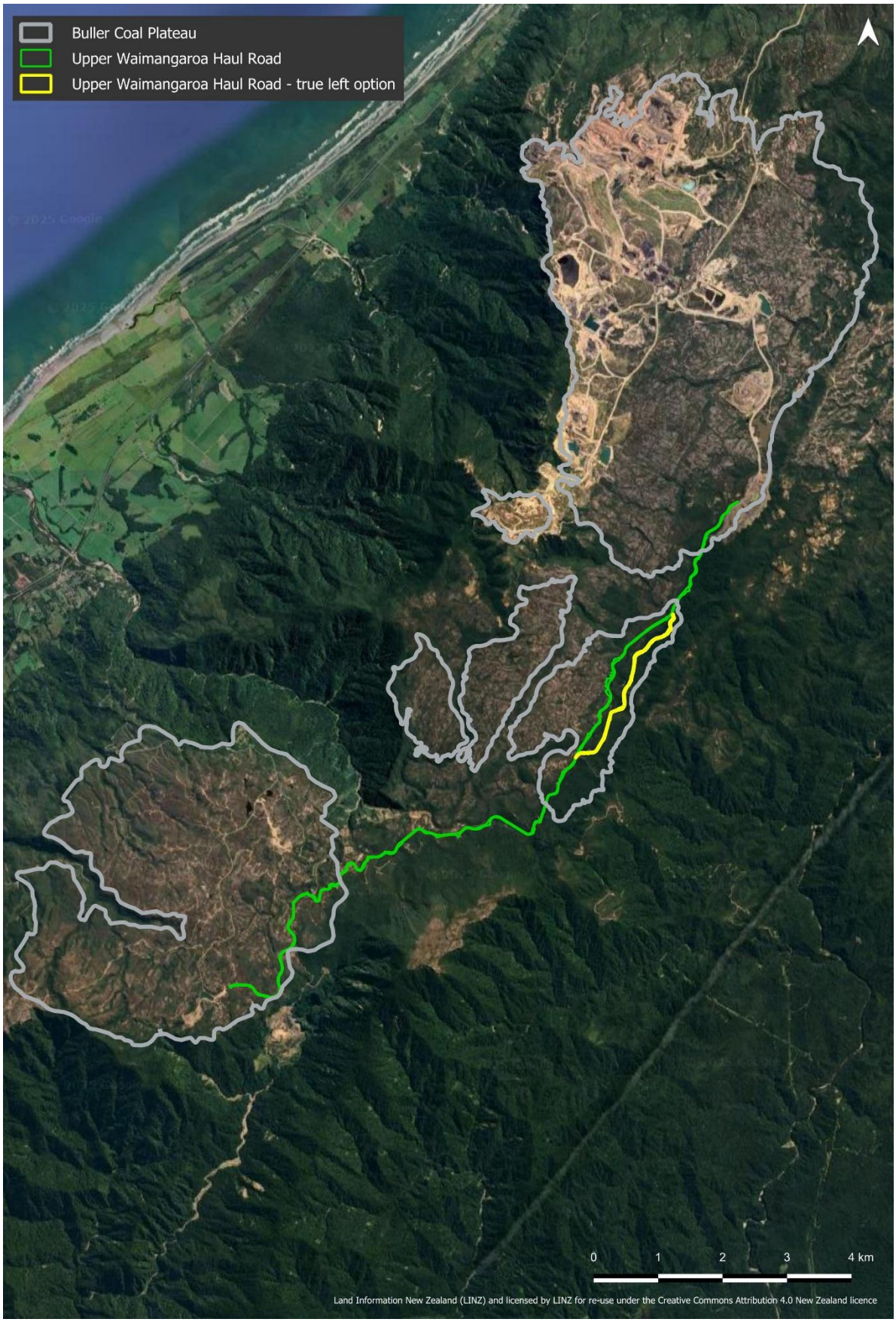


Figure 1: Proposed Upper Waimangaroa Haul Road including alternative route options.

1.4 Ecological Context

The Buller Plateaux comprises the Denniston and Stockton plateaux which are separated by the Waimangaroa Gorge. The Denniston Plateau, located south of the Waimangaroa River, covers approximately 1,700ha, forming a roughly circular area about 4.5km across. Most of the Denniston Plateau lies between 600–700m above sea level ('asl'), but it includes c. 280ha which is up-warped to the south (near Mt Rochfort) and a down-warped part covering c. 200ha in the northwest (Mabin 2012). The Stockton Plateau covers approximately 3,120ha north of the Waimangaroa River, forming an oval shape between Mt Augustus, the Mt William Range and Mt Stockton and comprising five separate areas (Templeton & McMorran 2020). Stockton Plateau includes a large triangular shaped area of outcropping Brunner coal measures geology within which Stockton Coal Mine is located and smaller areas (sub-plateau) of outcropping Brunner coal measures further south, between the Waimangaroa River and the existing mine. The Stockton Plateau slopes towards the northeast at elevations mostly varying between 610m and 860m asl. One of the southern sub-plateaux rises to 1,105m asl at the peak of Mt Frederick. The division of the smaller sub-plateau is predominately due to faulting and incision of watercourses into the plateau forming valleys and gorges (Templeton & McMorran 2020).

More than 50 terrestrial and aquatic ecological surveys have been undertaken in various parts of the Ngakawau Ecological District ('ED') including the Upper Waimangaroa valley and the Buller Plateaux (Ecological Solutions 2025b). Altitudinal sequences of lowland to subalpine vegetation occur on steep coastal hillslopes such as Mt Frederick (1,105m asl), which overlays fertile gneiss and granite parent material, Mt Rochfort (1,040m asl), which overlies infertile Brunner Coal Measures and Mt William (1,062m asl), which includes both granite and coal measures geology (Rattenbury et al. 1998, Nathan et al. 2002). At these locations lowland mixed beech-kāmahi-podocarp (often rimu) forest grades into beech (including both mountain beech and silver beech and Southern rātā forest which becomes more stunted with increasing altitude (Overmars et al. 1998).

The Buller Plateaux has high conservation values in the form of 'threatened' and 'at risk' species, indigenous habitats, and naturally uncommon ecosystems (Ecological Solutions Limited 2025c). Ecological Solutions Limited (2025b) reported at least 542 species of terrestrial plant, 56 species of bird (including 28 native species), 458 species of bryophyte species (345 liverworts, 123 mosses, 5 hornworts), three species of lizards, more than 300 species of terrestrial invertebrates and 186 taxa of aquatic invertebrates from within the Ngakawau ED. There are also at least five naturally uncommon ecosystems present within the Ngakawau ED, all of which occur on the Buller Plateaux including boulderfields of acidic rock, sandstone erosion pavement, tarns, seepages and flushes and pākihi wetlands (Ecological Solutions Limited 2025b).

Vegetation on the Buller Plateaux includes stunted forest, shrubland with a high component of mānuka (*Leptospermum scoparium* agg.), pākihi, and various rushland and tussockland vegetation types (Ecological Solutions Limited 2025d). Mānuka, pink pine (*Halocarpus biformis*), yellow-silver pine *(Lepidothamnus intermedius*) and *Gahnia* spp. are a significant component of the dense shrubland and low stature forest on the high elevation slopes.

Vegetation on the gently sloping sandstone pavements is dominated by stunted tussock-shrublands (Ecological Solutions Limited 2025d). *Chionochloa* spp. (tussock), *Gleichenia dicarpa* (tangle fern), *Dracophyllym* spp., wire rush (*Empodisma minus*) and prostrate mānuka are common and widespread. Based on the vegetation alone, large parts of the Buller Plateaux meet the criteria for natural inland wetlands (Ministry for the Environment 2020, Ecological Solutions Limited 2025d).

Approximately 94% of the 5,272ha Buller Plateaux receives ecosystem management funded by Bathurst as part of the Denniston Permanent Protection Area ('DPPA', 718ha); Denniston Biodiversity Enhancement Area ('DBEA', 1,742 ha); Snail Enhancement Area

('SEA', 893ha) or Wider Habitat Enhancement Area ('WHEA', 1,588ha) which extend beyond the Plateaux to adjoining habitats (Ecological Solutions Limited 2025b). Together the DPPA and the WHEA comprise 12,700ha which covers c. 26% of the Ngakawau ED (Ecological Solutions Limited 2025b).

The types of wildlife known to occupy the UWHR Project sub-area and which could be expected to be affected by the UWHR include flightless birds such as rōroa (*Apteryx maxima*) and western weka (*Gallirallus australis australis*) and poorly mobile species such as lizards (West Coast green gecko (*Naultinus tuberculatus*), forest gecko (*Mokopirirakau granulatus*) speckled skinks (*Oligosoma infrapunctatum*)) and land snails (*Powelliphanta patrickensis*).

2.0 Effects of Roads on Wildlife

2.1 Overview

The effects of roads on wildlife include mortality of large and small animals and a range of indirect effects on ecosystems. Benítez-López et al. (2010) concluded that, globally, road networks contribute significantly to terrestrial biodiversity loss because they remove and fragment habitats, facilitate land use change and infrastructure development (leading to further habitat loss), increase pollution, increase access for weeds and pests and can reduce animal populations directly due to vehicle collision. The effects of roads on wildlife can be summarised as follows:

Direct effects:

- Construction effects (mortality and habitat loss during construction); and
- Collision mortality during operation.

Indirect effects:

- Fragmentation of habitats;
- Habitat loss; and
- Habitat degradation due to weeds, pests, edge effects and pollution (including noise, lighting and chemical pollution).

These effects are generally well documented, although there is a geographic bias in published studies to Western Europe and North America and an over-representation in published material of the direct effects on large mammals.

Evidence of effects or effective mitigations in the New Zealand context is scarce. The exception is a comprehensive literature review of the indirect effects of roads in New Zealand undertaken by Manaaki Whenua – Landcare Research for Waka Kotahi – New Zealand Transport Agency (Simcock et al. 2022). Indirect effects explicitly considered by Simcock et al. (2022) were fragmentation and edge effects.

Efforts to mitigate the impacts of roads on wildlife are now common internationally with a wide range of strategies employed, although evidence for their effectiveness is often lacking (Rytwinski et al. 2016). There is no 'catch-all' approach to mitigation of effects either, since effective management must be tailored to the particulars of the road, each potentially vulnerable species present and the relevant ecological context.

Mitigation measures vary in suitability depending on the animal groups affected and the relative importance of each roading effect. In addition, there is likely to be multiple simultaneous impacts, with mitigations that vary in suitability between the different impacts

and between species and locations. Mitigations for one type of effect may exacerbate another, e.g., physical barriers may effectively reduce roadkill of some species, while increasing fragmentation effects for animals that were previously able to cross the road successfully (Olsson & Widen 2008).

The effects of roads on wildlife, as well as the range of mitigation measures aimed at reducing them, are summarised in Sections 2.2 and 2.3. These sections also identify and discuss the effects relevant to the UWHR. Species that could be expected to be affected by the UWHR are identified and discussed in Section 3. Mitigation measures specific to the UWHR are discussed in Section 4 and the findings of this literature review in relation to the UWHR are summarised in Section 5.

Where residual effects of the BPCP and UWHR cannot be avoided, minimised or remedied, offsetting and/or compensation will be applied. The extent and nature of the proposed offset and compensation activities is set out in Alliance Ecology Limited (2025a in prep).

2.2 Direct Effects

2.2.1 Construction Effects

Mortality during construction poses a risk to a range of fauna present within the footprint of a new road. Other disturbance effects, such as heavy machinery noise or lighting, can extend some distance beyond the physical works (Weller 2015). The construction effects of roads are generally similar to mining and urban development and involve vegetation clearance, heavy machinery and earth moving. These activities can cause mortality and/or disturbance of native fauna and temporarily increase background noise, dust, lighting and mobilisation of sediment if not properly managed.

These effects are generally managed to acceptable levels via a suite of site environmental management plans ('SEMPs') which may place limits on hours of operation, noise and/or lighting and also include measures to reduce dust (e.g., use of water trucks) and mobilisation of sediment into watercourses (e.g., decanting bunds, filter cloth, sediment ponds).

Poorly mobile species such as lizards, snails, and nesting birds within the road footprint itself would be at highest risk of mortality during construction. Individuals which move too slowly, or too short a distance, to avoid effects can be killed when vegetation and earthworks commence.

The primary means of reducing mortality of poorly mobile species during construction is pre-surveys combined with salvage, trapping and relocation of fauna from the construction footprint as set out in a species management plan. Exclusion fencing during construction has also been used to reduce risk to fauna, once pre-survey, salvage and relocation have occurred. Specific fauna management plans for lizards, snails, kiwi and the like are developed according to best practice (e.g., Department of Conservation Lizard Technical Advisory Group 2019). Although widely implemented, and expected to reduce mortality, the relative effectiveness of this approach remains unknown.

2.2.2 Collision Mortality

Summary of relevant Literature

Wildlife vehicle collision ('WVC') usually results in mortality and is the most commonly reported direct effect on wildlife due to roads, although it often goes undetected (Taylor & Goldingay 2010). WVC can affect large proportions of animal populations and has been implicated in declines in populations of a wide range of taxa (Rytwinski & Fahrig 2015).

WVC is often noticeable since animals, large mammals in particular, are highly visible when

killed near roads. Total mortality is higher, possibly much higher, than reported, since a large proportion of animals hit by vehicles die out of sight and small animal carcasses are quickly scavenged (Romin 1994).

WVC can be the biggest cause of mortality for some animals where dense, high speed and high traffic road networks are present. In the United Kingdom approximately one million wild animals each year are thought to be killed in traffic collisions (Underhill & Angold 2000), including as much as 50% of the total red fox population (White & Harris 1994) and 49% of the badger population (Clarke et al. 1998).

Collision mortality has been implicated in the decline in a range of animals, including in amphibians (Fahrig et al. 1995), marsupials (Jones 2000), reptiles (Gibbs & Shriver 2002) birds (Summers et al. 2011) and carnivorous mammals (Rytwinski & Fahrig 2015). In some cases, collision mortality has been found to be high enough to reduce genetic diversity and subsequent reproductive fitness and resilience of the population through depletion of the gene pool (Jackson & Fahrig 2011).

Effects of WVC are not always negative – a review found that effects at the population level varied, being typically negative for most carnivores and amphibians, neutral or negative for snakes and lizards, often neutral for perching birds and often positive for rodents and hoofed mammals (Rytwinski & Fahrig 2015). The positive effects may represent predation release from carnivores, which are more strongly affected by road mortality than some other groups.

In New Zealand, Beauchamp (2009) considered that the birds he found dead along an arterial road near Whangārei were a subset of those that used the road margins and neighbouring habitats. He recorded 116 bird deaths of 17 species over three years, with increasing mortality associated with increasing vehicle speed limits and the presence of important habitats (a bridge which connected estuarine and riparian habitats). No dead birds were collected from the stretch of road with a 50km/h speed limit, 8 deaths per km per year in the 70km/h zone and 15.6 deaths per kilometer per year in the 80km/h zone (Beauchamp 2009).

Brockie et al. (2009) compared the number of medium-sized animals (between rat- and dog-size) killed on roads using repeated counts along the same 1,660km of North Island highways in 1984, 1994 and 2005 with other counts going back to 1949. They recorded 11 mammal and 14 bird species with possums (*Trichosurus vulpecula*), hedgehogs (*Erinaceus europaeus*) and rabbits (*Oryctolagus cuniculus*) predominating. For birds, pūkeko (*Porphyrio porphyrio*), mynas (*Acridotheres tristis*), and Australian magpies (*Gymnorhina tibicen*) were most common. The relationship between road-kill and traffic volume indicated that roads carrying more than 3,000 vehicles per day act as barriers to larger mammals, while vehicles on less busy roads were most dangerous for crossing animals.

Not all roads, or stretches of roads, affect animals equally. Some stretches of road cause unusually high mortality and are considered ‘blackspots’ while others have minimal effects (Brockie 2007). Road attributes which contribute to the risk of WVC include:

- Vehicle speed and driver behaviour;
- Traffic volume;
- Road width;
- Habitats present on the road margin and species using them;
- Disconnection of habitat/populations;
- The presence of bridges.

Evidence from a wide range of sources, including in New Zealand, indicates that mortality is

strongly influenced by both traffic intensity and speed (Seiler & Helldin 2006, Beauchamp 2009). This risk increases sharply above speeds at which detection and avoidance are possible for either the animal or the driver. Detection is particularly influenced by the visibility of the animal to the driver (e.g. size) and the animal's mobility/speed (Hobday 2010).

Mortality increases with traffic volume (Sadleir & Linklater 2016), although total mortality may level off at very high traffic volumes (Taylor & Goldingay 2010) which can become a barrier and reduce mortality as animals avoid crossing at higher traffic densities (Denneboom at al. 2024). Seiler and Heldin (2006) proposed a conceptual model in which moderate traffic roads presented the greatest risk to wildlife, as traffic intensity lowers the chance of animals successfully crossing and decreases crossing attempts. Blackspots occur where animal densities or crossings are concentrated or where animals are locally more vulnerable (Rea et al. 2014). Bridges were found to be blackspots for pest mammals, but also for shags and gulls in New Zealand (Brockie 2007, Beauchamp 2009).

Research by Rytwinski & Fahrig (2015), Andrews et al. (2015) and others summarised by Simcock et al. (2022), identified wildlife attributes associated with greater road mortality as:

- Speed of animal movement (i.e., time spent crossing the road);
- Size and location of home range relative to the road (for example: a kiwi occupying several hectares would likely need to cross roads, but a lizard occupying several square metres would be less likely to need to cross a road);
- Types and frequency of movements (for example, breeding, migration or foraging movements);
- Attraction to road or road edge (e.g. by lighting, habitat type or food abundance);
- Lack of road avoidance behaviour.

Species with naturally low population densities and low reproductive rates are particularly vulnerable to decline as a result of this type of mortality which is usually additional to background levels (Rytwinski & Fahrig 2015).

Wildlife Vehicle Collision in New Zealand

New Zealand lacks the large mammalian ground fauna which are both vulnerable and conspicuous when killed near roads. Research into collision mortality for native fauna has been limited in New Zealand, though there have been a small number of studies (see Beauchamp (2009), Brockie et al. (2009) and Sadleir and Linklater (2016) for New Zealand case studies). Sadleir & Linklater (2016) considered that in New Zealand, exotic pest mammals are most frequently killed by WVC, although Beauchamp (2009) recorded nine exotic and eight indigenous species collected dead near Whangārei, suggesting indigenous animals are also susceptible to WVC. Indications are that a number of native species are vulnerable to WVC, particularly nocturnal, flightless or walking birds or those which are attracted to roadside habitats, live in proximity to roads or use features that cross them (such as rivers or estuaries) as habitat (Beauchamp 2009, Simcock et al. 2022).

Previous research has highlighted WVC associated mortality for weka (*Gallirallus australis*) and kororā/little blue penguins (*Eudyptula minor*), whilst general collection of animal carcasses has indicated a range of species are affected. Road kill was responsible for 43% of deaths of radio-tracked adult North Island weka at Rakauroa, inland from Gisborne, where stoat predation also accounted for 43% of deaths (Bramley & Veltman 2000). Both weka and stoats were likely to be preferentially using habitats adjoining the road, although no dead stoats were ever collected (G. Bramley, unpublished data). Road kill of western weka was found to be approximately 6 birds per kilometre per year around Cape Foulwind (near Westport), which was considered to be 2–4% of the local population (Freeman 2010).

Hocken (2000) examined carcasses of kororā in North Otago and determined road collision was responsible for 10.4% of deaths. Sadleir & Linklater (2016) found the most commonly killed animals on a stretch of lower North Island highway were pest mammals and common native birds such as such as swamp harrier (*Circus approximans*) and pūkeko.

Simcock et al. (2022) summarised the available literature, and concluded that roadkill may affect populations of threatened native birds including kiwi, pāteke (*Anas chlorotis*), kererū (*Hemiphaga novaeseelandiae*), and kea (*Nestor notabilis*), noting that mortality estimates vary substantially. For example, a management plan for North Island brown kiwi on Kerikeri Peninsula estimated 0.3 road kill deaths per month, while local newspapers estimated roadkill deaths at a rate of 0.75-0.8 per month (Simcock et al. 2022).

Five kea were killed on SH 24 (Te Anau - Milford) in only a few months in 2024 (Department of Conservation 2024). The West Coast Penguin Trust recorded over 100 fatalities of kororā at a roadkill blackspot on State Highway 6 (West Coast Penguin Trust 2023). Between 17% (in Auckland) and 27% (in the lower North Island) of dead and injured kererū delivered to Auckland Museum and the Department of Conservation were affected by WVC (Gill 2006; Cousins 2010).

A citizen science project recording roadkill of native and introduced animals in New Zealand on iNaturalist began in 2020 (iNaturalist 2020) and currently contains 1,805 observations from 123 species, 66 of which are native. This is a valuable dataset due to its breadth, though its lack of consistent survey methodology means that biases are highly likely. The direction of those biases is hard to predict, for example there may be an overrepresentation of uncommon or threatened species, because of a greater interest in those species, or a bias towards larger, more common species which are more noticeable. Similarly, there may be more reports from highly used roads, because there are more potential observers, or from less busy roads, where observations may be safer to collect. Currently, the most frequently recorded species are pūkeko with 289 observations (16%), followed by six introduced species and the swamp harrier with 44 observations (2.5%), silver eye (*Zosterops lateralis*) (35, 1.9%), weka with 30 observations (1.7%) three of which were North Island weka (*Galliralus australis greyi*) and one buff weka (*Galliralus australis hectori*), fantail/pīwaiwaka (*Rhipidura fuliginosa*), ruru (*Ninox novaeseelandiae*) and kererū. These findings are consistent with the observation that species which use roadside habitats, are attracted to roads, or cross them frequently when travelling between habitats, are most at risk. A high proportion (28 of 66, 42%) of species of conservation concern have been recorded in this dataset to date as set out in Table 1. Seabirds (10 species), lizards (eight species), lake or wetland birds (four species) and snails (one species) are all represented. Whilst the most frequently recorded species are common and/or known to associate with roads, the diversity of rare species recorded to date demonstrates the broad impacts roads can have.

Table 1: Species of conservation concern recorded in iNaturalist Roadkill Project (accessed 11 November 2024).

Species	Threat status	Number of records (percentage)
Little blue penguin (*Eudyptula minor*)	At Risk – Declining	9 (0.5)
Australasian bittern (*Botaurus poiciloptilus*)	Threatened – Nationally Critical	6 (0.3)
Brown teal *(Anas chlorotis*)	Threatened – Nationally Increasing	4 (0.2)
North Island weka (*Gallirallus australis greyi*)	At Risk – Relict	3 (0.17)
Spotted shag (*Stictocarbo punctatus*)	Threatened – Nationally Vulnerable	3 (0.17)
Forest gecko (*Mokopirirakau granulatus*)	At Risk - Declining	3 (0.17)
North Island brown kiwi (*Apteryx mantelli*)	Not Threatened	2 (0.1)
Black shag (*Phalacrocorax carbo novaehollandiae)*	At Risk – Relict	2 (0.1)
Bush falcon (*Falco novaeseelandiae ferox*)	Threatened – Nationally Increasing	2 (0.1)
Fairy prion (*Pachyptila turtur*)	At Risk – Relict	2 (0.1)
Little shag (*Phalacrocorax melanoleucos brevirostris*)	At Risk – Relict	2 (0.1)
Banded rail (*Gallirallus philippensis assimilis)*	At Risk - Declining	1 (0.06)
Barking gecko (*Naultinus punctatus*)	At Risk – Declining	1 (0.06)
Black-billed gull (*Chroicocephalus bulleri*)	At Risk – Declining	1 (0.06)
Buff weka (*Galliralus australis hectori*)	Ati Risk - Relict	1 (0.06)
Elegant gecko (*Naultinus elegans*)	At Risk - Declining	1 (0.06)
Fernbird (*Poodytes punctatus*)	At Risk - Declining	1 (0.06)
Fluttering shearwater (*Puffinus gavia*)	At Risk – Relict	1 (0.06)
Hutton's shearwater (*Puffinus huttoni*)	Threatened – Nationally Vulnerable	1 (0.06)
Kauri snail (*Paryphanta busbyi*)	At Risk – Declining	1 (0.06)
Marlborough green gecko (*Naultinus manukanus*)	At Risk - Declining	1 (0.06)
Mottled petrel (*Pterodroma inexpectata*)	At risk – Relict	1 (0.06)
Northland green gecko (*Naultinus grayii*)	At Risk - Declining	1 (0.06)
North Island rifleman (*Acanthisitta chloris granti*)	At Risk - Declining	1 (0.06)
Northern striped gecko (*Toropuku inexpectatus*)	Threatened – Nationally Vulnerable	1 (0.06)
Ornate skink (*Oligosoma ornatum*)	At Risk - Declining	1 (0.06)
Southern Alps gecko (*Woodworthia "Southern Alps"*)	At Risk - Declining	1 (0.06)
South Island pied oystercatcher (*Haematopus finschi*)	At Risk - Declining	1 (0.06)
White-fronted tern (*Sterna striata*)	At risk – Declining	1 (0.06)

Native Species Vulnerability

Impacts of WVC and factors which increase the risk of roads for birds were summarised by Simcock et al. (2022). Traits which increase vulnerability of native species were:

- Nocturnality;
- Fright freeze response;
- Flightlessness;
- Fly along rivers;
- Roost over water;
- Attracted to roads for food;
- Attracted to roads by lighting and;
- Roost at high tide.

Some of these traits are exhibited by species present in the Upper Waimangaroa Valley, specifically great spotted kiwi/ rōroa, ruru, weka and shag species. Risk factors associated with WVC and indirect effects for species present in The Upper Waimangaroa valley are discussed in Section 3.2.

Reducing Wildlife Vehicle Collision

Measures to reduce the direct effects of roads on wildlife range from wildlife crossing signs to alert drivers, which have low cost, but also little evidence of effectiveness, to infrastructure such as fences and crossings, which can be expensive to install, maintain and monitor, but provide the best evidence of reducing effects (Bramley & Veltman 2000, Glista et al. 2008). Other potential mitigations include planning of road placement to avoid important locations or habitats, reduction in speed limits, education to increase driver awareness, and monitoring and management of vulnerable species.

Driver Behaviour and Speed

Driver behaviour is one of the primary factors influencing collision mortality, particularly vehicle speed and awareness since both fauna and driver are afforded longer to avoid collisions at lower speeds, particularly if the driver understands that wildlife are present (Seiler & Helldin 2006). Speeds that would allow safe stopping distances ranged from 38km/h to 83km/h and was highest for brightly coloured animals and when drivers used high beams at night (Hobday 2010).

Modifying driver behaviour can be achieved by lowering maximum speed limits, constructing speed bumps or placing signage (Rytwinski et al. 2016). These mitigations have often proved ineffective however (Glista et al. 2008) likely due to poor compliance. Bramley & Veltman (2000) considered signage warning of weka crossing would be highly unlikely to be effective on State Highway 2 since drivers would become habituated to the signs and not alter their behaviour.

The existing speed limit within Stockton Mine is 60km/h and this is strictly enforced. As such, this limit is expected to significantly reduce the risk to rōroa and weka compared with typical open road speeds of 80 - 100km/h, despite the larger vehicles requiring longer stopping distances than smaller vehicles at equivalent speeds. A speed limit of 80km/h is proposed for the UWHR, with the average speed expected to be 40km/hr.

Ecopassages

Ecopassages such land bridges, pole or rope bridges, dry bridges or empty pipes/culverts and extended stream crossings can provide safe passage for animals and thereby reduce mortality and fragmentation effects for some species (Taylor & Goldingay 2010, Lesbarreres & Fahrig 2012). The effectiveness of ecopassages relies on the affected animals first detecting and then using the passages provided. This requires an intermediate level of road avoidance behaviour as very high or low road avoidance can both prevent detection of the ecopassages. Animals with low road avoidance may use the road at any point without searching for a safe crossing, while strong road avoidance can mean animals will avoid the area surrounding the road and have a low probability of detecting the ecopassage (Underhill & Angold 2000).

Ecopassages would be most effective with species which occupy large home ranges or travel large distances and can be directed towards the artificial crossings (e.g. via fencing or road avoidance behaviours). For species with small home ranges, or which make small daily or seasonal movements, locating and then using a passage across a c. 17m wide road would be unlikely.

Ecopassages have generally low effectiveness except when used in conjunction with fences to direct wildlife towards them (Rytwinski 2016) or when bridges are extended to allow passage alongside waterways beneath roads (Lesbarreres & Fahrig 2012). This 'extended stream crossing' method has been found to be the most effective type of ecopassage. Using this approach, road bridges must allow room for animal passage either side of the stream bank, leaving at least 5 m of clear bank above the waterline (Lesbarreres & Fahrig 2012). The likely reason why extended stream crossings are more successful than dry bridges is that streams themselves are natural crossing points for wildlife i.e., a linear feature in the landscape which animals use for navigation or as a range boundary (Brockie 2007). The addition of extended stream crossings may therefore, under the right conditions, convert what could be a WVC blackspot into a highly used ecopassage (Niemi et al. 2014).

Use of crossings by road avoidant species can be increased by incorporating cover near, at, and within the crossing, while non-avoidant species can be funnelled to the crossing with fencing (Taylor & Goldingay 2010). Use of crossings varies between species or animal groups according to their requirements or preferences for passage types or features. Crossings could act as prey traps for some species by creating bottlenecks of prey that could be exploited by predators, though there is scant evidence for this occurring (Little et al. 2002).

Barriers

Barriers such as fences have been found to be the most effective way of reducing WVC (Rytwinski et al. 2016). However, fences are not completely effective for all species, are generally expensive, and can exacerbate fragmentation effects. A meta-analysis found that barriers reduced roadkill by 40%, and that effectiveness increased to 83% for large mammals when crossings and barriers were combined (Rytwinski et al. 2016).

The selection of fence design and materials would depend on the target species. A 2.4m high wire mesh fence reduced WVC by 80% on a four lane, high traffic volume highway in Alberta, Canada, although the data collection relied on incidents reported to park wardens and would therefore be biased towards large mammals (Clevenger et al. 2001). Fences aimed at preventing small vertebrates such as lizards accessing roads are usually low height (15-120cm) and made from a variety of materials such including metal, soft plastics and tarpaper (Dodd 1991). Retrofit silt fences using wire and soft plastic have often been used to prevent lizard movement, including locally at the Westland Mineral Sands site at Nine Mile near Westport, although these have low durability, which compromises

effectiveness and can have negative impacts such as entanglement (Kapfer & Paloski 2011). Recent developments of dedicated fence materials and designs for mitigation of effects on small to medium sized fauna have resulted in best practice guidelines and methods to reduce attempted crossings overseas (Aburrow et al. 2023).

The construction of an exclusion fence to reduce mortality of kororā/little blue penguin crossing roads at Punakaiki, is a rare national example of this approach and appears to have significantly reduced penguin mortality associated with State Highway 6 (West Coast Penguin Trust 2023). Fencing is likely to be effective in this instance because the risk is highly concentrated at a single crossing point between nesting and feeding habitat and the birds all make that journey twice a day (going to feed and returning to roost/nest). This contrasts with roads which bisect the normal home range of birds such as a kiwi where the risk is diffuse and crossing points are much less predictable.

2.3 Indirect Effects of Roads on Wildlife

2.3.1 Habitat loss

Construction of new roads results in habitat loss which is both cumulative and permanent and can account for a large area in intensively modified landscapes (Underhill & Angold 2000). New Zealand has an overall moderate density of roads by international standards, similar to much of Europe and North America (Simcock et al. 2022). Construction of the UWHR would result in the loss of approximately 37.6ha of habitat and edge effects in a further 51.6ha. The specific type of habitat would vary depending on the route selected and amount of cut and fill required.

Habitat loss is an unavoidable consequence of road construction, however, consideration of road placement to avoid high value habitats can mitigate this effect, as can appropriate treatment of road edges and disturbed areas which are no longer required for road maintenance (Forman 2005). In addition, restoration and enhancement of habitats in the surrounding landscape can offset a reduction in habitat for some species (Cuperus et al. 1999).

2.3.2 Fragmentation

Roads can form partial or complete barriers to animal movement, particularly for poorly mobile species or those susceptible to WVC. If not managed, this can result in disconnection from previously available habitats and the separation of populations into smaller units. Fragmentation effects can be divided into;

- Habitat fragmentation,
- Population fragmentation.

Fragmentation is most severe when roads become impassable, either due to strong avoidance behaviour (Seigle-Ferrand et al. 2022), high collision mortality preventing successful crossing (Underhill & Angold 2000) or due to the road surface and associated infrastructure, including fences, preventing animals reaching the other side (Eftestøl et al. 2014). A habitat broken into smaller patches by roading could result in a reduction in accessible habitat, with particularly strong effects when the road constrains home ranges and reduces connectivity between habitats or resources e.g. food sources and nesting habitat (Eigenbrod et al. 2008). Species with large home ranges and multiple resource requirements are particularly vulnerable to this type of effect.

Fragmenting populations would reduce the size of each isolated sub-population, which can have reproductive (fitness) and genetic effects if prolonged. Multiple disconnected sub-populations are much more vulnerable to local extinction than a single connected large

population. Genetic effects resulting from population fragmentation can include reduced genetic diversity and inbreeding depression and if prolonged, this separation can result in reduced productivity and local population extinction (Jackson & Fahrig 2011).

Ecopassages, as described in Section 2.2.2, are an attempt to address habitat and population fragmentation effects, however in order to be effective, animals would have to use them in sufficient numbers to overcome the fragmentation and maintain natural (or similar) levels of gene flow. Evidence for the effectiveness of ecopassages is limited to confirmation of use by animals. We could find no evidence of ecopassages confirming the maintenance of genetic diversity or population viability. There is a general lack of connectivity measures pre- and post-construction, or in the absence of any road, upon which to base any definitive conclusions with respect to fragmentation (Lesbarreres & Fahrig 2012).

Population fragmentation or disconnection could be an issue for snails and lizards at the UWHR because the known distribution of *Powelliphanta patrickensis* generally includes some areas to the east of both proposed routes, although we note that the Waimangaroa River itself would provide a significant barrier throughout parts of its length (particularly further downstream) and the true left route is outside the best snail habitats and the majority of snail and shell records as shown in Figure 2. Both of these features would tend to mitigate fragmentation effects for snails, but could lead to an overall reduction in the known range. Note that snails do occur on both sides of the Waimangaroa River, with records from near Burnett's Face in the south and at Cypress Mine in the north.

If habitat disconnection was identified as a significant effect, it could be addressed, at least in theory, via assisted dispersal (i.e., relocation). There are few examples of the success of this approach. The popular novel Braiding Sweetgrass by Kimmerer (2013) described informal work where the author assisted a nocturnal migration of salamanders across a rural road, though whether this was successful remains unknown. While carrying out this self-directed assistance of salamanders, Kimmerer unintentionally interrupted a study of population effects of the road mortality (Gibbs & Shriver 2005) which concluded that annual mortality exceeding 10% could lead to extirpation of the salamander population.

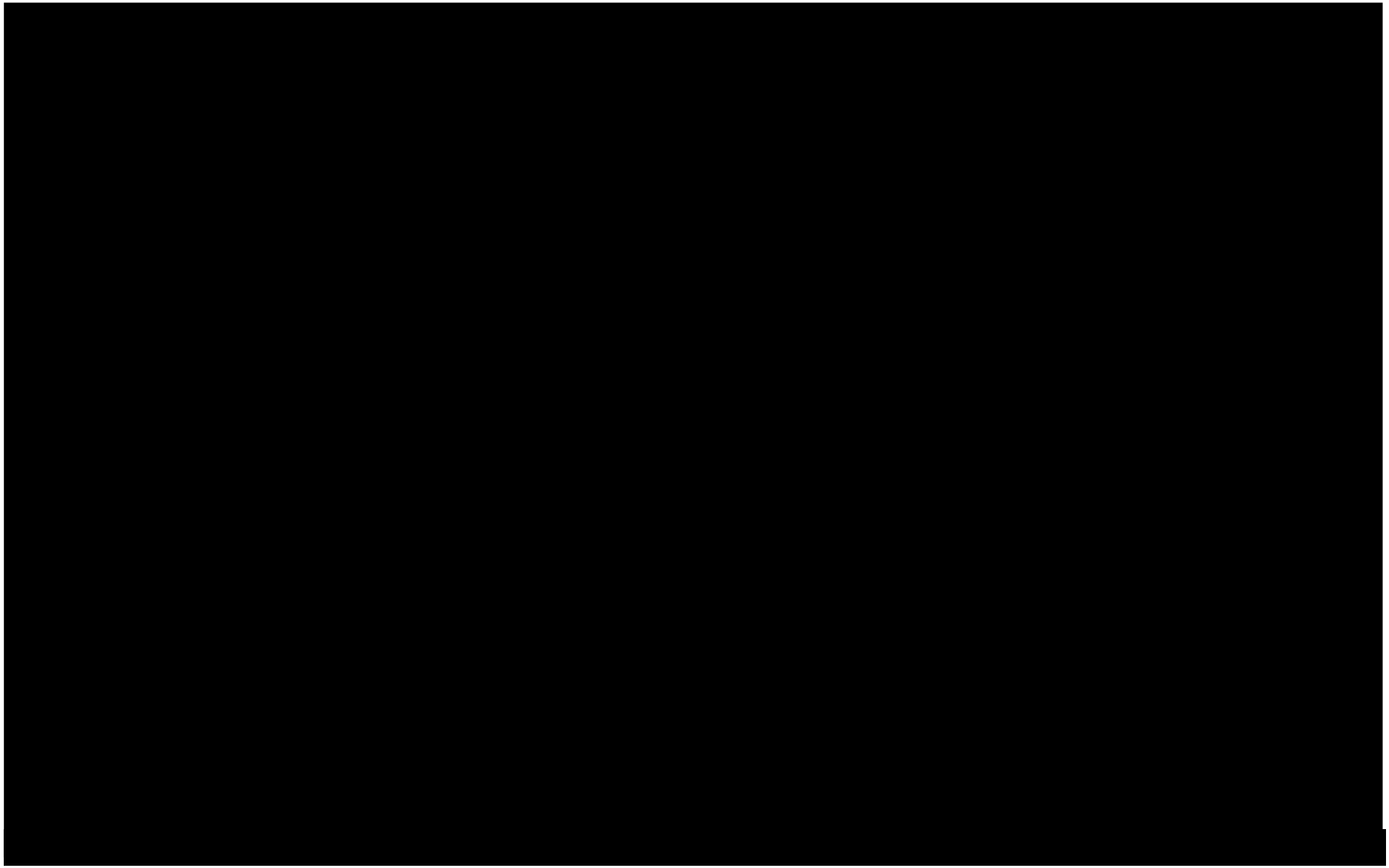


Figure 2: Records of live snails and snail shells in relation to the UWHR route.

2.4 Habitat Degradation

2.4.1 Overview

Roads remove habitat from within the footprint of the road itself and its immediate margin and can also degrade surrounding habitats to varying degrees via edge effects which can extend up to 1000m depending on the vegetation type (Forman & Deblinger 2000). These effects include alterations to microclimate and vegetation and road specific effects such as sediment runoff, pollution, noise and artificial light (Simcock et al. 2022).

Effects which extend beyond the footprint of the road itself include:

- Noise and vibration;
- Pollution from vehicle exhausts, brakes and tyres;
- Artificial light at night;
- Invasion by exotic plants and predators;
- Edge effects on vegetation, animals and microclimate;
- Erosion, sediment mobilisation and altered hydrology.

Each of these is considered in more detail below.

2.4.2 Noise and Vibration

The UWHR will be a low-speed gravel road, used predominantly by large vehicles (trucks), at least during mine life. Gravel roads can be subject to wash boarding (corrugation), which can create additional noise/vibration beyond 'normal' roads if not constructed/maintained appropriately.

Road noise is identified internationally as a major cause of far-reaching effects of roads (Forman et al. 2003) although there has been little research with respect to effects of noise on wildlife generally in New Zealand. Road noise can degrade habitats by triggering stress response and avoidance behaviours, reducing foraging effectiveness or masking vocalizations (Bennett 2017). There has been no New Zealand research identifying thresholds or distances at which road noise adversely affects native bird, lizard or invertebrate species, however the 55–59 decibels (dB) contour (designed for humans) is commonly used as an upper limit above which noise effects are considered likely to be negative (Simcock et al. 2022).

In New Zealand, the general approach to managing noise and vibrational disturbance for avifauna has been for consenting authorities to specify a setback distance from works, most often 50m. Such an approach is not site or species specific, nor is there a scientific rationale for that particular setback distance.

Species vary in their response to noise. A review of overseas literature from 1999 to 2013 found that animals respond to road noise at levels lower than 50dB (Shannon et al. 2016). With respect to birds, noise levels as low as 45db affected song frequency, abundance, stress levels and reproductive metrics (Shannon et al. 2016). Little blue penguins/kororā at Waiheke Island were found to be tolerant of construction noise up to 80dB close to their burrows (Lawrence et al 2023), whilst at an Australian site average noise levels of 67dB resulted in no grey shrikethrush (*Colluricincla harmonica*) being detected and at 72.3dB no grey fantails (*Rhipidura albiscapa*) were detected (Ortega 2012). This lack of detection could have been due to the difficulty of detecting birds in the presence of loud noise, rather than an absence of birds per se (Ortega 2012). The frequency of grey shrikethrush calls also increased with increasing traffic noise, with the trend beginning at 30dB, possibly to overcome the masking effect of traffic noise. The birds were unable to fully compensate for

the masking effect, and the alteration to their song may have made them less desirable as mates (Parris & Schneider 2009). Internationally, some bird species, such as black-chinned hummingbirds (*Archilochus alexandri*) and house finches (*Haemorhous mexicanus*) appear to prefer noisier nesting sites (up to 85dB), perhaps because their predators avoid noisier sites (Ortega 2012).

Traffic also causes localised ground vibrations and the nature and magnitude of the effects of these vibrations on wildlife are not well understood. Effects could be similar to noise, i.e., including inducing stress, masking calls, disrupting prey detection, or mimicking environmental signals such as initiating reproductive activity in giant wētā (Wu & Elias 2014, Simcock 2022). Vibration effects are likely to operate over shorter distances than noise effects.

Noise and vibration can be reduced by adopting lower speed limits, deploying low noise road surfaces, planning of road placement, and incision of roads to avoid steep gradients. Reduction in speed corresponds with a reduction of noise, especially from 80-50 km/hr. Road noise is 75% lower at 40km/hr compared with 110 km/hr (Den Boer & Schroten 2007). Use of low road noise surfaces can be effective although these are generally types of porous asphalt (Wareing et al. 2022). Reduction in slope through planning and hillslope incision can also significantly reduce noise (Hosseini et al. 2016).

2.4.3 Discharges

Discharges from roads includes hydrocarbons, particulates and gasses from exhausts, and through wear from tyres and brake pads. These can accumulate in soils and have been found internationally to cause plant stress for road edge vegetation, invertebrates and aquatic biota (Bignal et al. 2007, Reck & van der Ree 2015, Sager 2020). These pollutants can degrade local receiving environments, including waterbodies such as streams and wetlands and reduce the health of aquatic organisms (Hwang et al. 2016). Spills can also be an acute source of pollution for roadside soils or waterbodies (Siqueira et al. 2017). Apart from accidental spills and the like, the effects of discharges would increase with increasing traffic density.

Reduction of discharges from engine exhausts and wear on brakes and tyres is difficult, although containment of these pollutants may reduce their overall impact and low traffic volumes reduce the risk. Treatment of roadside run off at retention ponds can reduce the acute loads of these pollutants entering nearby waterways and maintaining or planting roadside vegetation can help to settle suspended particles (Mrowiec 2016, Baldauf 2017).

Dust nuisance is a common effect of unmanaged gravel roads and this can also affect roadside vegetation. Dust control sprays, which keep unsealed roadside surfaces from becoming suspended as dust are effective in reducing dust, but some additives can themselves become pollutants and should be avoided (Kunz et al. 2021). Dust suppression using water carts occurs on existing roads at Stockton Mine and is generally effective at suppressing dust.

2.4.4 Artificial Lighting

The UWHR will not have any fixed street lighting, however, there would be vehicle movements along the UWHR at night.

Artificial lighting can disorient night-active birds, particularly seabirds and migratory birds, and kiwi and other animals crossing roads, causing them to collide with infrastructure or vehicles, which can cause mortality (Longcore et al. 2018). Lights from towns, vehicles, boats at sea and the like all have similar disorienting effects on wildlife. The brightness of light is also known to affect species' vision and behaviour (e.g., 'possum in the headlights'). Lighting also affects other nocturnal species and can disrupt food webs by, for example, concentrating insects such as moths around lights, which in turn attracts their predators.

Unmanaged artificial lighting produced by streetlights or vehicle headlights, can influence animal behaviour by, for example, disrupting bird migration and feeding patterns, and attracting flying invertebrates and their predators (Simcock et al. 2022). Artificial lighting can have particularly severe effects on seabirds which can be attracted to lights, resulting in groundings (Rodríguez et al. 2017) and bird strike with vessels (Goad et al. 2023). The effects of artificial light at night have not been well studied on New Zealand land birds, reptiles or insects (Simcock et al. 2022), although grounding of Westland petrels (tāiko, *Procellaria westlandica*) between Westport and south of Hokitika and grounding of Hutton's shearwater (*Puffinus huttoni*) near Kaikoura are both thought to be a result of artificial lighting and to contribute significantly to population mortality for those species (Wilson 2016).

Management of artificial light to reduce effects from roading can be achieved by avoiding or limiting stationary lighting in high value areas, restricting lighting duration, shielding to direct light more precisely, lowering intensity of lights, and changing the spectral composition (Gaston et al. 2012). Specific lighting guidelines have been developed to reduce effects on wildlife (Department of Climate Change, Energy, the Environment and Water 2023) and where lighting effects are considered important, lighting can be managed via a specific lighting management plan.

2.4.5 Invasion by Exotic Plants, Pathogens and Animal Pests

Roads can facilitate exotic plant invasions via transportation of seeds, spores or fragments, and by creating corridors of disturbance which are vulnerable to invasion (Christen & Matlack 2009). This effect is particularly severe where weeds using roadside margins were previously absent and are capable of invading surrounding habitats and outcompeting existing native vegetation, thus lowering the quality of habitat available for native fauna and increasing competition/reducing space for native plants (Simcock et al. 2022). Roads can also create corridors used by pests and pathogens into otherwise less accessible habitat (Murphy and Dowding 1994; Delgado et al. 2017).

Invasion into disturbed areas and via roads has already occurred on the Buller Plateaux where heath rush (*Juncus squarrosus*) and gorse (*Ulex europaeus*) are widespread on road margins and in disturbed habitats. Weed invasion can be reduced by:

- Use of already disturbed areas;
- Location of roads away from areas most vulnerable to weed invasion (low growing or sparse vegetation);
- Monitoring of weeds, including for new incursions, and prompt attention to weed control; and
- Revegetation with native species at disturbed sites along margins to reduce opportunities for weed invasion.

Appropriate biosecurity measures can avoid introducing pests and pathogens, particularly cleaning of large vehicles and earth moving machinery coming from offsite. Increased pest access can be mitigated by undertaking pest control along road margins.

2.4.6 Edge Effects

Roads modify habitats by creating new edges, which can alter the existing edges, add to the extent of edge habitats and create zones with increased light and wind, which in turn affects temperature and humidity. These effects can extend for some distance into the surrounding habitats (Davies-Colley et al 2000). The extent and magnitude of edge effects depends on the original vegetation type and the species present. Norton (2002) found microclimate edge effects extended up to 20m from the edge of forest fragments, although

effects extended to 70m for sensitive flora such as ferns and bryophytes and up to 100m for pest predators.

Roadside plantings, particularly of hardy and 'bushy' species where ecologically appropriate can help to protect or 'seal' the edge of newly exposed forested areas (Denyer et al. 2006).

2.4.7 Mobilisation of Sediment and Water Runoff

Roads increase surface run off by decreasing infiltration of rainfall, altering hydrological regimes and increasing sedimentation and erosion (Gudino-Elizondo et al. 2018). This can pollute and degrade receiving waters and negatively affect aquatic life (Waters 1995). The placement of roads, can also alter catchments and divert water, adversely affecting freshwater habitats such as wetlands and streams. Use of sediment retention ponds and planting and maintenance of roadside vegetation can help to settle suspended particles and slow runoff (Mrowiec 2016, Baldauf 2017).

3.0 Species that might be affected by the Upper Waimangaroa Haul Road

3.1 Context

The proposed UWHR is described in Section 1.2, and the effects of roading and approaches to mitigation are summarised in Section 2. This section identifies the species present and considers how the expected effects would manifest along the UWHR and how the species present might be affected. Due to a lack of specific evidence of the effects of roads on the particular suite of species present, we have based this assessment on traits which are known to be risk factors and species known to be affected by roads elsewhere.

In terms of assessing likely effects, the Project Description sets out that coal haulage is based on c. 70-minute return cycle time per load (average speed of 40 kmph). There will be variable speed restrictions across the road length, determined by road design, operating conditions, other users and the types of vehicles. There will be an overall maximum limit of 80 km/h for some vehicles in some sections. Average speeds will likely be much lower than this due to the meandering nature of the road and associated sightlines and stopping distances. We have assumed that the current road management at Stockton Mine would apply with respect to dust management.

We have also factored into our consideration the presence of the Waimangaroa River as a natural barrier to small, poorly mobile fauna. We have focussed here specifically on operational effects rather than construction effects.

3.2 Potentially Vulnerable Species

3.2.1 Introduction

Fauna known or considered likely to occur within the UWHR route and considered vulnerable to the effects of roads are listed in Table 2. Each species has been assessed against the attributes which contribute to WVC listed in Section 2.2.2.

Table 2: Species known or likely to be present within the UWHR footprint and considered likely to be vulnerable to roading impacts.

	WVC		Direct Effects	Indirect Effects
	Risk factor for WVC	WVC Risk[1]		
Birds				
Threatened – Nationally Endangered				
Kea (*Nestor notabilis*)	Behaviour, road attraction.	Low	Risk of collision	Increased pests, pollution
Threatened – Nationally Vulnerable				
Great spotted kiwi/rōroa (*Apteryx haastii*)	Nocturnal, flightless, freeze response, large home range.	Moderate	Habitat loss, risk of collision, possibly fragmentation	Lighting, noise, increased pests
At Risk – Declining				
New Zealand pipit/pīhoihoi (*Anthus novaeseelandiae novaeseelandiae*)	Road attraction, habitat preference.	Low	Risk of collision	Noise, increased pests
Not Threatened				
Kererū (*Hemiphaga novaeseelandiae*)	Low flight paths	Low	Habitat loss, risk of collision	Noise, increased pests
Weka (*Gallirallus australis*)	Flightless, habitat preference, crepuscular (predominantly dawn and dusk active)	Moderate	Habitat loss, risk of collision, possibly fragmentation	Lighting, noise, increased pests

[1] All species are likely to be subject to the direct effect of construction mortality, depending on the specific habitats affected and the timing of habitat clearance. Therefore, construction effects are not included as a line item for each species individually here.

	WVC		Direct Effects	Indirect Effects
	Risk factor for WVC	WVC Risk[2]		
Lizards				
Threatened – Nationally Vulnerable				
West Coast green gecko *(Naultinus tuberculatus)*	Low mobility, cathemeral (irregularly active at any time of day), potentially attracted to road for basking (heliothermic).	Moderate	Habitat loss, risk of collision, fragmentation	Lighting, noise, increased pests, pollution
At Risk – Declining				
Forest gecko (*Mokopirirakau granulatus*)	Low mobility, nocturnal, potentially attracted to road for basking (heliothermic). Fragmentation.	Moderate	Habitat loss, risk of collision, fragmentation	Lighting, noise, increased pests, pollution
Speckled skink (*Oligosoma newmani*)	Low mobility, potentially attracted to road for basking (heliothermic). Fragmentation.	Moderate	Habitat loss, fragmentation, risk of collision	Lighting, noise, increased pests, pollution
Snails				
Threatened – Nationally Critical	**Risk factor**			
Powelliphanta patrickensis	Low mobility, nocturnal. Fragmentation.	High	Habitat loss, Fragmentation, risk of collision	Noise, increased pests, pollution

[2] All species are likely to be subject to the direct effect of construction mortality, depending on the specific habitats affected and the timing of habitat clearance. Therefore, construction effects are not included as a line item for each species individually here.

3.2.2 Birds

Three species of birds of conservation concern occur in and around the UWHR footprint, as well as two species which are not threatened, but are also considered vulnerable to road effects. The species known or likely to be present and are considered vulnerable to roading effects are listed in Table 2.

Kiwi are vulnerable to roadkill and habitat fragmentation (Simcock et al. 2022). Their vulnerability is increased by their behavioural traits, since they are nocturnal, flightless, have large home ranges (c. 60 – 80ha) and can exhibit a freeze response. Great spotted kiwi/rōroa are known to occur in and around the UWHR route. Rōroa have a population of c. 14,000 birds spread across approximately 850,000ha (approximately one bird per c. 61ha) (Toy et al. 2021, Roroa Practitioner Group 2021). Rōroa are classified as 'Threatened – Nationally Vulnerable', and are declining primarily due to stoat predation (Robertson et al. 2021). Territories on and near the Buller Plateaux are exceptionally large (≥ 80ha) and typically include a range of habitat types (McLennan 2020).

Instances of WVC with rōroa have been rare over the recent history of mining activity on the Buller Plateaux with two fatalities recorded at Stockton Mine in the last approximately 20 years (L. Maguire, MBC Environmental, pers. comm.). This number is relatively low, despite home ranges of multiple birds overlapping existing road networks and mining areas and regular reports of drivers seeing rōroa using or near the road. This indicates that despite the risk factors for rōroa, the overall risk is likely to be low. Compared to roads that have caused high kiwi mortality elsewhere, roads on the Buller Plateaux have low traffic volumes and are travelling at low speed which greatly reduces their risk to rōroa.

Other bird species present include those adapted to forests, shrublands and open areas, although numbers on the Buller Plateaux are generally lower than in the surrounding habitats which are typically more fertile (Overmars et al. 1998, Ecological Solutions Limited 2025b). Forest birds are considered to be of low risk of collision mortality because they are highly mobile and generally avoid roads, furthermore the UWHR does not bisect tall forest habitats at any point.

Pākihi shrubland provides habitat for South Island fernbird. Black shag (*Phalacrocorax carbo*) and little shag (*Phalacrocorax melanoleucos*) are characteristic of major rivers in the ED and may be present at low densities in the Upper Waimangaroa Valley. Long-tailed cuckoo (*Eudynamys taitensis*) are also seasonally present and likely use densely forested areas nearby, where one of their host species, brown creeper (*Mohoua novaeseelandiae*) are present.

Species of low or open habitat such as fernbird and pipit are potentially vulnerable to the impacts of roads, due to the potential creation of favourable habitats at roadside margins. The behaviour of pipit increases their risk, as they show low avoidance behaviours and preferentially select recently disturbed habitats around earthworks and road edges (Beauchamp 2019). The behaviour of fernbird, flying close to the vegetation, often from plant to plant, would reduce their risk because they would likely not cross the road. The low speed of vehicles using the UWHR would reduce the risk to pipit.

3.2.3 Long-tailed Bats

Bats are potentially vulnerable to a wide range of road effects. However, bats are unlikely to be exposed to risk of effects from UWHR because they are not known to be present. Bats (presumed long-tailed bats) were recorded in the Happy Valley area (Upper Waimangaroa River) on the Buller Coal Plateau in 1997 (Thomas et al. 1997), but have not been detected since in the plateau or surrounding areas since, despite survey effort to detect them (Buckingham 1999; Thomas & Toft 2002; Waybacks & Wildlife Solutions 2008).

3.2.4 Lizards

The Buller Plateaux and Waimangaroa Valley provide habitat for forest gecko ('At Risk – Declining') West Coast green gecko ('Threatened – Nationally Vulnerable') and speckled skink ('At Risk – Declining') (Hitchmough et al. 2021).

Though there is a lack of evidence about the effect of roads on lizard populations in New Zealand, lizards have been recorded in the iNaturalist Roadkill Project and are considered at risk of WVC and fragmentation of habitats at the UWHR. Lizards have poor ability to avoid collision due to low mobility and fright freeze behaviour. In addition, they may be thermally attracted to some road surfaces, and particularly sensitive to chemical pollutants (Andrews et al. 2006). The iNaturalist Roadkill Project contains perhaps the best evidence of WVC of lizards in a New Zealand context (see Table 1). Though reported in low numbers there is a high diversity of lizard species collected. They are very likely under-represented compared with larger animals due to the likely low detection rate of small animals (Underhill & Angold 2000). That database includes mortality of species within the same genera (*Naultinus* and *Oligosoma*) as those found near the UWHR, although none of the three species present have been recorded. Lizards are also at risk of population fragmentation, because the low probability of successfully crossing the road means that the population could become disconnected. The chance of lizards successfully crossing the road is reduced by the width and open nature of the road, relative to lizard home ranges, and by the fact lizards would be too small for drivers to see and too slow moving to avoid WVC. The low number of vehicles would reduce the risk for lizards somewhat.

3.2.5 Snails

Powelliphanta are a group of large carnivorous land snails with at least 20 species and 59 sub-species (Walker 2018). Predation by pests, especially possums, predation by native animals such as weka, habitat degradation and climate change are thought to be causing population declines of *Powelliphanta* (Walker 2003, Walker et al. 2024). The conservation status of 28 taxa worsened to 'Threatened – Nationally Critical' in the most recent assessment, including the two present on the Buller Plateaux (Walker et al. 2024).

The frequency with which snails use roads is currently uncertain and would be the main determinant of their risk of WVC. Road construction may pose a threat to *Powelliphanta patrickensis*, principally due to loss and degradation of habitat. Predation by thrushes (*Turdus philomelos*) and loss of habitat due to the upgrading of the narrow road to the Oparara Arch in Kahurangi National Park are thought to have contributed to the decline of *P. annectens* which occur from the Oparara River near Karamea, to Gunner Downs south of the Heaphy River (Walker et al. 2024). Road mortality was also considered an important factor in population decline of *Powelliphanta lignaria lusca,* due to locally high mortality on the new Karamea Highway through prime snail habitat at Happy Valley Saddle (Walker et al. 2024). There is one record of WVC of snail from the related genus *Paryphanta* (kauri snails) in the iNaturalist Roadkill Project (Table 1).

Powelliphanta patrickensis (Threatened – Nationally Critical, Walker et al. 2024) is the only species present near the UWHR. This species is confined to the infertile, poorly drained Brunner coal measures of the Buller Plateaux and occurs patchily from the headwaters of St Patrick Stream south to Mt Rochfort. Previous surveys have found a high density of *P. patrickensis* on the east (true left) side of the Waimangaroa River (Buckingham 1998), although this is close to the edge of the species distribution as noted above and set out in Walker (2003).

P. patrickensis may lose habitat within the road footprint, and have habitat degraded at the road margin and a short distance beyond. It is clear that any snails using the road would be at high risk of mortality due to their slow mobility and small size which would make them undetectable to drivers. However, the road routes do not provide, nor bisect, ideal snail

habitat, since *P. patrickensis* require low vegetation for overhead cover and as a substrate. The UWHR is located near the distribution edge. Together these factors would make crossings less likely, and the effect is likely to be a reduction in the known range, rather than fragmentation per se, although the distribution does extend further east near Cypress Mining Area and Burnett's Face as discussed above, so fragmentation may be an issue.

4.0 Recommendations

4.1 Introduction

Based on our review, the key drivers of effects on wildlife due to roading include road design, road location, vehicle speed, driver behaviour, life history characteristics of particular species, habitat quality adjoining the road and the presence of bridges or other pre-existing wildlife routes. The level of effects can be influenced by good road design, appropriate construction management and ongoing operational management practices. Each of these factors is considered in more detail below.

4.2 Road Design

The best time to reduce overall effects is when considering and planning road placement and construction, since this can mitigate or amplify other effects once construction and operation proceed. Placement of the UWHR should avoid or minimise features which can create roadkill blackspots as described in Section 2.2.2. This includes consideration of road width, road location, gradient, habitats adjoining the road and their relative value, the species present, and the location and nature of bridges.

A major landscape feature in relation to the UWHR and its potential effects on wildlife, is the Waimangaroa River. The river likely represents an existing barrier to rōroa, lizards and snails to varying, but unknown, degrees. This was considered in Ecological Solutions Limited (2025a) and contributed to selection of the true left route.

For lizards and snails for which the road would be an impermeable barrier, road placement close to the river would remove and/or bisect the smallest amount of habitat. Placement near the river might also reduce the risk of WVC by reducing the likelihood of crossing attempts. For any animals 'orphaned' between the road and the river however, fragmentation and WVC effects are likely to be severe and the best outcome for those individuals and species might be to salvage and relocate them to suitable habitats nearby. Ecopassages to connect any areas of large or important habitat remaining between the river and road would be unlikely to assist the species most affected by the road (lizards and snails), because of their poor mobility.

For rōroa, habitat loss and fragmentation would depend on the specific home ranges of the resident individuals. This could be informed by a radio-tracking study and decisions made with respect to the degree to which individual birds would be affected. Provision of ecopassages (in the form of extended stream crossings and/or dry crossings) might assist juvenile rōroa dispersing across the landscape to cross the road, but in the absence of an understanding of the cues rōroa use for moving across the landscape, these would need to be relatively frequent to ensure they were located by birds wanting to cross the road. Given that rōroa are regularly reported crossing mine roads at Stockton, the presence of ecopassages is unlikely to provide significantly greater protection.

Assessment of the relative value of the habitats within and adjoining the footprint contributed to the selection of the true left route and therefore avoidance of the higher value habitats on the true right of the Waimangaroa River (Ecological Solutions Limited 2025a). This approach will have avoided direct habitat loss for those habitats on the true right. In

addition, the route on the true left of the Waimangaroa River which was selected will not require multiple bridges over the Waimangaroa River which could create WVC blackspots for species travelling up and down the river such as shags.

The UWHR route generally closely follows the Waimangaroa River, reducing the amount habitat fragmentation, although potentially increasing its impact on animals or populations existing between the river and road. At some locations the Waimangaroa River meanders away from the road creating fragments up to 40ha in extent. Other management approaches discussed below are of particular importance where habitat exists between the road and river.

4.3 Construction Management

4.3.1 Species Management

Species and habitat management techniques already deployed at Stockton Mine for vegetation removal including direct transfer of vegetation, search and salvage for lizards and snails and radio tracking of rōroa combined with pre-clearance surveys would reduce the risk of direct effects on fauna species due to construction.

4.3.2 Construction Elements

Ecopassages

Ecopassages in the form of dry/empty culverts spaced along the UWHR could theoretically reduce fragmentation and WVC effects, allow safe passage of rōroa and weka and enable movements of snail and lizards, though use by these species is uncertain, particularly for lizards and snails which are poorly mobile. Due to the low effectiveness of ecopassages without funnelling (Taylor & Goldingay 2010) (such as by fencing), use of ecopassages alone is not recommended.

Extended Crossings

Although ecopassages are most effective when combined with barriers, the extended crossing style passage uses natural animal behaviour to partially address the lack of funnelling without fencing (Taylor & Goldingay 2010). In addition, extended crossings could possibly be added to existing crossings at relatively low cost.

The available literature suggests that extended crossings are more effective than ecopassages alone, due to the funnelling effect for animals which tend to follow streams and other linear landscape features. The UWHR will cross a number of watercourses of various sizes and extended stream crossings or similar could assist in reducing the risk of WVC for species such as rōroa and weka, and for flighted species such as shags which would move along the waterways. Extended crossings also mitigate the increased risk of WVC which can occur at bridges (Lesbarreres & Fahrig 2012).

Since neither weka nor rōroa are likely to move preferentially along streams, and given that use of mine roads has not been shown to be a significant cause of mortality for either species to date, extended crossings are not considered necessary.

Barriers

Barriers serve to either prevent animals from entering the road or divert and focus them to cross at particular (safe) locations. Safe crossings are most effective with highly mobile species, whilst barriers could prevent even poorly mobile species from entering roads, but would also effectively create separate subpopulations bisected by the barrier, unless managed. Barriers are not recommended for the UWHR.

Exclusion fencing would prevent rōroa, lizards and snails from using the road however it would exacerbate fragmentation impacts for those species. Given the risk of WVC for rōroa and weka can be reduced by other means, including speed limitation, barriers are not justified.

Determining the magnitude of WVC on lizards and snails in this context would require detailed monitoring via regular and frequent searches for carcasses and live individuals. We are only aware of one West Coast green gecko ever being recorded dead on Fly Creek Road at Stockton Mine, although the cause of death was unknown. It would depend on the frequency of crossing attempts and/or mortality whether construction of a barrier would mitigate these effects. It seems unlikely that WVC is significant for lizards or snails, and more likely that they are affected by habitat fragmentation and loss.

Snails and lizards have small home ranges and are poorly mobile. The width of the UWHR (16.7m) may mean that lizards and snails attempting to cross the UWHR via an ecopassage devoid of food or habitat would not be successful, even if such passages were present. The appropriateness of barriers for lizards and snails is difficult to assess, but given they could adversely affect other species, barriers are not recommended for the UWHR.

4.4 Operational Management

4.4.1 Vehicle speed

While the success of speed restrictions on public roads can be limited, this is generally due to poor driver adherence to posted limits (Glista et al. 2008). Since the UWHR would be used by mine employees or contractors, vehicle speeds can be reliably controlled. An average speed of 40km/hr on Stockton Mine roads would significantly reduce the risk of WVC for rōroa and other birds compared to higher speeds. Data from Beauchamp (2009) suggests each 10km/hr increase in the speed of vehicles would approximately double the wildlife mortality. Limiting the use of the road at night would reduce this risk further.

The low mobility and detectability of snails and lizards means speed limitation would not reduce the risk of WVC for these species.

4.4.2 Noise

Road noise can be mitigated by limiting vehicle speeds. Den Boer & Schroten (2007) considered that the optimal speed for reducing road noise was 40-50 km/hr, however there is no reliable evidence with respect to the noise level above which wildlife living within the UWHR route would be affected.

4.4.3 Dust

The existing dust management at Stockton Mine in general and specifically Cypress Mining Area is sufficient to avoid visible build-up of dust and therefore any likely effects on vegetation or fauna (Ecological Solutions Limited 2025e).

4.4.4 Lighting

Lighting effects can be minimized via management of light usage via a lighting management

plan. This would include eliminating stationary lights wherever possible, shielding and directing lights where they are required, using fewer lights at less attractive wavelengths to wildlife.

4.4.5 Increased access for weeds and pests

Weed invasion can be reduced by placement of roads away from areas most vulnerable to weed invasion and this has been considered in route selection (Ecological Solutions Limited 2025a). Monitoring for new weed invasions and prompt control of new weed infestations is also required. Weed management for the wider Buller Plateaux, including the UWHR Project sub-area is set out in the Weed Management Plan for the BCPCP. Revegetation with native species, either via planting or VDT, along margins which are not to be intensively managed can reduce opportunities for weed invasion.

Control of pest mammal species along the UWHR would reduce the effects of these predators and pests and this is proposed as part of site management (Alliance Ecology Limited 2025b).

4.4.6 Species Relocation

Wildlife movements across the UWHR are expected to be low, and mostly consist of movements by mobile animals which have low to moderate vulnerability to WVC such as forest birds, or rōroa and weka. Management of vehicle speed is expected to address the risk to these animals. The placement of the UWHR alongside the Waimangaroa River has the potential to disconnect small areas of habitat from each other, creating isolated habitat fragments.

For more sedentary, or poorly mobile, species, fragmentation effects are expected to be high or very high, depending on their distribution in relation to the road. Although ecopassages might address this habitat fragmentation, it remains unknown whether they would be effective. Alternatively, if sub-populations of lizards or snails were confirmed to be isolated by the road, episodic relocations of small numbers of individuals from one side of the road to the other could reduce fragmentation effects (particularly on the population genetics). The value of this approach has not been confirmed anywhere, but at least in theory, this could restore connectivity and prevent loss of genetic diversity by enabling flow of individuals (and genes) across the road. Research would be required to determine the level of relocation required (i.e., number of individuals, frequency of relocation, direction of relocation and the like) and measure the effectiveness of this approach.

4.5 Monitoring

Monitoring of rōroa in the vicinity of the proposed road is likely to be required prior to construction in order to mitigate construction effects. Given the low risk to rōroa due to low traffic volume and speed, ongoing monitoring of rōroa surrounding the UWHR is unlikely to be required.

Survey of existing mine or other roads (e.g., at Denniston) for either live snails and lizards or carcasses in advance of UWHR construction could provide evidence about the risks to these species posed by the UWHR, which is currently uncertain. Such survey would need to be sufficiently frequent to represent a real chance of detecting WVC before they are removed by predators or natural decay. Given that these animals are not expected to frequently attempt to use or cross roads, since they prefer vegetation cover, the chances of detecting WVC and accurately attributing the cause of mortality is very low. On the basis of current evidence, WVC for lizards and snails seems unlikely, with much greater effects due to habitat loss and/or fragmentation/isolation of habitats. On that basis, management of effects should focus on addressing habitat removal and fragmentation.

5.0 Summary

The proposed Upper Waimangaroa Haul Road could negatively affect fauna directly, through mortality during construction and WVC during operation, as well as indirectly through loss, fragmentation and/or degradation of habitat via habitat removal, discharges of contaminants and edge effects. Planning of road placement can reduce, but not eliminate, these effects. Monitoring of wildlife mortality associated with roads (particularly WVC) both within New Zealand and internationally has identified that a range of species are affected to varying (usually unknown) degrees. Mitigations which have been attempted internationally in order address effects on wildlife include:

- Reducing vehicle speed;
- Barrier fencing;
- Including ecopassages in road construction (sometimes with barrier fencing);
- Providing extended stream ecopassages; and
- Lighting, noise and dust management.

The efficacy of these approaches has generally not been measured, and although intuitively sensible, it remains unknown whether they are effective at reducing effects or not. The strongest evidence, including that collected in New Zealand, relates to limiting vehicle speeds to reduce WVC. Monitoring of individual home ranges of rōroa around the footprint, as occurs elsewhere during mine development, would inform efforts to reduce effects during construction.

With respect to speed, limiting vehicle speed to 80km/hr (with an average speed of 40km/hr due to road conditions and vehicle type), and providing for dust suppression and lighting management would substantially reduce associated effects at the UWHR.

The use of extended stream passages and/or dry culverts as ecopassages at construction would be relatively low cost and might afford some species, such as weka and rōroa, protection from WVC in particular, but is unlikely to reduce effects on poorly mobile species such as lizards and snails, which would be unlikely to come in contact with an ecopassage, and if they did, would take substantial time to use it to cross the road. Given effects on weka and rōroa are expected to be negligible, the use of ecopassages is not recommended.

The degree to which populations of poorly mobile species such as lizards and snails might become fragmented remains unknown, but could be high. This effect would be reduced to some extent via the placement of the road near the Waimangaroa River, and the use of ecopassages where habitat exists on both sides of the road is unlikely to assist these poorly mobile species in moving across the road to any meaningful degree. Episodic relocation of individuals or, alternatively, salvage and relocation of as many individuals as possible to suitable habitat elsewhere prior to or soon after construction could reduce the population level effects (particularly genetic effects) on those species, although this remains untested as well and would require research to inform the effort required.

Avoiding high weed risk areas as part of route planning, combined with effective weed and pest control and replanting of any areas not required to be kept cleared would reduce any adverse effects due to weeds and is proposed within the site environmental management plans for the BCPCP.

6.0 References

Aburrow, K., Moffat, D., Bega, S., & Clarke, K. (2023). What is wrong with wildlife fencing and what should we do? A review of fencing guidance for reptiles and amphibians. *Authorea Preprints*.

Alliance Ecology Limited (2025a in prep.). Offset report.

Alliance Ecology Limited (2025b). Pest Control and Elimination Plan, Buller Coal Continuation Project. Unpublished draft report prepared for Bathurst Resources Limited.

Andrews, K. M., Nanjappa, P., & Riley, S. P. (Eds.). (2015). Roads and ecological infrastructure: Concepts and applications for small animals. JHU Press.

Andrews, K. M., Gibbons, J. W., & Jochimsen, D. M. (2006). Literature synthesis of the effects of roads and vehicles on amphibians and reptiles. *Synthesis*.

Baldauf, R. (2017). Roadside vegetation design characteristics that can improve local, near-road air quality. *Transportation research part D: Transport and environment*, *52*, 354-361.

Beauchamp, A.J. (2009). Bird deaths on Riverside Drive between Whangarei and Onerahi, New Zealand. *Notornis* 56:95-97.

Beauchamp, A. J. (2019). New Zealand pipit (*Anthus n. novaeseelandiae*) nesting and breeding behaviour in urban Onerahi, Whangarei. *Notornis*, *66*, 200-209.

Benítez-López, A., Alkemade, R., & Verweij, P. A. (2010). The impacts of roads and other infrastructure on mammal and bird populations: a meta-analysis. *Biological conservation*, *143*(6), 1307-1316.

Bennett, V. J. (2017). Effects of road density and pattern on the conservation of species and biodiversity. *Current Landscape Ecology Reports*, *2*, 1-11.

Bignal, K. L., Ashmore, M. R., Headley, A. D., Stewart, K., & Weigert, K. (2007). Ecological impacts of air pollution from road transport on local vegetation. *Applied Geochemistry*, *22*(6), 1265-1271.

Bramley, G.N & Veltman, C. (2000). Directions for future management of North Island Weka *Gallirallus australis greyi* to improve survival and productivity in situ. Bird Conservation International (2000) 10:241–253.

Brockie, R. E. (2007). Notes on New Zealand mammals 4. Animal road-kill “blackspots”.

Brockie, R. E., Sadleir, R. M. F. S., & Linklater, W. L. (2009). Long-term wildlife road-kill counts in New Zealand. *New Zealand Journal of Zoology*, *36*(2), 123–134. https://doi.org/10.1080/03014220909510147

Buckingham, R.P. (1998). Surveys for *Powelliphanta* land snails in the upper Waimangaroa Valley, Blackburn-Orikaka pākihi, Mount Stockton and Mount Rochfort localities, South Island West Coast, New Zealand. Contract report No. 24/1 prepared for Solid Energy International by Wildlife Surveys. 11 pp. Plus maps.

Buckingham, R.P. (1999). A survey for birds and bats in Inangahua Working Circle (Beech Working Circle 2). Wildlife Surveys contract report No. 25/2 for Timberlands West Coast New Zealand Limited, Greymouth. 146 pp plus maps.

Christen, D. C., & Matlack, G. R. (2009). The habitat and conduit functions of roads in the spread of three invasive plant species. *Biological invasions*, *11*, 453-465.

Clarke, G. P., White, P. C., & Harris, S. (1998). Effects of roads on badger (*Meles meles*)

populations in south-west England. *Biological conservation*, *86*(2), 117-124.

Clevenger, A. P., Chruszcz, B., & Gunson, K. E. (2001). Highway mitigation fencing reduces wildlife-vehicle collisions. *Wildlife society bulletin*, 646-653.

Cousins, R. A. (2010). Kererū (*Hemiphaga novaeseelandiae*)-Impact injuries, morphometrics, moult and plumage. *Unpublished MSc). Massey University, Palmerston North, New Zealand*.

Cuperus, R., Canters, K. J., de Haes, H. A. U., & Friedman, D. S. (1999). Guidelines for ecological compensation associated with highways. Biological conservation, 90(1), 41-51.

Davies-Colley, R. J., Payne, G. W., & Van Elswijk, M. (2000). Microclimate gradients across a forest edge. *New Zealand Journal of Ecology*, 111-121.

Delgado, J. D., Abreu-Yanes, E., Abreu-Acosta, N., Flor, M. D., & Foronda, P. (2017). Vertebrate ticks distribution and their role as vectors in relation to road edges and underpasses. *Vector-Borne and Zoonotic Diseases*, *17*(6), 376-383.

Den Boer, L. C., & Schroten, A. (2007). Traffic noise reduction in Europe. *CE delft*, *14*, 2057-2068.

Denneboom, D., Bar-Massada, A., & Shwartz, A. (2024). Wildlife mortality risk posed by high and low traffic roads. *Conservation Biology*, *38*(2), e14159.

Denyer, K., Burns, B., & Ogden, J. (2006). Buffering of native forest edge microclimate by adjoining tree plantations. *Austral Ecology*, *31*(4), 478-489.

Department of Climate Change, Energy, the Environment and Water. (2023). National Light Pollution Guidelines for Wildlife, Department of Climate Change, Energy, the Environment and Water, Canberra, May 2023.

Department of Conservation. (2024). Five kea killed by vehicles on Milford Road. Available at https://www.doc.govt.nz/news/media-releases/2024-media-releases/five-kea-killed-by-vehicles-on-milford-road/. Accessed 28 October 2024.

Department of Conservation Lizard Technical Advisory Group. (2019). Key principles for lizard salvage and transfer in New Zealand.

Dodd Jr, C. K. (1991). Drift fence-associated sampling bias of amphibians at a Florida sandhills temporary pond. Journal of Herpetology, 296-301.

Ecological Solutions Limited 2025a. Upper Waimangaroa Haul Road Options Assessment. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. Kāeo, Northland. In prep.

Ecological Solutions Limited 2025b. Buller Coal Plateau Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited. Kāeo, Northland. In prep.

Ecological Solutions Limited 2025c. Conservation Prioritisation at the Buller Coal Plateau. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited. Kāeo, Northland. In prep.

Ecological Solutions Limited 2025d. Buller Coal Plateau Vegetation Mapping. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. Kāeo, Northland. In prep.

Ecological Solutions Limited 2025e. Cypress Mining Area Annual Vegetation Monitoring Report 2025. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited. Kāeo, Northland.

Eftestøl, S., Tsegaye, D., Herfindal, I., Flydal, K., & Colman, J. E. (2014). Measuring effects

of linear obstacles on wildlife movements: accounting for the relationship between step.

Eigenbrod, F., Hecnar, S. J., & Fahrig, L. (2008). Accessible habitat: an improved measure of the effects of habitat loss and roads on wildlife populations. *Landscape Ecology*, *23*, 159-168. length and crossing probability. *European Journal of Wildlife Research*, *60*, 271-278.

Fahrig, J. H. Pedlar, S. E. Pope, P. D. Taylor, and J. F. Wegner. (1995). Effect of road traffic on amphibian density. Biological Conservation 73:177–182.

Forman, R. T. (2005). Good and bad places for roads: effects of varying road and natural pattern on habitat loss, degradation, and fragmentation.

Forman, R. T., & Deblinger, R. D. (2000). The ecological road-effect zone of a Massachusetts (USA) suburban highway. *Conservation biology*, *14*(1), 36-46.

Forman, R. T., Sperling, D., Bissonette, J. A., Clevenger, A. P., Cutshall, C. D., Dale, V. H., & Winter, T. C. (2003). Road ecology. *Science and solutions*, 482.

Freeman, S. (2010). Western weka road-kill at Cape Foulwind, Buller, New Zealand. *New Zealand Journal of Zoology, 37*(2), 131–146.

Gaston, K. J., Davies, T. W., Bennie, J., & Hopkins, J. (2012). Reducing the ecological consequences of night-time light pollution: options and developments. *Journal of Applied Ecology*, *49*(6), 1256-1266.

Gibbs, J. P., & Shriver, W. G. (2005). Can road mortality limit populations of pool-breeding amphibians?. *Wetlands Ecology and Management*, *13*, 281-289.

Gibbs, J. P., & Shriver, W. G. (2002). Estimating the effects of road mortality on turtle populations. *Conservation Biology*, *16*(6), 1647-1652.

Gill, B. J. (2006). Post-mortem examination of New Zealand pigeons (*Hemiphaga novaeseelandiae*) from the Auckland area. *New Zealand Journal of Zoology*, *33*(1), 31-37.

Glista, D. J., DeVault, T. L., & DeWoody, J. A. (2008). Vertebrate road mortality predominantly impacts amphibians. *Herpetological conservation and Biology*, *3*(1), 77-87.

Goad, D., Middlemiss, K., Cieraad, E., Duke, K., Bell, H., Le Lec, M., & Taylor, G. (2023). MIT2022-06 Light mitigation: Reducing vessel interactions with seabirds Final Report.

Gudino-Elizondo, N., Biggs, T. W., Bingner, R. L., Yuan, Y., Langendoen, E. J., Taniguchi, K. T., & Liden, D. (2018). Modelling ephemeral gully erosion from unpaved urban roads: Equifinality and implications for scenario analysis. *Geosciences*, *8*(4), 137.

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson, G.B., Reardon, J.T., van Winkel, D., Rolfe, J. and Michel, P. 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35. Department of Conservation, Wellington. 15 pp.

Hobday, A. J. (2010). Nighttime driver detection distances for Tasmanian fauna: informing speed limits to reduce roadkill. *Wildlife Research*, *37*(4), 265-272.Jones, M. E. (2000). Road upgrade, road mortality and remedial measures: impacts on a population of eastern quolls and Tasmanian devils. *Wildlife research*, *27*(3), 289-296.

Hocken, A. G. (2000). Cause of death in blue penguins (*Eudyptula m. minor*) in North Otago, New Zealand, *New Zealand Journal of Zoology, 27*:4, 305-309.

Hosseini, S. A. O., Zandi, S., Fallah, A., & Nasiri, M. (2016). Effects of geometric design of

forest road and roadside vegetation on traffic noise reduction. *Journal of forestry research*, *27*, 463-468.

Hwang, H. M., Fiala, M. J., Park, D., & Wade, T. L. (2016). Review of pollutants in urban road dust and stormwater runoff: part 1. Heavy metals released from vehicles. *International Journal of Urban Sciences*, *20*(3), 334-360.

iNaturalist. (2020). Roadkill Project New Zealand. Available at (https://inaturalist.nz/projects/roadkill-new-zealand). Accessed 11 November 2024.

Jackson, N. D., & Fahrig, L. (2011). Relative effects of road mortality and decreased connectivity on population genetic diversity. *Biological Conservation*, *144*(12), 3143–3148.

Jones, M. E. (2000). Road upgrade, road mortality and remedial measures: Impacts on a population of eastern quolls and Tasmanian devils. Wildlife Research, 27, 289–296. https://doi.org/10.1071/wr98069.

Kapfer, J. M., & Paloski, R. A. (2011). On the threat to snakes of mesh deployed for erosion control and wildlife exclusion. *Herpetological Conservation and Biology*, *6*(1), 1-9.

Kimmerer, R. (2013). *Braiding sweetgrass: Indigenous wisdom, scientific knowledge and the teachings of plants*. Milkweed editions.

Kunz, B. K., Little, E. E., & Barandino, V. L. (2021). Aquatic toxicity of chemical road dust suppressants to freshwater organisms. *Archives of environmental contamination and toxicology*, 1-12.

Lesbarreres, D., & Fahrig, L. (2012). Measures to reduce population fragmentation by roads: what has worked and how do we know?. *Trends in ecology & evolution*, *27*(7), 374-380.

Little, S. J., Harcourt, R. G., & Clevenger, A. P. (2002). Do wildlife passages act as prey-traps?. *Biological Conservation*, *107*(2), 135-145.

Longcore, T., Rodríguez, A., Witherington, B., Penniman, J. F., Herf, L., & Herf, M. (2018). Rapid assessment of lamp spectrum to quantify ecological effects of light at night. Journal of Experimental Zoology Part A: Ecological and Integrative Physiology 329:8-9.

Mabin M. (2012). Statement of evidence of Mark Charles Grace Mabin. Prepared for West Coast Environmental Network Incorporated, Royal Forest and Bird Society of New Zealand Incorporated, West Coast Regional Council and Buller District Councils and Buller Coal Limited. Dated 7 June 2012.

McLennan, J. (2020). Great Spotted Kiwi on the Buller Plateau: Distribution, habitat-use and conservation status. Commissioned by Bathurst Resources Ltd.

Mrowiec, M. (2016). Road runoff management using improved infiltration ponds. *Transportation Research Procedia*, *14*, 2659-2667.

Murphy, E. C., & Dowding, J. E. (1994). Range and diet of stoats (*Mustela erminea*) in a New Zealand beech forest. *New Zealand Journal of Ecology*, 11-18.

Nathan, S., Rattenbury, M.S., and Suggate, R.P. (compilers). 2002. Geology of the Greymouth area. Institute of Geological & Nuclear Sciences 1:250,000 geological map 12. Institute of Geological & Nuclear Sciences, Lower Hutt. 1 sheet and 58pp.

Niemi, M., Jääskeläinen, N. C., Nummi, P., Mäkelä, T., & Norrdahl, K. (2014). Dry paths effectively reduce road mortality of small and medium-sized terrestrial vertebrates. *Journal of environmental management*, *144*, 51-57.

Norton, D. A. (2002). Edge effects in a lowland temperate New Zealand rainforest. Bulletin, New Zealand, (No.27), Wellington, DOC Science Internal Series, (33 pp.),

Department of Conservation.

Olsson, M. P., & Widen, P. (2008). Effects of highway fencing and wildlife crossings on moose Alces alces movements and space use in southwestern Sweden. *Wildlife Biology*, *14*(1), 111-117.

Ortega, C. P. (2012). *Effects of noise pollution on birds: a brief review of our knowledge. Ornithol Monogr 74: 6–22*.

Overmars, F.B., Kilvington, M.J. and Gibson, R.S. (1998). Ngakawau Ecological District: Survey report for the Protected Natural Areas Programme. New Zealand Protected Natural Areas Programme Series No. 11. Department of Conservation, Hokitika. 178 pp.

Parris, K. M., & Schneider, A. (2009). Impacts of traffic noise and traffic volume on birds of roadside habitats. *Ecology and society*, *14*(1).

Rattenbury, M.S., Cooper, R.A and Johnston, M.R. (compilers). (1998). Geology of the Nelson area. Institute of Geological & Nuclear Sciences 1:250,000 geological map 9. 1 sheet and 67pp. Institute of Geological & Nuclear Sciences, Lower Hutt.

Rea, R. V., Johnson, C. J., & Emmons, S. (2014). Characterizing moose–vehicle collision hotspots in northern British Columbia. *Journal of Fish and Wildlife Management*, *5*(1), 46-58.

Reck, H., & van der Ree, R. (2015). Insects, snails and spiders: The role of invertebrates in road ecology. *In:* Handbook of Road Ecology; van der Ree, R., Smith, D.J., Grilo, C., Eds.; Wiley-Blackwell: Chichester, UK, 2015; pp. 247–257.

Robertson, H. A., Baird, K. A., Elliott, G., Hitchmough, R., McArthur, N., Makan, T. and Michel, P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. Department of Conservation, Te Papa Atawhai.

Rodríguez, A., Holmes, N. D., Ryan, P. G., Wilson, K. J., Faulquier, L., Murillo, Y., and Corre, M. L. (2017). Seabird mortality induced by land-based artificial lights. *Conservation Biology*, *31*(5), 986-1001.

Romin, L. A. (1994). Factors associated with the highway mortality of mule deer at Jordanelle Reservoir, Utah.

Roroa Practitioner Group (2021). Roroa / great spotted kiwi (*Apteryx maxima*) species plan 2019–2029. Department of Conservation, Nelson. 42 p.

Rytwinski, T., & Fahrig, L. (2015). The impacts of roads and traffic on terrestrial animal populations. *Handbook of road ecology*, 237-246.

Rytwinski, T., Soanes, K., Jaeger, J. A., Fahrig, L., Findlay, C. S., Houlahan, J., & van der Grift, E. A. (2016). How effective is road mitigation at reducing road-kill? A meta-analysis. *PLoS one*, *11*(11), e0166941.

Sadleir, R. M., & Linklater, W. L. (2016). Annual and seasonal patterns in wildlife road-kill and their relationship with traffic density. *New Zealand journal of zoology*, *43*(3), 275-291.

Sager, M. (2020). Urban soils and road dust—civilization effects and metal pollution—a review. *Environments*, *7*(11), 98.

Seigle-Ferrand, J., Marchand, P., Morellet, N., Gaillard, J., Hewison, A. J. M., Saïd, S., Chaval, Y., Santacreu, H., Loison, A., Yannic, G., & Garel, M. (2022). On this side of the fence: Functional responses to linear landscape features shape the home range of large herbivores. *Journal of Animal Ecology*, *91*(2), 443–457. https://doi.org/10.1111/1365-2656.13633

Seiler, A., & Helldin, J. O. (2006). Mortality in wildlife due to transportation. In *The ecology of transportation: Managing mobility for the environment* (pp. 165-189). Dordrecht: Springer Netherlands.

Shannon, G., McKenna, M. F., Angeloni, L. M., Crooks, K. R., Fristrup, K. M., Brown, E., Warner, K. A., Nelson, M. D., White, C., Briggs, J., McFarland, S., Wittemyer, G. (2016). A synthesis of two decades of research documenting the effects of noise on wildlife. Biological Reviews, 91(4), 982–1005.

Simcock, R., Innes, J., Samarasinghe, O., Lambie, S., Peterson, P., Glen, A., & Faville, N. (2022). *Road edge-effects on ecosystems: A review of international and New Zealand literature, an assessment method for New Zealand roads, and recommended actions*.

Siqueira, H. E., Pissarra, T. C. T., do Valle Junior, R. F., Fernandes, L. F. S., & Pacheco, F. A. L. (2017). A multi criteria analog model for assessing the vulnerability of rural catchments to road spills of hazardous substances. *Environmental Impact Assessment Review*, *64*, 26-36.

Summers, P. D., Cunnington, G. M., & Fahrig, L. (2011). Are the negative effects of roads on breeding birds caused by traffic noise?. *Journal of Applied Ecology*, *48*(6), 1527-1534.

Taylor, B.D., and Goldingay, R.L. (2010). Roads and wildlife: Impacts, mitigation and implications for wildlife management in Australia. Wildlife Research, 37, 320–331.

Templeton, L. and McMorran, T. (2020). Geomorphological Assessment of the Stockton Plateau. Unpublished report prepared for Bathurst Resources Limited by Golder Associates. 15 pp.

Thomas, B. and Toft, R.J. (1997). Surveys for Fauna in the Upper Waimangaroa Valley. Prepared by Landcare Research for Kingett Mitchell and Associated Ltd.

Thomas, B., Toft, R.J., and Mason, R. (1997). Fauna of the Proposed Northern Opencast Development, Waimangaroa Valley, Buller Coalfield. Landcare Research.

Toy, R., Toy, S., MacKenzie, D., Simister, K., Yong, S. (2021). Distribution of great spotted kiwi (*Apteryx maxima*), 2012–2021 Notornis, 2021, Vol. 68: 1-18. The Ornithological Society of New Zealand Inc.

Underhill, J. E., & Angold, P. G. (2000). Effects of roads on wildlife in an intensively modified landscape. *Environmental Reviews*, *8*(1), 21–39. https://doi.org/10.1139/er-8-1-21.

Walker, K. J. (2003). Recovery plans for *Powelliphanta* land snails. Threatened Species Recovery Plan (Vol. 49, pp. 208). Wellington: Department of Conservation.

Walker, K. J. (2018). Systematics and phylogeography of the large land snail *Powelliphanta*: a thesis presented in fulfilment of the requirements for the degree of Doctor of Philosophy in Zoology, Massey University, New Zealand (Doctoral dissertation, Massey University).

Walker, K., Walton, K., Edwards, E., Hitchmough, R., Payton, I., Barker, G. and Michel, P. (2024). Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and snails). Part 3. Rhytididae (carnivorous snails), 2022.

Wareing, R., Bull, J., Chiles, S., & Jackett, R. (2022). Optimising New Zealand's State highway low-noise road surface. *Romanian Journal of Transport Infrastructure*, *11*(1).

Waters, T. F. (1995). Sediment in streams: sources, biological effects, and control. American Fisheries Society Monograph, Bethesda, Maryland, 7, 79-118.

Weller, C. (2015). Construction of roads and wildlife mitigation measures: pitfalls and opportunities. *Handbook of road Ecology*, 60-64.

West Coast Penguin Trust (2023). Pahautane Penguin Fence. Available at https://www.westcoastpenguintrust.org.nz/projects/pahautane-penguin-fence/. Accessed 28 October 2024.

White, P. C., & Harris, S. (1994). Encounters between red foxes (*Vulpes vulpes*): implications for territory maintenance, social cohesion and dispersal. *Journal of Animal Ecology*, 315-327.

Wilson, K. J. (2016). A Review of the Biology and Ecology and an Evaluation of Threats to the Westland Petrel *Procellaria westlandica. Charleston, NZ: West Coast Penguin Trust. [Available online at: http://www. bluepenguin. org. nz/wp-content/uploads/Westland-petrel-threats-report-June-2016-Kerry-Jayne-Wilson1. pdf.*

Wu, C. H., & Elias, D. O. (2014). Vibratory noise in anthropogenic habitats and its effect on prey detection in a web-building spider. *Animal Behaviour*, *90*, 47-56.

APPENDIX J

Upper Waimangaroa Haul Road (UWHR) Options Assessment (Ecological Solutions Limited 2026j)

ecoLogical solutions ltd

brightwater, nelson

e: rbodley@ecologicalsolutions.co.nz

w: www.ecoogicalsolutions.co.nz

20 December 2024

(Revised 6 August 2025)

Bathurst Resources Limited

[redacted]

Attention: [redacted]

Upper Waimangaroa Haul Road (UWHR) Options Assessment

Introduction

Bathurst Resources Limited (including its subsidiary companies BT Mining Ltd, Bathurst Coal Ltd, and Buller Coal Ltd) (collectively referred to here as 'Bathurst') are seeking approvals through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('BPCP', or the Project'). A component of the Project is the Upper Waimangaroa Haul Road ('UWHR'), which would be used to enable transportation of coal from the Extended Escarpment mining area on the Denniston Plateau to the Coal Handling and Processing Plant ('CHPP') at Stockton Mine, as well as for movement of plant and personnel between sites.

Two potential haul road routes through the Upper Waimangaroa Valley were considered by Bathurst, one on the true left and one on the true right of the Waimangaroa River. The haul road would be c. 19km long, but only c. 7km would affect greenfield sites, the balance being an upgrade of an existing 4WD track. The vegetation types within the greenfield sections of the two options provided to Ecological Solutions Limited in August 2024 are shown in Figure 1. The true right option occupies 22.71ha, while the true left option has a slightly smaller footprint, covering 21.63ha.

Ecological Solutions Limited were commissioned in late 2024 to assess the ecological values of habitat and fauna within the greenfield section of each potential route, in order to assist in determining the likely level of relative effects for each alternative routes and inform project planning. This assessment was completed in December 2024 using information available at that time and this letter was updated in August 2025 to accompany the application for resource consent.

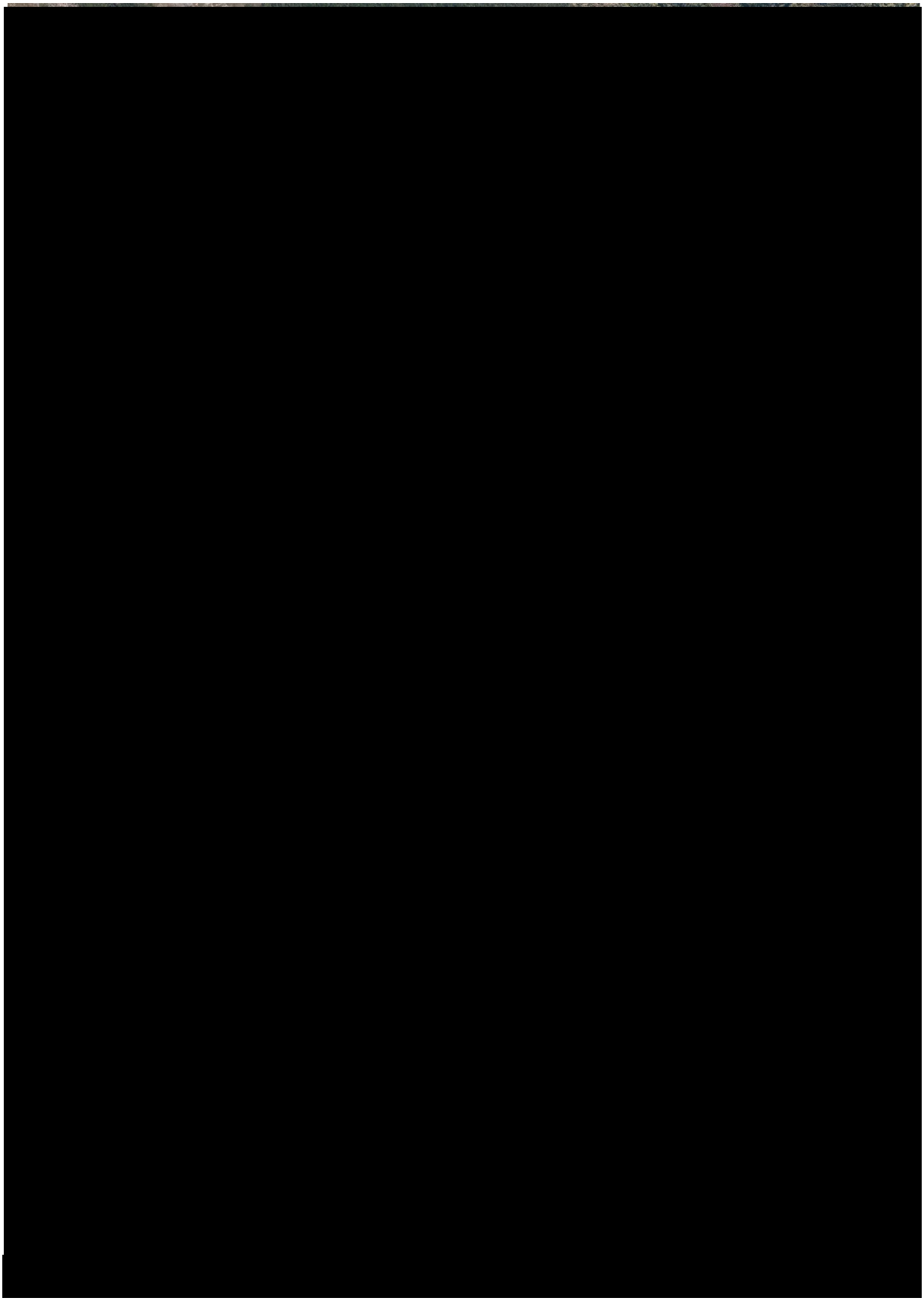


Figure 1: Vegetation types with the greenfield sections of the alternative proposed Upper Waimangaroa Haul Road routes.

Methodology

Introduction

A generally accepted approach to assessing ecological values and determining ecological effects in New Zealand is the application of the Ecological Impact Assessment (EcIA) guidelines (Roper-Lindsay et al. 2018), which assists with assessing values and effects in a consistent and transparent way. The method involves assigning both ecological value and a magnitude of effect on a 5-point scale ('very low' to 'very high'), which feeds into a matrix to provide an overall level of effect (also on a five-point scale). The difficulty in using this approach for this particular assessment is that the ecological values present within each haul road option, and the magnitude of effect for each option, are very similar and the resulting overall level of effect would be unlikely to reflect the relative difference in the effects of the route options at the fine scale required.

In the absence of a model or template in the literature, for this assessment we developed a scoring system using four different attributes in order to provide a quantitative score for each option which could then be compared.

The four attributes scored for each route option were:

- The likelihood that each vegetation type within the route supported a species of conservation concern.
- The extent of naturally uncommon ecosystems.
- The extent of wetlands.
- The vulnerability of each vegetation type to weed invasion.

The details of our approach are set out in Appendix A and Appendix B. To summarise:

- Existing information about the actual and potential vegetation, habitats and fauna present within the potential greenfield construction sections each of the alternative proposed haul road options was compiled from relevant previous surveys, reports and databases.
- The vegetation and habitat types within each route option were identified and mapped using our recent Buller Plateaux-wide vegetation map (Ecological Solutions Limited, 2025). We included an additional 25m either side of each footprint to account for edge effects.
- For the purposes of this assessment, we have estimated a riparian zone to be approximately 2m either side of the Waimangaroa river and other smaller watercourses. This area is intended to capture the area of shaded rocky stream banks and additional associated rock in these locations which provide habitat for some species of interest, particularly bryophytes.
- Once the extent of each vegetation type present along each alternative route had been calculated, it was then scored for each of the four factors outlined in Table 1 and described below.

Table 1. Factors considered for each alternative route.

Description of factor considered	Score
Likelihood of the presence of 'threatened' or 'at risk' species of flora and fauna. 'Species of conservation concern score'	Expressed as the combined average score (per fauna group) of species of conservation concern within each habitat type (refer to detailed methodology) **multiplied by** the total extent of that habitat type within each route (including a 25m buffer).
Naturally uncommon ecosystems present.	Expressed as the total extent (ha) of naturally uncommon ecosystems within each route (including a 25m buffer).
Wetlands present.	Expressed as the total extent (ha) of wetlands within each route (including a 25m buffer).
Weed invasion risk score	Expressed as the weed vulnerability score of each habitat type (refer to detailed methodology) **multiplied by** the total extent of that habitat type within the 25m wide buffer each road route (excluding the haul road footprint).

Species of Conservation Concern

Species of conservation concern may occur throughout any of the vegetation types present. For that reason, we scored each vegetation type according to the number of species of conservation concern that are known to use that particular vegetation type as habitat. Habitat value was assigned for 'Threatened' and 'At Risk' species of vascular plant, bryophytes, lichens, avifauna, lizards, *Powelliphanta* snails and other terrestrial invertebrates. Aquatic flora, fish and freshwater invertebrates were not included.

For each 'threatened' and 'at-risk' species, a value from 0 - 1 was derived for the vegetation type, based on the likelihood of occupancy and the suitability of that habitat for each species being considered. Appendix B provides the completed table setting out the scores used. Once each species was assigned a score, the scores were averaged for each fauna or flora group and then combined (i.e., added) to give an overall habitat score for each vegetation type. The higher the score, the more species of conservation concern the vegetation type is likely to support. The maximum score of 7 would indicate that all species of conservation concern known to occur within the Stockton and the Denniston Plateaux (together referred to as the Buller Plateaux) would use that particular vegetation type as core habitat.

A score of 3.5 was considered high, and indicates that around half of the species of conservation concern known to inhabit the area would occur within that vegetation type.

The final habitat score was multiplied by the extent of that vegetation type within each respective route in order to provide a route specific 'species of conservation concern score'. A higher score indicates that construction of that route would remove more important habitat for species of conservation concern than a route with a lower score.

Naturally Uncommon Ecosystems

The extent of naturally uncommon ecosystems present within each alternative route was calculated using the Buller Plateaux vegetation map completed by Ecological Solutions Limited (2025). All the 'bare rock' mapped was considered to be sandstone erosion pavement for the purposes of this assessment. This is likely to overstate the amount of sandstone pavement present slightly, since this land cover type also included minor elements of talus, boulderfields and rocky margins of watercourses.

Tarns, seepages and flushes are also naturally uncommon ecosystems known to occur on the Buller Plateaux, and may be present within each haul road option, but were not separately mapped.

Tarns are small lakes, which in the context of the Buller Plateaux, are embedded amongst the sandstone erosion pavement landscape. The extent of tarns is likely to be captured within the extent of habitat classed as sandstone pavement and/or within the low pākihi vegetation type.

Seepages and flushes have a limited extent across the Buller Plateaux, being present on hillslopes, gullies and among red tussock vegetation in Happy Valley. Due to the difficulty in mapping small, sometimes ephemeral features like seepages these have not been considered here; however, they may exist within the alternative routes.

The score for naturally uncommon ecosystems was expressed as the total extent (hectares) of sandstone pavement and pākihi within each option plus a 25m buffer.

Wetlands

With respect to wetlands, the following vegetation types were defined as wetlands for the purposes of this assessment:

- Mānuka-mountain beech-podocarp shrubland;
- Mānuka-tussock-wire rush shrubland;
- Tussock-flax shrubland; and
- Low pākihi.

These vegetation types had vegetation, hydrology and/or soil features characteristic of wetlands (Ecological Solutions Limited 2025). The two pākihi groups met all the criteria to be considered a 'natural inland wetland' in terms of the National Policy Statement for Freshwater Management (2020 and subsequent amendments). Although the vegetation tests for the mānuka-mountain beech-podocarp shrubland were ambiguous, they were considered to meet the hydrology and soil tests. The red tussock fen sub-type of the tussock-flax shrubland exists on the flat terraces along the Waimangaroa River.

The score for wetlands was expressed as the total area (hectares) of wetlands within each option plus a 25m buffer.

Weed Invasion Risk

The risk of weed invasion was assessed for vegetation adjoining the road footprint (between the footprint and the outer edge of the 25m wide buffer) and scored on a scale from 0 - 1. A low score indicated a vegetation/ habitat type that was highly resistant to invasion, while a high score indicated low resistance to invasion. The weed invasion score for each vegetation type was then multiplied by the total area of that vegetation type within each footprint to give a weed risk score.

Scores for weed risk for the vegetation types present adjacent to the road footprint were as follows;

- Mixed beech-podocarp-broadleaved forest: **0** (low vulnerability)
- Southern rātā-mountain beech-podocarp forest: **0.25**
- Mānuka-mountain beech-podocarp shrubland: **0.5**
- Weed Shrubland: **0.5**
- Moderate height mānuka-tussock-wire rush shrubland: **0.5**

- Low pākihi: **1** (high vulnerability)
- Tussock-flax shrubland: **1**
- Sandstone pavement: **0.75**
- Riparian: **0.5**
- Open water: **0**
- Cleared vegetation: **1**

Habitat within the Proposed Haul Road Routes

The extent of each vegetation/habitat type within the alternative haul road routes is summarised in Table 2 and shown in Figure 1 (in Introduction). Each vegetation type is described in more detail in 'Buller Plateaux Vegetation Mapping' (Ecological Solutions Limited 2025).

Vegetation accounts for over 99% (22ha) of the extent of the true left haul road route and buffer, with open water and cleared vegetation accounting for <1%. Both forest types and pākihi were the most widespread vegetation types, since this route intersects the colluvial toe slopes of the Mt William range and gently sloping terraces along the Waimangaroa River as shown in Figure 1.

Vegetation accounts for 90% (21ha) of the extent of the true right haul road route with bare rock (sandstone erosion pavement), cleared vegetation and open water accounting for the remaining 10%. Short forest (i.e., Southern rātā-mountain beech-podocarp forest) and pākihi were the most common vegetation type within this route as shown in Figure 1.

The true left route was dominated by mixed beech-podocarp-broadleaved forest in the northern section. The true right route featured red tussock wetlands in the northern part. These wetlands appear to be fed by small watercourses originating in sandstone pavement to the west.

Table 2: Extent of each vegetation type within the alternative Upper Waimangaroa Haul Road routes.

Vegetation type	True left		True right	
	Total (ha)	25m buffer only (ha)	Total (ha)	25m buffer only (ha)
Mixed beech-podocarp-broadleaved forest	5.52	3.88	0.85	0.69
Southern rātā-mountain beech-podocarp forest	6.54	4.84	7.23	4.76
Mānuka-mountain beech-podocarp shrubland	2.46	1.82	0.35	0.34
Weedy shrubland	-	-	0.53	0.32
Mānuka-tussock-wire rush shrubland	6.40	4.48	7.65	5.26
Low pākihi	0.11	0.11	1.06	0.80
Tussock-flax shrubland	0.12	0.09	2.29	1.78
Sandstone pavement	-	-	0.31	0.27
Cleared vegetation	0.18	0.06	1.23	0.69
Water	0.09	0.09	0.65	0.56
Riparian	0.23	0.19	0.57	0.45
Total	**21.63**	**15.57**	**22.71**	**15.93**

Species of Conservation Concern

Species of conservation concern may be present within any of the vegetation types present. A summary of the vegetation types and their respective habitat scores for species of conservation concern is provided in Table 3.

Vegetation types that scored the highest included both pākihi types and tussockland (all of which were also considered to be wetlands). These habitats had scores ranging between 3.53 and 3.62. The high scores could be attributed to the likelihood of these habitats providing primary or core habitat for the majority of vascular plants of conservation concern and for lizards and snails, with known records. These habitats were also important for terrestrial invertebrates, birds (particularly fernbird*, Poodytes punctatus*), bryophytes and lichens.

Southern rata-mountain beech-podocarp forest and mānuka-mountain beech-podocarp shrubland also scored highly with scores of 2.84 and 2.71 respectively. Both habitat types were considered important for lizards and bryophytes, the former also provides important habitat for birds such as South Island robin (*Petroica australis*) and rōroa (*Apteryx maxima*).

The removal of these vegetation types is likely to have a greater impact on species of conservation concern (and therefore, greater overall level of effect) than the removal of the other habitat types within the proposed footprints.

The average species score per vegetation type multiplied by the extent of each vegetation type within the different route options is presented in Table 4. The true right alignment has a higher score, indicating it would affect more habitat that is important for species of conservation concern than the true left option.

Naturally Uncommon Ecosystems

There are at least five naturally uncommon ecosystems present within the Ngakawau Ecological District, two of which (sandstone erosion pavement and pākihi wetlands) occur within the footprint of the true right UWHR alignment. The true left alignment route of the UWHR contains 6.51ha of naturally uncommon ecosystems, all of which is pākihi. The true right alignment route contains 9.02ha of naturally uncommon ecosystems (0.31ha of sandstone erosion pavement and 8.71ha of pakihi) as shown in Figure 2.

It is possible that tarns exist within the proposed routes, but these would be captured within the sandstone erosion pavement category or low pākihi as stated above. Both of these habitat types are also considered naturally uncommon ecosystems in their own right. Seepages and flushes may also be present, but are not considered here.

Part of the reason these habitats are important, is their irreplaceability, and there are limits to what can practically be achieved to mitigate or offset effects on these environments. The loss of naturally uncommon ecosystems would have a greater overall level of effect than the loss of other more common or more easily replaceable habitat types within the proposed haul road footprints.

Table 3: Average habitat score by species group for the habitats present within the alternative UWHR routes.

	Tall forest	Short forest	Shrubland		Pākihi		Tussockland				
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy Shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland	Sandstone pavement	Riparian	Open water	Cleared vegetation
Vascular plants	0.13	0.23	0.20	0.11	0.27	0.44	0.44	0.16	0.17	0.00	0.07
Lizards	0.75	0.75	0.83	0.50	1.00	1.00	1.00	0.83	0.00	0.00	0.08
Snails	0.00	0.25	0.50	0.25	1.00	1.00	1.00	0.00	0.25	0.00	0.00
Birds	0.47	0.53	0.25	0.14	0.36	0.28	0.39	0.28	0.17	0.11	0.08
Terrestrial invertebrates	0.25	0.33	0.33	0.00	0.46	0.46	0.42	0.21	0.08	0.25	0.00
Bryophytes	0.25	0.75	0.59	0.06	0.47	0.44	0.28	0.16	0.66	0.00	0.00
Lichens	0.00	0.00	0.10	0.00	0.55	0.30	0.45	0.65	0.00	0.00	0.00
Total Score (Max 7)	**1.85**	**2.84**	**2.71**	**1.07**	**3.56**	**3.62**	**3.53**	**1.63**	**1.33**	**0.36**	**0.25**

Table 4: Average habitat score multiplied by area of habitat type.

	Tall forest	Short forest	Shrubland		Pākihi		Tussock land					
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy Shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland	Sandstone pavement	Riparian	Open water	Cleared vegetation	Total
True Left	10.20	18.56	6.68	0.00	22.79	0.40	0.42	0.00	0.31	0.03	0.04	**59.39**
True Right	1.57	20.52	0.95	0.56	27.24	3.83	8.08	0.51	0.76	0.23	0.29	**64.26**

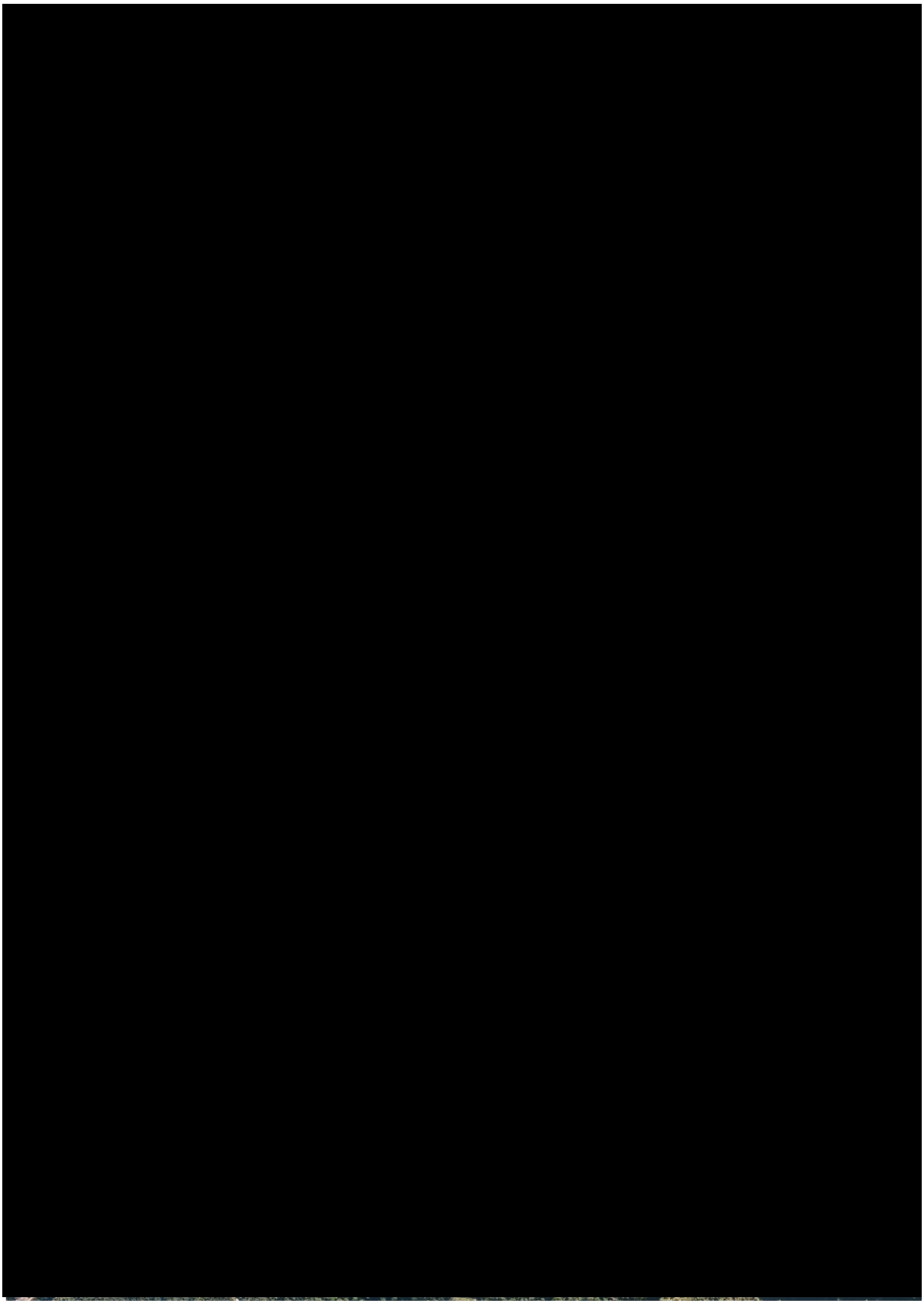


Figure 2: Location of naturally uncommon ecosystems within the proposed alternative routes.

Wetlands

Wetlands are present within both proposed routes, but are more common in the true right alignment as shown in Figure 3. There is approximately 9.1ha of wetland in the true left route and 11.4ha of wetland in the true right route. Pākihi vegetation and tussockland accounts for 85% of wetland extent in the true left route and 97% of wetland extent in the true right route.

Wetlands are a habitat type that has been severely reduced in extent. By 2008, wetlands were estimated to have declined to 10.1% (about 250,000ha) of the estimated pre-human extent of 2,471,080ha – with swamps[1] particularly affected. Policy 6 of the National Policy Statement for Freshwater Management 2020 (and subsequent amendments) promotes the protection and enhancement of natural inland wetlands and the avoidance of further loss of extent.

Weed Invasion Risk

Vulnerability to weed invasion can vary between vegetation types depending on the relative competitiveness of existing native plants and communities against potential invaders (Hulme 2020). This is an important consideration because roads can provide pathways for invasion, which can potentially spread from road margins into surrounding habitats. Vulnerability depends on weed species traits and tolerances and relative competitiveness of existing native vegetation in that context.

The weed invasion risk scores, multiplied by the total extent of each vegetation type within the buffer area are shown in Table 5.

The true right route has a higher combined weed invasion risk score than the true left alignment (7.28 vs. 4.59). Adopting the true right route would likely expose more vulnerable habitats to weed infestation than the true left route.

[1] https://www.stats.govt.nz/indicators/wetland-extent/ Accessed 19/12/2024.

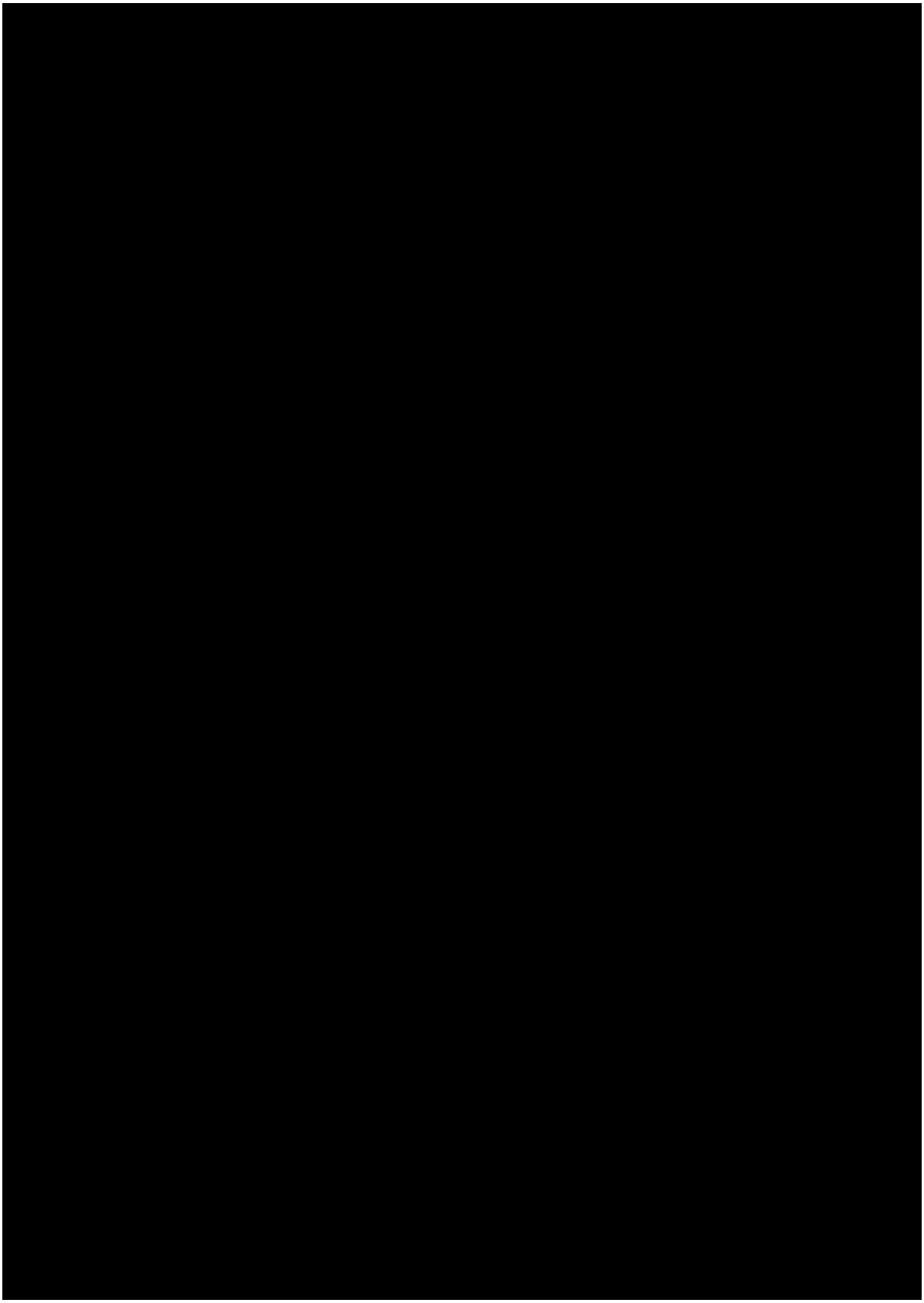


Figure 3: Wetlands by vegetation type within the 25m buffer adjoining the proposed alternative road routes.

Table 5: Weed invasion risk scores.

	Tall forest	Short forest	Shrubland		Pākihi		Tussockland					
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy Shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland	Sandstone pavement	Riparian	Open water	Cleared vegetation	Total Score
True Left	0.00	1.21	0.91	0.00	2.24	0.11	0.09	0.00	0.03	0.00	0.19	**4.58**
True Right	0.00	1.19	0.17	0.16	2.63	0.80	1.78	0.20	0.35	0.00	0.45	**7.28**

Conclusions

Based on our assessment set out above, the true right scores higher in all of the factors considered. The footprint of this route occupies a larger area, provides more valuable habitat for species of conservation concern, contains a greater extent of naturally uncommon ecosystems and wetlands, and the vegetation surrounding it is more vulnerable to weed invasion. This is primarily attributable to the larger areas of low and open vegetation and habitat types present within and adjoining the true right route which are less common within and adjoining the true left route, which is predominantly forested.

Table 6 below provides a summary of scores with commentary.

Table 6: Summary of scoring for alternative road routes.

	True Left	True Right	Outcome	Commentary
Total area (ha)	21.65	22.72	True Right + 1.07	The true left alignment is marginally smaller in terms of overall area based on the shape files provided in August 2024.
Species score	59.39	64.26	True Right + 4.88	True left alignment has a lower overall species score. This indicates using this route would affect less of the highest priority habitats (i.e., those which are home to threatened and at-risk species).
Naturally uncommon ecosystems (ha)	6.51	9.02	True Right + 2.51	The true left alignment would remove a smaller amount of naturally uncommon ecosystems.
Wetlands (ha)	9.09	11.35	True Right + 2.26	The true left alignment would remove less wetland habitat.
Weed invasion risk score	4.59	7.28	True Right + 2.69	The true left alignment has a lower weed vulnerability score, meaning the habitats exposed by the creation of the haul road are less vulnerable to weed invasion than those that would be exposed if the haul road was constructed on the true right alignment.

To summarise, we consider the true left route would have a lower overall level of effects on the ecological values of the area than the true right route. If you have any questions, please contact the author.

Sincerely

[redacted]

Senior Ecologist

[redacted]

References

Ecological Solutions Limited. 2025. Buller Plateaux Vegetation Mapping. Unpublished report prepared for Bathurst Resources Limited, August 2025.

Hulme, P. E. 2020. Plant invasions in New Zealand: global lessons in prevention, eradication and control. Biological Invasions 22: 1539 – 1562.

Landcare Research 2012. Naturally Uncommon Ecosystems. https://www.landcareresearch.co.nz/publications/naturally-uncommon-ecosystems/. Accessed 1 May 2024.

Vegetation and Landcover Within the Haul Road Footprint

The vegetation within the proposed UWHR route options was mapped following a recent survey of the Buller Plateaux and surrounds which used data from 152 RECCE plots (Hurst et al. 2022) and high-resolution drone images to map and describe 13 vegetation types derived from non-metric multidimensional scaling ordinations (Ecological Solutions Limited, 2025a). The 13 vegetation types were mapped using training samples that informed the classification of segmented polygons. These mapped vegetation types were overlayed onto the proposed UWHR route options to inform this survey.

Scoring

Introduction and Overview

Our assessment of the proposed UWHR routes involved assigning four scores to each option for comparison. The four scores generated captured:

- Species of conservation concern,
- Weed invasion risk,
- Naturally uncommon ecosystems present,
- Wetlands.

The methods used to develop the species of conservation concern and weed vulnerability scores are described in greater detail below.

Species of Conservation Concern Score

The species of conservation concern included in scoring were those listed as either 'threatened' or 'at-risk in the applicable Department of Conservation New Zealand Threat Classification Series (de Lange et al. 2024, de Lange et al. 2020, de Lange et al. 2018, Grainger et al. 2018, Hitchmough et al. 2021, Hoare et al. 2017, Robertson et al. 2021, Trewick et al. 2022, Walker at al. 2024).

The habitat value of each vegetation and land cover type was assigned a score from 0 – 1 for each individual species of conservation concern based on the suitability for, and likelihood of occupancy by, that species. Each individual species score is presented in Appendix B.

The score for each individual species was then averaged within the following groups:

- Vascular plants,
- Bryophytes,
- Lichens,
- Avifauna,
- Lizards,
- *Powelliphanta* snails,
- Other terrestrial invertebrates.

Each average group score was then combined (i.e., added) to give a species of conservation score for each vegetation or landcover type.

The species of conservation score per vegetation or landcover type was then multiplied by the extent of the corresponding vegetation or land cover type within each haul road option, and combined (i.e., added) to give an overall value score for each option.

The sources of information and method of scoring each species of conservation concern were as follows:

Source of Species Distribution and Habitat Preference Information

The information used to derive species scores was sourced from the Buller Plateaux Contextual study (Ecological Solutions Limited 2025b) which synthesised the available ecological surveys from the Ngakawau Ecological District and Buller Plateaux to describe the ecological values of the Buller Plateaux and the context in which they are located. The study summarised the available literature and survey information on flora, bryophytes, lichens, terrestrial invertebrates, avifauna and lizards.

Species scores for vascular and non-vascular plant species of conservation concern were supplemented by information from the New Zealand Plant Conservation Network (NZPCN).

Species scores for lizards were workshopped by the authors and Dr Matt Baber (Alliance Ecology Limited).

Flora

A scoring system was used to assess habitat/vegetation type suitability and the likelihood of occurrence of each species for each vegetation type. The scoring system is set out in Table 7.

Table 7. Flora species scoring system.

Score	Description
0	Unsuitable habitat.
0.25	Marginal habitat. No evidence of vegetation type being suitable for said species, but possibility of occurrence based on structure, composition, hydrology or other environmental variables associated with the vegetation type.
0.5	Likely suitable habitat, but lacking occurrence records within that vegetation type, A broad description of vegetation type was provided in surveys. Habitat preference was derived from NZPCN or other sources not specific to the Buller Plateaux.
0.75	Preferred habitat as evidenced from descriptions in surveys/studies undertaken within the Buller Plateaux and surrounds, but lacking location data
1	Preferred habitat with confirmed record of species within that vegetation type on the Buller Plateaux and surrounds (e.g. herbarium records, survey data or georeferenced photographs).

Fauna

The habitat value of each vegetation type for fauna was assessed using a scoring system on the same scale as flora, with slight modification of criteria as shown in Table 8, to capture the temporal and spatial use of habitats as fauna move across the Buller Plateaux.

This mobility varies between fauna groups and to a lesser extent between species, though the high heterogeneity of the habitats at the Buller Plateaux means that even less mobile species may travel between multiple vegetation types. Detectability of fauna also varies and increases the degree of uncertainty.

Table 8. Fauna species scoring system.

Score	Description
0	Unsuitable habitat. Records may exist, although occupancy is expected to be limited to movements between other habitat types.
0.25	Marginal or occasional habitat. Near the edge of habitat requirements, may be used infrequently and is of minor importance to species requirements.
0.5	Suitable secondary habitat. Provides habitat of value, though occupancy is not permanent or at lower densities than primary habitat.
0.75	Suitable primary habitat. Likely to support permanent populations, though preferred habitat exists elsewhere.
1	Preferred primary or obligate habitat.

Weed Risk

The risk of weed invasion was considered for vegetation surrounding the road footprint (between the footprint and 25m from the edge of the footprint) on a 5-point scale from 0 – 1 as set out in Table 9. A low score indicated a vegetation/habitat type that was highly resistant to an uncontrolled invasion of the main light demanding weed species present on the Buller Plateaux (for example gorse, health rush), while a high score indicated low resistance to invasion. The weed invasion score for each vegetation/ habitat type was then multiplied by the total extent of that habitat type within each footprint, to give a final score.

There are shade tolerant weed species present throughout the Buller Plateaux, although they are not as commonly encountered as the light demanding species noted above and they are not currently considered to pose as high a risk to indigenous communities. The consideration of invasion of shade tolerant species would likely result in different scores to those included here.

Table 9. Weed risk scoring system.

Score	Description
0	Highly resistant to invasion due to deep shade, leaf litter layer, root competition and soil conditions.
0.25	Resistant to invasion, with local opportunities for invasion that recede with time.
0.5	Minor displacement of natives, weeds may be persistent.
0.75	Partial dominance and displacement of native vegetation with persistent weeds.
1	Low resistance to invasion, displacement of natives and exotic dominance is likely without control.

References:

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

de Lange, P.J., Glenny, D., Frogley, K., Renner, M.A.M., von Konrat, M., Engel, J.J., Reeb, C. and Rolfe, J.R. 2020. Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31. Department of Conservation, Wellington. 30 pp.

de Lange, P., Blanchon, D., Knight, A., Elix, J., Lucking, R., Frogley, K., Harris, A., Cooper, J. and Rolfe, J. 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27. Department of Conservation, Wellington. 64 pp.

Ecological Solutions Limited. 2025a. Buller Plateaux Vegetation Mapping. Prepared for Bathurst Resources Limited, December 2024.

Ecological Solutions Limited. 2025b. Buller Plateaux Contextual Study. Prepared for Bathurst Resources Limited, October 2024.

Grainger, N., Harding, J., Drinan, T., Collier, K., Smith, B., Death, R., Makan, T., and Rolfe, J. 2018. Conservation status of New Zealand freshwater invertebrates, 2018. New Zealand Threat Classification Series 28.

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J.M., Patterson, G.B., Reardon, J.T., van Winkel, D., Rolfe, J. and Michel, P. 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35. Department of Conservation, Wellington. 15 p.

Hoare, R.J.B., Dugdale, J.S., Edwards, E.D., Gibbs, G.W., Patrick, B.H., Hitchmough, R.A and Rolfe, J.R. 2017. Conservation status of New Zealand butterflies and moths (Lepidoptera), 2015. New Zealand Threat Classification Series 20. Department of Conservation, Wellington. 13 pp.

Hurst, J.M. and Allen, R.B. 2007. The RECCE method for describing New Zealand vegetation – expanded manual, version 4. Landcare Research Contract Report (LC0708/029), Manaaki Whenua – Landcare Research, Lincoln.

Robertson, H. A., Baird, K. A., Elliott, G., Hitchmough, R., McArthur, N., Makan, T. and Michel, P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. Department of Conservation, Te Papa Atawhai.

Trewick, s., Hegg, D., Morgan-Richards, M., Murray, T., Watts, C., Johns, P and Michel, P. 2022. Conservation status of Orthoptera (wētā, crickets and grasshoppers) in Aotearoa New Zealand, 2022. New Zealand Threat Classification series 39. Department of Conservation, Wellington 28 pp.

Walker, K., Walton, K., Edwards, E., Hitchmough, R., Payton, I., Barker, G. and Michel, P. 2024. Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and snails). Part 3. Rhytididae (carnivorous snails), 2022.

Appendix B: Species Scoring

Vascular Plants

Species of Conservation Concern (de Lange et al. 2023)	Tall forest	Short forest	Shrubland		Pākihi		Tussockland				
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy shrubland	Mānuka-tussock-wire rush shrubland	J: low pākihi	M: tussock-flax shrubland	Sandstone pavement	Riparian	Open Water	Cleared vegetation
Threatened – Nationally Vulnerable											
Bearded orchid (*Calochilus paludosus*)	0	0	0	0	0.25	0.5	0.5	0	0	0	0
At Risk – Declining											
Bulbinella modesta	0	0	0	0	0.75	0.5	0.5	0	0	0	0
Coal measures tussock (*Chionochloa juncea*)	0	0	0.25	0.25	1	1	1	1	0	0	0.5
Dracophyllum densum	0	0	0	0	0.25	1	0	1	0	0	0.5
Euphrasia wettsteiniana	0	0	0	0	0.25	1	1	0	0	0	0
Long-leaved pimelea (*Pimelea longifolia*)	0	0.25	0.5	0.5	0.5	0.25	0.75	0	0	0	0
Red mistletoe (*Peraxilla tetrapetala*)	0.5	1	0.5	0.25	0	0	0	0	0	0	0
At Risk – Naturally Uncommon											
Astelia subulata	0	0	0	0	0	1	0.5	0	0	0	0
Brachyglottis traversii	0	0	0	0	0.25	1	0.5	1	0.5	0	0.25
Carse's sedge (*Carex carsei*)	0	0	0.25	0.25	0.25	0.5	1	0	0	0	0
Dall's sedge (*Carex dallii*)	0	0	0.25	0.25	1	0.5	1	0	0	0	0
Euphrasia disperma	0	0	0	0	0.25	1	1	0	0	0	0
Hymenophyllum australe	0	0	0	0	0	0	0	0	0.75	0	0
Hymenophyllum pluviatile	0.5	0.5	0.5	0	0	0	0	0	0	0	0
Dwarf rush (*Juncus pusillus*)	0	0	0	0	0.75	0.5	0.5	0	0	0	0
Lobelia fatiscens	0	0	0	0	0	0.25	0.5	0	0.5	0	0.25
Pterostylis humilis	0.5	0.5	0.25	0.25	0.25	0	0	0	0	0	0
Travers horopito (*Pseudowintera traversii*)	0.5	1	0.5	0	0	0	0	0	0	0	0
Schizacme helmsii	0	0	0	0	0.25	0.75	1	0.5	0	0	0
Townsonia deflexa	0.75	0.75	0.5	0.25	0	0	0	0	0	0	0
Sticherus tener	0	0.5	0.5	0.25	0	0	0	0	1	0	0
Sticherus urceolatus	0	0.5	0.5	0.25	0	0	0	0	1	0	0
Total	2.75	5	4.5	2.5	6	9.75	9.75	3.5	3.75	0	1.5
Mean	**0.13**	**0.23**	**0.20**	**0.11**	**0.27**	**0.44**	**0.44**	**0.16**	**0.17**	**0.00**	**0.07**

Lizards

Species of Conservation Concern (Hitchmough et al. 2021	Tall forest	Short forest	Shrubland		Pākihi		Tussockland				
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland	Sandstone pavement	Riparian	Open water	Cleared vegetation
Threatened - Nationally Vulnerable											
West Coast green gecko *(Naultinus tuberculatus)*	1	1	1	0.5	1	1	1	0.75	0	0	0
At Risk - Declining											
Forest gecko *(Mokopirirakau granulatus)*	1	1	1	0.5	1	1	1	0.75	0	0	0
Speckled skink *(Oligosoma newmani)*	0.25	0.25	0.5	0.5	1	1	1	1	0	0	0.25
Total	2.25	2.25	2.5	1.5	3	3	3	2.5	0	0	0.25
Mean	**0.75**	**0.75**	**0.83**	**0.50**	**1.00**	**1.00**	**1.00**	**0.83**	**0.00**	**0.00**	**0.08**

Snails

Species of Conservation Concern (Walker et al. 2022)	Tall forest	Short forest	Shrubland		Pākihi		Tussockland	Sandstone pavement	Riparian	Open water	Cleared vegetation
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland				
Threatened – Nationally Critical											
Powelliphanta patrickensis	0	0.25	0.5	0.25	1	1	1	0	0.25	0	0
Total	0	0.25	0.5	0.25	1	1	1	0	0.25	0	0
Mean	**0**	**0.25**	**0.5**	**0.25**	**1**	**1**	**1**	**0**	**0.25**	**0**	**0**

Birds

Species of Conservation Concern (Robertson et al. 2021)	Tall forest	Short forest	Shrubland		Pākihi		Tussockland				
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland	Sandstone pavement	Riparian	Open water	Cleared vegetation
Threatened – Nationally Endangered											
Kea (*Nestor notabilis*)	0.25	0.25	0	0	0.25	0.25	0.5	0.5	0	0	0
Threatened – Nationally Vulnerable											
Great spotted kiwi *(Apteryx haastii)*	1	1	0.5	0.25	0.25	0.25	1	0.25	0	0	0
Long tailed cuckoo *(Eudynamys taitensis)*	1	1	0.5	0	0.5	0	0	0	0	0	0
South Island kaka *(Nestor meridionalis meridionalis)*	1	0.5	0	0	0	0	0	0	0	0	0
At Risk – Declining											
South Island fernbird *(Bowdleria punctata punctata)*	0	0.5	0.5	0.25	1	0.5	1	0.25	0	0	0
South Island robin *(Petroica australis)*	1	1	0.5	0	0.25	0	0	0	0	0	0
New Zealand pipit *(Anthus novaeseelandiae novaeseelandiae)*	0	0	0.25	0.75	1	1	1	1	0	0	0.75
At Risk – Relict											
Black shag (*Phalacrocorax carbo novaehollandiae*)	0	0.25	0	0	0	0.25	0	0.25	0.75	0.5	0
Little shag (*Phalacrocorax melanoleucos brevirostris*)	0	0.25	0	0	0	0.25	0	0.25	0.75	0.5	0
Total	4.25	4.75	2.25	1.25	3.25	2.5	3.5	2.5	1.5	1	0.75
Mean	**0.47**	**0.53**	**0.25**	**0.14**	**0.36**	**0.28**	**0.39**	**0.28**	**0.17**	**0.11**	**0.08**

Invertebrates

Species of Conservation Concern (Hoare et al. 2017, Grainger et al. 2018, Trewick et al. 2022)	Tall forest	Short forest	Shrubland		Pākihi		Tussockland				
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland	Sandstone pavement	Riparian	Open water	Cleared vegetation
Threatened – Nationally Critical											
Avatar moth (*Arctesthes avatar*)	0	0	0	0	0.5	1	0.75	0.5	0	0	0
Spathula neara (Aquatic flatworm)	0	0	0	0	0.25	0.25	0.75	0.25	0	0.5	0
Threatened – Nationally Endangered											
White-faced cave weta (*Occultastella morgana*)	1	1	1	0	0.5	0	0	0	0	0	0
Threatened – Nationally Vulnerable											
Kokira miharo (aquatic caddisfly)	0	0	0	0	0	0	0	0	0	0.5	0
Rygmodus alienus (water scavenger beetle)	0	0	0	0	0.5	0.75	0.5	0.5	0	0.5	0
At Risk - Relict											
Forest ringlet (*Dodonidia helmsii)*	0.5	1	1	0	1	0.75	0.5	0	0.5	0	0
Total	1.5	2	2	0	2.75	2.75	2.5	1.25	0.5	1.5	0
Mean	**0.25**	**0.33**	**0.33**	**0.00**	**0.46**	**0.46**	**0.42**	**0.21**	**0.08**	**0.25**	**0.00**

Bryophytes

Species of Conservation Concern (de Lange et al. 2020)	Tall forest	Short forest	Shrubland		Pākihi		Tussockland				
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland	Sandstone pavement	Riparian	Open water	Cleared vegetation
Threatened – Nationally Critical											
Allisoniella scottii	0	0	0	0	0.25	0.25	0	0	1	0	0
Isolembidium anomalum var. anomalum	0.25	1	1	0.25	0.75	1	0.25	0.5	1	0	0
Neogrollea notabilis	0	0	0	0.25	1	1	1	0.5	0	0	0
Pseudolophocolea denticulata	0.25	1	0.5	0	0.5	0	0	0	0	0	0
Threatened Nationally – Vulnerable											
Acromastigum verticale	0	1	1	0	0	0	0	0	1	0	0
Telaranea inaequalis	0.25	1	0.25	0	0.25	0.25	0	0	1	0	0
At Risk - Declining											
Acromastigum interstisiale	1	1	1	0	0	0	0	0	1	0	0
Saccogynidium decurvum	0.25	1	1	0	1	1	1	0.25	0.25	0	0
Total	2	6	4.75	0.5	3.75	3.5	2.25	1.25	5.25	0	0
Mean	**0.25**	**0.75**	**0.59**	**0.06**	**0.47**	**0.44**	**0.28**	**0.16**	**0.66**	**0.00**	**0.00**

Lichen

Species of Conservation Concern (de Lange et al. 2018)	Tall forest	Short forest	Shrubland		Pākihi		Tussockland				
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland	Sandstone pavement	Riparian	Open water	Cleared vegetation
Threatened Nationally Endangered											
Pycnothelia caliginosa	0	0	0	0	0	0	0	1	0	0	0
Threatened Nationally Vulnerable											
Austropeltum glareosum	0	0	0	0	0.25	0.25	0	1	0	0	0
Knightiella splachnirima	0	0	0	0	1	1	1	0.25	0	0	0
Cladia fuliginosa	0	0	0	0	0.5	0.25	0.25	1	0	0	0
At Risk - Declining											
Cladia inflata	0	0	0.5	0	1	0	1	0	0	0	0
Total	0	0	0.5	0	2.75	1.5	2.25	3.25	0	0	0
Mean	**0.00**	**0.00**	**0.10**	**0.00**	**0.55**	**0.30**	**0.45**	**0.65**	**0.00**	**0.00**	**0.00**

Weed Vulnerability Score

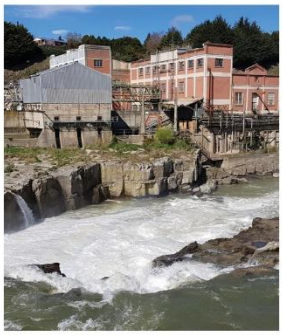
	Tall forest	Short forest	Shrubland		Pākihi		Tussockland				
	Mixed beech-podocarp-broadleaved forest	Southern rātā-mountain beech-podocarp forest	Mānuka-mountain beech-podocarp shrubland	Weedy shrubland	Mānuka-tussock-wire rush shrubland	Low pākihi	Tussock-flax shrubland	Sandstone pavement	Riparian	Open water	Cleared vegetation
Weed risk score	0	0.25	0.5	0.5	0.5	1	1	0.75	0.5	0	1
Total	0	0.25	0.5	0.5	0.5	1	1	0.75	0.5	0	1
Mean	**0.00**	**0.25**	**0.50**	**0.50**	**0.50**	**1.00**	**1.00**	**0.75**	**0.50**	**0.00**	**1.00**

APPENDIX K

Conservation Prioritisation at the Buller Plateaux (Ecological Solutions Limited 2026k)

ecoLogical Solutions
Environmental Consultants







December 2025

Conservation Prioritisation at the Buller Plateaux

Submitted to:
Bathurst Resources Limited

water fauna flora land

Quality Assurance

This report has been prepared and reviewed by the following:

Prepared by:	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
	[redacted] Ecologist	[redacted]
Reviewed by:	[redacted] Director	[redacted]

Status: Final **Issued:** 17 December 2025

ecoLogical solutions

tauranga office
115 the strand, tauranga 3141.
po box 13507
p: 07 577 1700

auckland office
building 2/195 main highway,
ellerslie, Auckland, 1051
p: 021 578 726

northland office
30 leigh street, kāeo
po box 180, kāeo 0448
p: 021 403 386

58 factory road, brightwater
p: 021 172 2091
www.ecoLogicalsolutions.co.nz

www.ecoLogicalsolutions.co.nz

Table of Contents

1.0 Introduction 1
1.1 Background and Purpose 1
2.0 Methods 4
2.1 Background and Rationale 4
2.2 Zonation Outputs 5
2.2.1 Priority Rank Map (Heatmap) 5
2.2.2 Performance Curves 5
2.3 Data Sources 6
2.3.1 Vegetation and Land Cover Types (Approach 1 and 2) 6
2.3.2 Species Distribution Layers (Approach 1 and 2) 6
2.3.3 Streams (Approach 1) 7
2.4 Zonation - Approach 1 7
2.4.1 Overview 7
2.4.2 Data Processing and Setup 7
2.4.3 Assigning Scores 10
2.5 Zonation – Approach 2 11
2.5.1 Overview 11
2.5.2 Data Processing and Setup 11
2.5.3 Flora Scoring System 13
2.5.4 Fauna Scoring System 13
3.0 Results 14
3.1 Approach 1 14
3.1.1 Performance Curves 14
3.1.2 Feature Richness 15
3.1.3 Priority Rank Heatmap 17
3.1.4 Area Statistics 22
3.2 Approach 2 22
3.2.1 Performance Curves 22
3.2.2 Priority Rank Heatmap 22
4.0 Discussion 27
4.1 Limitations and opportunities 27
4.2 Conservation Priority Areas 27
4.3 Effects Management 28
4.4 Conclusion 28
5.0 References 30

Index to Tables

Table 1: Input data used in the preparation of conservation priority maps – Approach 1. 8
Table 2: Zonation Setup – Approach 1. 10
Table 3: Input data used in the preparation of conservation priority maps – Approach 2. 12
Table 4: Zonation Setup – Approach 2. 13
Table 5: Habitat scoring system used to assign habitat value to vegetation types for vascular and non-vascular plants for input into Zonation. 13
Table 6. Fauna species scoring system applied to different vegetation classes. 14
Table 7: High conservation priority cells (score >0.7) comprising each proposed disturbance area for the Buller Plateaux Continuation Project. 17
Table 8: Extent of vegetation and land cover types in High Priority areas using Approach 2 and the species that each type supports. 24

Index to Figures

Figure 1: Mapped Area in relation to the Proposed Consent and Disturbance areas. 2
Figure 2: Buller Plateaux vegetation and land cover types (from Ecological Solutions Limited 2025a). 3
Figure 3: Hypothetical example of a performance curve produced by Zonation software illustrating the relationship between the proportion of landscape protected and the proportion of features protected. 5
Figure 4: Zonation performance curves for each input group at the Buller Plateaux. 15
Figure 5: Individual Zonation performance curves for A) Lizards, B) Bryophytes, C) snails, D) coal measures tussock, E) rōroa, and F) Fernbird at the Buller Plateau. 16
Figure 6: Species and vegetation class richness heatmap derived using Zonation. Red areas have high species richness; blue areas have low species richness. 18
Figure 7: Conservation priority areas ranked from low (blue) to high (red) and project disturbance areas. 19
Figure 8: Conservation priority areas (Gruner 2013). Ranked from low (red) to high (blue) and disturbance areas. 21
Figure 9: A) Mean performance curve for input layers into Zonation using Approach 2 B) High priority areas (rank 0.7–1.0) identified. 22
Figure 10: Conservation priority rank heat map created using Approach 2 in Zonation. 25
Figure 11: Conservation priority rank heatmap for all species showing high rank (0.7–1.0) locations only created using Approach 2 in Zonation. 26

Appendices

Appendix A – Species distribution maps – Approach 1
Appendix B – Conservation priority maps – Approach 2

1.0 Introduction

1.1 Background and Purpose

Bathurst Resources Limited ('Bathurst') is seeking authorisation through the Fast-track Approvals Act 2024 ('FTAA') for the Buller Plateaux Continuation Project ('the BPCP'). The BPCP area includes parts of both the Denniston and Stockton Plateaux, collectively referred to here as the 'Buller Plateaux' and is located approximately 15km northeast of Westport as shown in Figure 1. The BPCP is a complex proposal which seeks to enable a mix of ongoing and new mining activities.

The BPCP has been divided into five project areas as follows and shown in Figure 1:

- Stockton (including the Ngakawau Coal Handling Facility and Aerial Ropeway);
- Cypress Mining Area ('Cypress');
- Mount Fred South ('MFS');
- Escarpment Extended ('ESE');
- Upper Waimangaroa Haul Road ('UWHR').

Disturbance areas (identified in Figure 1) show the extent of 'new' habitat removal within each of the project areas above.

Despite its long history of mining and human occupation, the Buller Plateaux is home to a large number of species of non-vascular flora (mosses, liverworts, hornworts, and lichens), vascular plants, terrestrial invertebrates (including land snails and wētā), lizards and birds which are considered 'Threatened' or 'At Risk' as well as naturally uncommon ecosystems and distinctive assemblages of species. The communities are predominantly indigenous and there are also a number of species with unusual or disjunct distributions which include the Buller Plateaux. Most of the Denniston Plateau comprises public conservation land administered by the Department of Conservation and conservation values are high or very high. Due to the competing interests of coal mining and ecosystem, habitat and species protection, the identification of any areas of particularly high conservation value is critical to inform planning for the BPCP by:

- Enabling avoidance of high value areas where achievable;
- Identifying suitable locations for minimisation and remediation activities where relevant; and
- Locating priority areas for ecological offsetting and compensation activities.

Conservation mapping of the Buller Plateaux was previously undertaken using Zonation software by the Department of Conservation in 2013 (Gruner 2013). Gruner (2013) used 24 biodiversity features and explored six scenarios, resulting in six maps with different conservation priority areas depending on the assumptions and constraints applied to each scenario. The Gruner (2013) assessment concluded that the use of potentially out of date and inaccurate data was a limitation, and noted that her approach provided a proof of concept to expand upon as new data came to hand. Another limitation of the Gruner (2013) approach was that survey effort was not comprehensive across the plateaux, and most information was collected from areas proposed for development, which may or may not have proceeded. A recent addition to the data available for inclusion to inform the assessment is a high-resolution vegetation map for the area. The vegetation within the area outlined in black in Figure 1 was recently mapped and described using plot-based surveys, high resolution drone photography, machine learning, local knowledge, and multivariate analysis to discriminate, describe and map the different vegetation types present (Ecological Solutions Limited 2025a). A low-resolution version of the vegetation map is provided as Figure 2.

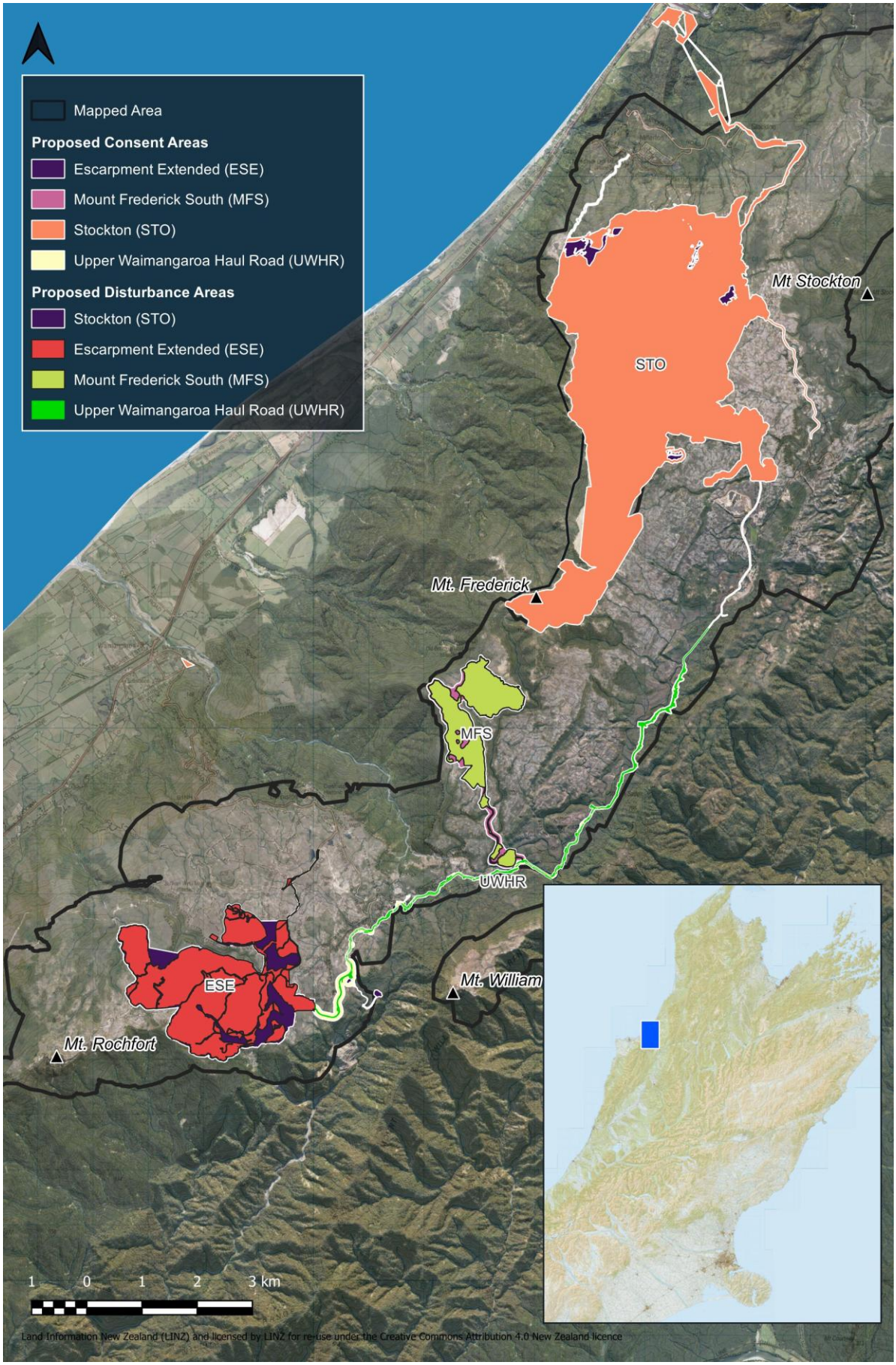


Figure 1: Mapped Area in relation to the Proposed Consent and Disturbance areas.

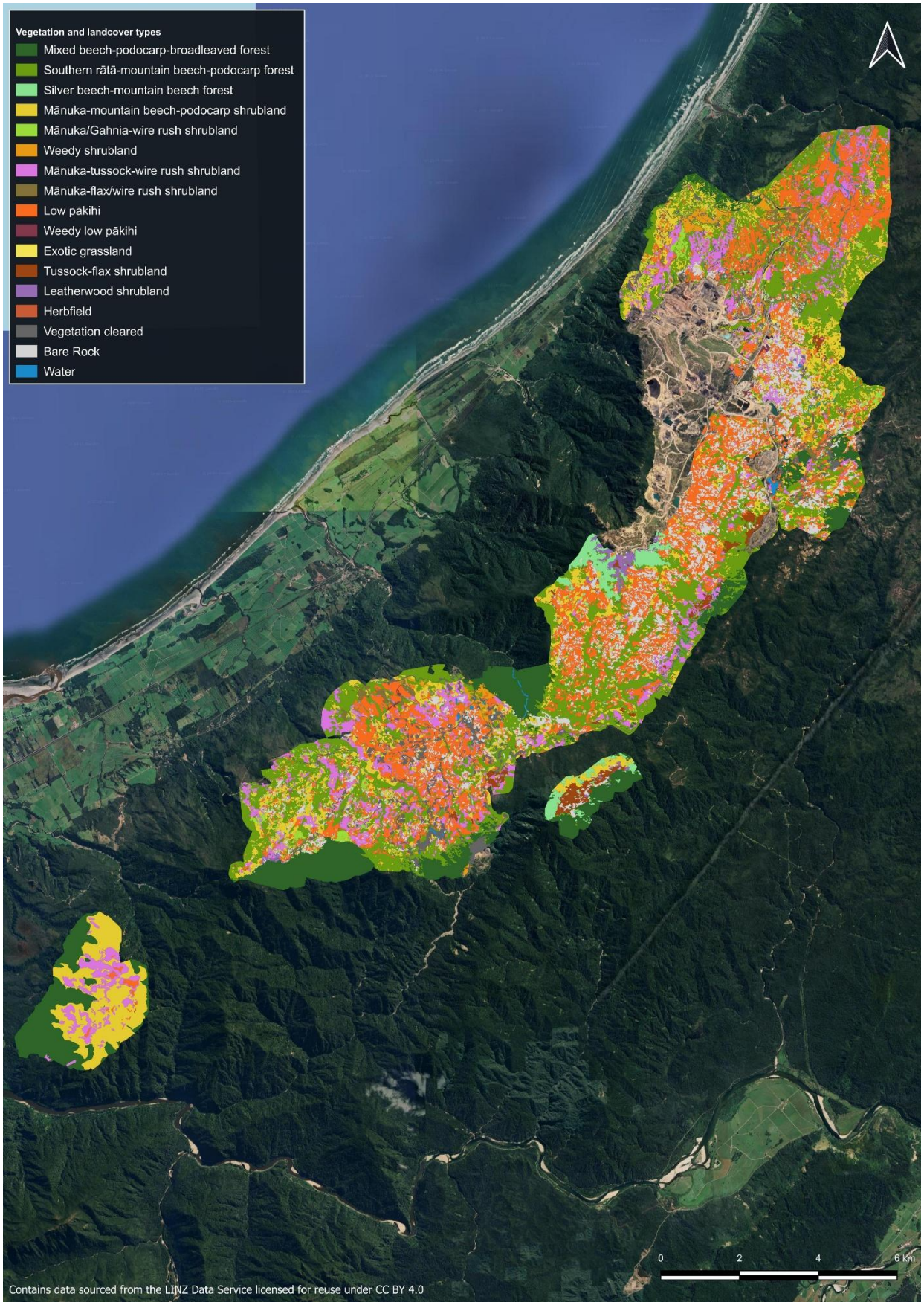


Figure 2: Buller Plateaux vegetation and land cover types (from Ecological Solutions Limited 2025a).

The vegetation types present are discussed further in Section 2.3.1 and described in detail in Ecological Solutions Limited (2025a). The mapped area was used as the boundary for this analysis.

This study used two approaches, firstly expanding on the analysis in Gruner (2013) by compiling recent species and feature location data collected up to 2024. Since this method was heavily reliant on survey effort, and the location of previous surveys, we attempted to reduce the sampling bias resulting from the previous unequal survey effort across the plateaux by using vegetation type as the primary input, rather than species locations, and scoring each vegetation type according to its value as habitat for the species of interest.

This report sets out the data and methods used to identify and map the areas of relative conservation value within the mapped area shown in Figure 2. The relative conservation value was identified using Zonation 5 software ('Zonation') (Moilanen et al. 2024) and data collected between approximately 1997 and 2024 and sourced from the ecological reports summarised in Ecological Solutions Limited (2025a, 2025b). Those reports, along with this one, are part of a suite of baseline ecological reports prepared to inform the BPCP Assessment of Environmental Effects ('AEE') (Mitchell Daysh 2025, in prep.).

2.0 Methods

2.1 Background and Rationale

Systematic Conservation Planning ('SCP') is a field of conservation biology concerned with the effective allocation of conservation efforts and the implementation of management actions. Zonation is a decision support tool used in spatial conservation and land use planning to identify priority areas and provide quantitative methods for enhancing species persistence.

Zonation has been used globally, although the tool has had limited application in New Zealand (Ribeiro and Atadeu 2019). Recent examples of the use of Zonation include spatial conservation over entire river basins (Yaun et al. 2025), conservation management of small mammals considering land use and climate change (da Costa-Pinto et al. 2023), amphibian conservation (Fuentes-de la Rosa et al. 2024) and restoration planning for land birds (Frand et al. 2024). As mentioned above, an earlier version of Zonation was used to identify and map high priority locations for conservation of biodiversity on the Buller Plateaux by Gruner (2013).

Zonation uses spatial raster input layers of the distribution of individual biodiversity features (species, habitats, ecosystem services and the like) to build a conservation prioritisation map which can be used to identify both 'high value' and 'low value' areas for conservation action. The Zonation software implements a set of interrelated techniques in one package and can account for many factors, including multiple costs, habitat condition and ecological connectivity. In this study, Zonation mapping was undertaken using two methods which are described in detail in Sections 2.4 and 2.5. The main differences in approach were:

Approach 1 - The first approach replicated and updated Gruner (2013), whereby historical survey data and current conservation status were used to give a score to individual species based on their vulnerability and threat status. In this approach the resulting conservation prioritisation map is based on known distributions of species within the Buller Plateaux and is necessarily dependent on known survey locations and distribution data. The species scores were derived during a workshop by Ecological Solutions and Dr. Matt Baber of Alliance Ecology Limited (a herpetologist) on 19 December 2024 (see Section 2.4.2 for detail). This approach favours areas which have been surveyed and found to contain 'Threatened' or 'At Risk' species, but does not take account of those species where they are present in areas that have not been surveyed.

Approach 2 - The second approach employed the 16 vegetation and land cover types that were identified as part of vegetation mapping of the Buller Plateaux as the input layers. Each vegetation and landcover type was scored based on its suitability for each of 54 species of conservation concern (either 'Threatened' or 'At-Risk') informed by the previous records from NZPCN, eBird, NZ Birds online of those species within the relevant vegetation/landcover. Using this approach the resulting conservation priority rank map is based on the known and potential distribution of the species of conservation concern within each vegetation type, independent of species records at particular locations. This approach was used in an attempt to reduce the sampling bias inherent in the first approach.

2.2 Zonation Outputs

2.2.1 Priority Rank Map (Heatmap)

The first output from the Zonation analysis is a priority rank map, otherwise known as a 'heatmap'. The heatmap is a raster layer containing a conservation priority value for each one-hectare cell. Values range between 0 (no value) and 1 (highest priority for conservation) indicating their priority rank. The heatmap is colour coded with a simple-to-interpret gradient from deep blue (low priority) to green (moderate priority) to orange and red indicating the highest priority areas. The priority is based on the input layers applied.

2.2.2 Performance Curves

The second output of Zonation are 'performance curves' that quantify the proportion of a feature that would be conserved if cells at a given rank were protected. In the example below (Figure 3), the top 20% of cells (i.e., ranks 0.8–1.0) hold roughly 85% of the distribution of that biodiversity feature. Conversely, the bottom 80% of cells contain 15% of that feature. Performance curves are generated for each input layer, and mean curves are also available in the output (Lehtomäki et al. 2016). The curves are helpful for understanding the overall performance of a zonation analysis, but can also be produced for individual features of interest (e.g., species or vegetation type).

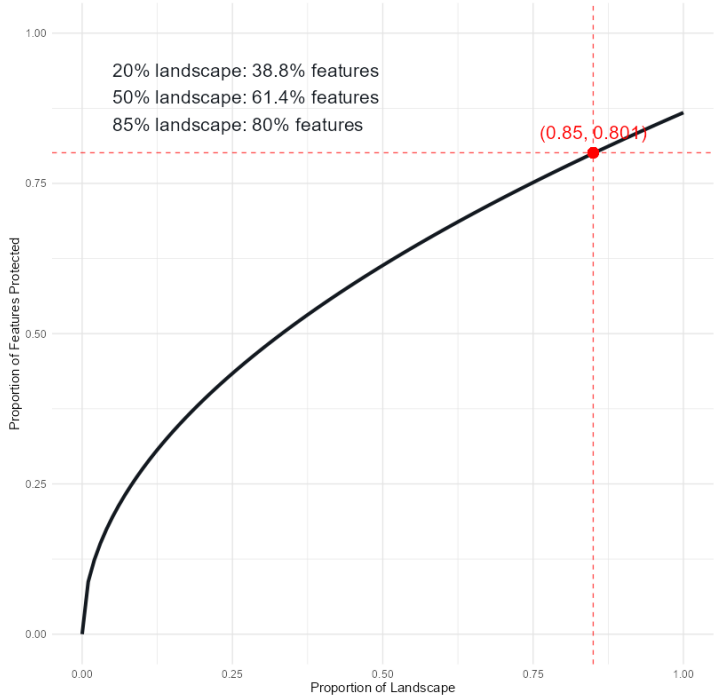


Figure 3: Hypothetical example of a performance curve produced by Zonation software illustrating the relationship between the proportion of landscape protected and the proportion of features protected.

2.3 Data Sources

2.3.1 Vegetation and Land Cover Types (Approach 1 and 2)

Vegetation and land cover types used were as defined and mapped in Ecological Solutions Limited (2025a). Ecological Solutions Limited (2025a) analysed compositional variation in 152 vegetation plots using data collected between 2008 and 2025 across the Buller Plateaux using multivariate analysis to discriminate classes.

By training a machine learning algorithm on the aerial images of plots of known vegetation class, 45,690 aerial photographs collected between July 2019 and January 2024 were then classified into vegetation classes and these were then used to create the overall vegetation map. The vegetation and land cover types identified and mapped within the mapped area covered c. 11,438ha within and surrounding the Buller Plateaux and this area also defined the boundary for this analysis.

2.3.2 Species Distribution Layers (Approach 1 and 2)

Approach 1

Each of the 24 species distribution layers used in Approach 1 was generated by collating data from existing reports where it was possible to identify and subsequently map an exact or approximate location for records of a species. The references used to derive the species distribution layers are listed by taxonomic group in Section 5.0. By way of example, we were able to use:

- GPS co-ordinates supplied within reports;
- Ecological Solutions Limited photographs of 'Threatened' and 'At-Risk' species with geolocation tags; and
- Geo-referenced maps from within reports.

QGIS version 3.34 was then used to generate a shapefile layer for each species with specific location information.

Approach 2

The information used to assign a value to each vegetation and land cover type dependent on either occupancy by or potential suitability for 'Threatened and At-Risk' species was informed by both existing records and known habitat preferences for these species described in existing reports (including those listed by group in Section 5.0), the Buller Plateaux Contextual study (Ecological Solutions Limited 2025b) and other sources such as the New Zealand Plant Conservation Network (NZPCN) website[1] and New Zealand Birds Online website[2]. Details with respect to assigning those values are set out in Section 2.4.3.

Species used in Each Approach

There were differences in the number of flora and fauna species used for Approaches 1 and 2 because the species used in Approach 1 were derived from existing location records whilst species used in Approach 2 were derived from both existing records as well as the presence of the preferred habitat for that species.

For example, some 'Threatened' and 'At Risk' species known to occur within habitats at the Buller Plateaux (e.g., avatar moth (*Arctesthes avatar*) and Denniston white-faced wētā (*Occultastella morgana*)) were excluded in Approach 1 because there were few or no specific location records for them. However, these species were included in Approach 2 because suitable habitat for them is present.

[1] https://www.nzpcn.org.nz/
[2] https://www.nzbirdsonline.org.nz/

The list of plant species used in Approach 2 was more extensive than that used in Approach 1 (i.e., 26 versus 9 species) because a combination of confirmed species records and species known to occur in the Ngakawau Ecological District, but not confirmed from the Buller Plateaux, were used in Approach 2, but not in Approach 1. Species of conservation interest that have the potential to occur within the area were added and scored against the vegetation and land use types in Approach 2 but not in Approach 1. Details of both methods are discussed in Sections 2.4 and 2.5.

2.3.3 Streams (Approach 1)

Hogsden and Watson (2024) ranked stream quality within the Buller Plateaux based on data collected by various organisations between 1986 and 2024 including water quality information, sampling location coordinates and acidic metalliferous drainage ('AMD') categories. Data from Hogsden and Watson (2024) was provided in an excel spreadsheet to Ecological Solutions Limited and their categories were adopted here. Specifically in relation to AMD:

- High = mine affected.
- Low = not affected.
- Moderate = mixture of moderately mine affected and naturally acidic.

The classification of the streams was based on the following criteria:

1. pH – where pH >6 = low AMD, pH 4–6 = moderate AMD, and pH <4 = high AMD.
2. Conductivity – where conductivity <90µS/cm = low AMD, conductivity >90µS/cm = high AMD.
3. Metalloids – AMD were high where aluminium, nickel and/or zinc exceeded the ANZECC (ANZG 2018) and Canadian Council of Ministers of the Environment guidelines, or were an order of magnitude higher than the 'low' sites.

2.4 Zonation - Approach 1

2.4.1 Overview

The 45 data layers used for conservation mapping using Approach 1 are set out in Table 1. They include 26 species layers for 'Threatened' and 'At Risk' plant and animal species known to occur on the Buller Plateaux, three stream layers (low AMD, moderate AMD and high AMD) and 16 vegetation and land cover classes identified in Ecological Solutions Limited (2025a). The sources used to generate each layer are set out in Section 2.3.

2.4.2 Data Processing and Setup

The conservation priority maps were developed using the following workflow:

1. Vegetation types, species distribution and other relevant data were collated from various sources as set out in Section 2.3. The specific data used is set out in Table 1.
2. Each data layer was processed so that species presence / absence was recorded within each 1ha cell.
3. Presence data was converted to a raster layer for input into Zonation for analysis.
4. Zonation configuration files (i.e., the settings files) included settings for the features and rules are shown in Table 2.

This pre-processing of species data (i.e., steps 1–4) was automated in QGIS version 3.34.

The features and rules of the model are detailed in Table 2.

Table 1: Input data used in the preparation of conservation priority maps – Approach 1.

Group	Species / features	Conservation status	Scoring Criteria		Score (A x B)
			A	B	
			Irreplaceability	Vulnerability (threat) status)	
Avifauna	Kea (*Nestor notabilis*)	Threatened – Nationally Endangered	0.10	0.70	0.07
	Kākā/South Island kākā (*Nestor meridionalis meridionalis*)	Threatened – Nationally Vulnerable	0.20	0.70	0.14
	Rōroa/Great spotted kiwi (*Apteryx maxima*)	Threatened – Nationally Vulnerable	0.50	0.70	0.35
	Koekoeā/long-tailed cuckoo (*Eudynamys taitensis*)	Threatened – Nationally Vulnerable	0.20	0.70	0.14
	Kakaruai/South Island robin (*Petroica australis australis*)	At Risk – Declining	0.20	0.50	0.10
	Mātātā/South Island fernbird (*Bowdleria punctata punctata*)	At Risk – Declining	0.70	0.50	0.35
	Pīhoihoi/New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*)	At Risk – Declining	0.60	0.50	0.30
	Yellow-crowned parakeet (*Cyanoramphus auriceps)*	At Risk – Declining	0.20	0.50	0.10
Non-vascular flora (bryophytes and lichens)	Four species of liverwort*	Threatened – Nationally Critical	1.00	1.00	1.00
	Two species of liverwort	Threatened – Nationally Vulnerable	0.50	0.70	0.35
	Two species of liverwort	At Risk – Declining	0.50	0.50	0.25
	32 species of liverwort, two species of moss and one hornwort	At Risk – Naturally Uncommon	0.50	0.30	0.15
	Three species of lichen	Threatened – Nationally Endangered Threatened – Nationally Vulnerable	0.50	0.70	0.35
	Four species of lichen	At Risk – Declining At Risk – Naturally Uncommon	0.50	0.50	0.25
Herpetofauna	Forest gecko *(Mokopirirakau granulatus)*	At Risk – Declining	0.80	0.50	0.40
	West coast green gecko *(Naultinus tuberculatus)*	Threatened – Nationally Vulnerable	0.90	0.70	0.63
	Newman's speckled skink (*Oligosoma newmani)*	At Risk – Declining	0.50	0.50	0.25
Invertebrates	*Powelliphanta patrickensis*[#]	Threatened – Nationally Critical	1.00	1.00	1.00
Streams	High AMD	-	0.20	0.10	0.02
	Moderate AMD	-	0.20	0.20	0.04
	Low AMD	-	0.20	0.60	0.12
Vascular Plants	*Astelia subulata*	At Risk – Naturally Uncommon	0.20	0.30	0.06

	Brachyglottis traversii	At Risk – Naturally Uncommon	0.50	0.30	0.15
	Coal measures tussock (*Chionochloa juncea*)	At Risk – Declining	1.00	0.50	0.50
	Dracophyllum densum	At Risk – Declining	0.30	0.50	0.15
	Euphrasia wettstieniana	At Risk – Declining	0.50	0.50	0.25
	Red mistletoe (*Peraxilla tetrapetela*)	At Risk – Declining	0.20	0.50	0.10
	Pseudowintera traversii	At Risk – Declining	0.50	0.50	0.25
	Sticherus (*S. tener, S. urceolatus*)	At Risk – Naturally Uncommon	0.50	0.30	0.15
Vegetation Types	Silver beech-mountain beech forest	-	0.70	0.25	0.17
	Mānuka-mountain beech-podocarp shrubland	-	0.80	0.25	0.20
	Mānuka/Gahnia-wire rush shrubland	-	0.70	0.50	0.35
	Weedy shrubland	-	0.30	0.20	0.06
	Mānuka-tussock-wire rush shrubland	-	0.70	0.50	0.35
	Mānuka-flax/wire rush shrubland	-	0.70	0.50	0.17
	Exotic grassland and herbfield	-	1.00	0.75	0.75
	Low pākihi	-	1.00	0.25	0.25
	Weedy low pākihi	-	0.80	0.20	0.16
	Exotic grassland	-	0.10	0.10	0.01
	Tussock-flax shrubland and herbfield merged	-	1.00	0.75	0.75
	Leatherwood shrubland	-	0.50	0.75	0.37
	Cleared vegetation	-	0.10	0.10	0.01
	Mixed beech-podocarp-broadleaved forest	-	0.50	0.50	0.25
	Southern rātā-mountain beech-podocarp forest	-	0.80	0.25	0.20
	Bare rock	-	1.00	0.25	0.25

Note: * Nationally critical liverwort species: *Allisoniella scottii, Isolembidium anomalum* var. *anomalum, Neogrollea notabilis* and *Pseudolophocolea denticulata*.

Powelliphanta augusta also occurs within the Buller Plateaux, but it's known natural distribution is mostly within the active Stockton Mine so it was not included in this analysis.

Table 2: Zonation Setup – Approach 1.

Features and rules	Comment
Input layers	45 input layers listed in Table 1 reflecting known distributions of native flora and fauna of conservation concern and other relevant information including vegetation types and stream classifications.
Weighting	Weights were applied based on endemism, threat status and conservation values as shown in Table 1. Streams were scored according to their acidic metalliferous mine drainage (AMD) status (Hogsden and Watson 2024), vegetation classes were scored equally. Bryophytes were weighted according to their conservation status (de Lange et al. 2020; Rolfe et al. 2016) as were vascular plants (de Lange et al. 2024) and lichens (de Lange et al. 2024). Land snails (*Powelliphanta patrickensis*) are 'Threatened – Nationally Critical' (Walker et al. 2022) and were given a weight of '1' given they are endemic to the Buller Plateaux and have the highest possible threat status. Birds were also weighted according to conservation status (Robertson et al. 2021).
Cost	No cost layer was applied. Cost layers can be used when the costs of rehabilitation land acquisition and maintenance are known or have been estimated for areas of interest.
Hierarchical masks	A hierarchical mask in Zonation is a GIS layer that captures information about the hierarchy of land uses in the landscape. Zonation ensures that highest priority ranks are assigned to protected areas. Masks were not applied at this stage of the project because this would have elevated the ranks of legally protected conservation areas, as opposed to identifying the highest value conservation areas.
Cell removal rule	The core area zonation (CAZ2) cell removal value was applied in this analysis. This is the default rule in Zonation 5. The CAZ2 emphasises high average coverage, even at the cost of reduced coverage for some features. Adopting this rule comes with the trade-off of lower coverage for the lower-weighted features.

2.4.3 Assigning Scores

Alliance Ecology Limited and Ecological Solutions Limited held a workshop (19 December 2024) to assign scores for each input layer used in Approach 1. Weights were assigned for each species or feature on a scale between 0 and 1. Scores were assigned according to irreplaceability and vulnerability which were multipliers for the final overall weighting as set out in Table 1.

The irreplaceability score for a feature or species was based on their uniqueness (endemism), their dependence upon the Buller Plateaux habitat types for their persistence and the relative importance of the Buller Plateaux for that species. For example, the snail *Powelliphanta patrickensis* is endemic, is dependent on vegetation at the Buller Plateaux and is only found there. It was accordingly scored '1' for irreplaceability.

The vulnerability score is a proxy for threat status, with 'Nationally Critical' species being assigned a 1, 'Nationally Endangered' or 'Nationally Vulnerable' species assigned 0.7, 'Declining' species assigned 0.5 and 'Naturally Uncommon' species assigned 0.3.

An example of how irreplaceability differs from vulnerability for kea (*Nestor notabilis*) using the plateau is as follows: kea are highly vulnerable with a threat status of 'Threatened – Nationally Endangered' – they were assigned a vulnerability score of 0.7. Kea using the plateaux were assigned a low irreplaceability score (0.1) because they only occasionally visit the plateaux, and it is not regarded as 'core habitat' for kea. The loss of the Buller Plateaux habitats used by kea would be unlikely to significantly affect kea persistence.

With respect to vulnerability of streams, there is no conservation status classification system for watercourses that we are aware of. High AMD streams were given a score of 0.2 for irreplaceability and a score of 0.1 for vulnerability based on their current poor state and the

limited potential for further effects in an already affected stream. Moderate AMD streams were given weights of 0.2 for irreplaceability and vulnerability.

Low AMD streams were also given a weight of 0.2 for irreplaceability and a moderately high weight of 0.6 for vulnerability as they are more susceptible to change than the high and moderate AMD streams.

Ecological Solutions Limited (2025a) identified 16 vegetation and land types which were used as input layers for zonation. Vegetation types: mānuka/Gahnia-wire rush shrubland, mānuka-tussock-wire rush shrubland, mānuka-flax/wire rush shrubland, low pākihi and weedy low pākihi are considered 'Naturally Uncommon' (Wiser et al. 2007). Bare rock (sandstone erosion pavement is 'Endangered' (Holdaway 2012) and other wetland types not assigned threat status but referred to as 'Naturally Uncommon' (MfE 2007) are mānuka-mountain beech-podocarp shrubland and tussock-flax shrubland.

The irreplaceability scores for vegetation classes were based on rarity, uniqueness, and value as habitat for 'Threatened' plant species. Consideration of vulnerability was largely based on the extent remaining within the Buller Plateaux for each vegetation class with those which have already been substantially reduced scoring higher than those which have not (Ecological Solutions Limited 2025a).

2.5 Zonation – Approach 2

2.5.1 Overview

The 16 vegetation and land cover types identified in Section 2.3 were used as input layers for Approach 2. The features and rules of the model are detailed in Table 3. Approach 2 relied on an estimated habitat value for each of the species known or likely to occur on the Buller Plateaux identified in Table 3. To estimate this value, each vegetation type was assigned a habitat value on a 5-point scale (0–1) for each species. This value was then summed for each of the seven taxa groups (vascular plants, bryophytes, lichen, snails, other terrestrial invertebrates, lizards and birds) to give a habitat value for each group and then across all groups to give an overall habitat value score.

2.5.2 Data Processing and Setup

The conservation priority maps were developed using the following workflow:

1. A list of 'Threatened' and 'At Risk' species known or predicted to occur, vegetation types, species distribution and other relevant data were collated from various sources as set out in Section 2.3. The specific data used is set out in Table 3.
2. Each species was assigned a habitat suitability score between 0 and 1 for each vegetation and land cover type as set out in Sections 2.5.3 and 2.5.4.
3. Each of the 16 vegetation type layers were converted to raster layers based on the presence or absence of each feature in each 1ha. grid cell across the mapped area.
4. Zonation configuration files (i.e., the settings files) included settings for the features and rules are shown in Table 4.

This pre-processing of species data (i.e. steps 1–4) was automated in QGIS version 3.34. The features and rules of the model are detailed in Table 4.

Table 4: Zonation Setup – Approach 2.

Features and rules	Comment
Input layers	16 vegetation and land cover layers (Table 3) which were assigned scores for their suitability and known occupancy for each of the 54 species identified.
Scores	Scores were assigned to each vegetation class using the scoring system described below and in Table 5 and Table 6. Stockton Mine was included in the analysis and given a negative score indicating that it is not available or suitable habitat. This is a conservative approach because 'Threatened' and 'At Risk' species are known to occur in rehabilitated sites within the mine, including *Powelliphanta patrickensis*.
Cost	No cost layer was applied. Cost layers can be used when the costs of rehabilitation land acquisition and maintenance are known or have been estimated for areas of interest.
Cell removal rule	The core area zonation (CAZ2) cell removal value was applied in this analysis. This is the default rule in Zonation. The CAZ2 emphasises high average coverage, even at the cost of reduced coverage for some features. Comes with the trade-off of lower coverage for the lower-weighted features.

2.5.3 Flora Scoring System

A scoring system was used to assign each vegetation type a habitat suitability score considering the likelihood of occurrence for each species within each vegetation and landcover type. The scoring system for flora species is presented in Table 5.

Table 5: Habitat scoring system used to assign habitat value to vegetation types for vascular and non-vascular plants for input into Zonation.

Score	Description
0	Unsuitable habitat. No known records within the vegetation type and/or completely different vegetation from the usual habitat for the species under consideration.
0.25	Marginal habitat. No evidence of the vegetation type being suitable for species under consideration, but may be present based on the structure, composition, hydrology or other environmental variables associated with the vegetation type.
0.5	Likely suitable habitat, but the species under consideration within that vegetation type is unconfirmed (i.e., based on a broad description of the vegetation type from surveys, habitat preference derived from NZPCN or other sources not specific to the Buller Plateaux).
0.75	Preferred habitat as described in surveys/studies undertaken within the Buller Plateaux and surrounds, but lacking specific location data.
1	Preferred habitat with confirmed record of species under consideration within the vegetation type within the Buller Plateaux and surrounds (e.g., herbarium records, survey data or photographs).

2.5.4 Fauna Scoring System

The habitat value of each vegetation type for particular fauna was assigned using a similar scoring system to that used for flora as set out in Table 6. An assessment of the likelihood of occupancy by fauna must also consider the temporal and spatial use of habitats since fauna move across the Buller Plateaux and wider landscape using a variety of vegetation classes at different times with varying frequency. This mobility varies between fauna groups and to a lesser extent among species, although the high heterogeneity of the habitats within the Buller Plateaux means that even poorly mobile species may travel between several vegetation types regularly. Detectability of fauna also varies, including across different

habitat types, which increases the degree of uncertainty associated with estimating habitat value.

Some species with ranges extending beyond the Buller Plateaux have declined in abundance or range, or both, to the point that the likelihood or frequency of habitat use on the plateaux has been affected and this is reflected in the scores shown in Table 6. A summary of habitat descriptions provided in previous surveys was used to separate habitat value for fauna into the five levels set out in Table 6 which consider both likelihood and frequency of occupancy.

Table 6. Fauna species scoring system applied to different vegetation classes.

Score	Description
0	Vegetation type comprises mostly unsuitable habitat. Records may exist, although occupancy is expected to be limited to movements between other habitat types.
0.25	Vegetation type includes marginal or occasional habitat. Near the edge of habitat requirements, may be used infrequently and is of minor importance to the species being considered.
0.5	Vegetation type includes suitable secondary habitat. Occupancy may not be permanent or densities are lower than primary habitats.
0.75	Vegetation type includes suitable primary habitat. Supports permanent populations, at higher densities than secondary habitat, although preferred habitat may exist elsewhere.
1	Vegetation type includes referred primary or obligate habitat. Supports permanent populations at the highest densities known.

3.0 Results

3.1 Approach 1

3.1.1 Performance Curves

Performance curves for streams, flora (all vegetation types and species listed in Table 1) and fauna (all fauna groups listed in Table 1) are shown in Figure 4. The proportion of land potentially protected is shown on the x-axis and the shading along the x axis also shows the priority cell ranks (i.e., priority ranks 0.7–1.0 cover ~ 30% of the landscape). The y-axis represents the mean proportion of a species or feature that would be protected given the proportion of land protected.

On average, if 10% of the Buller Plateaux was protected (i.e., protection of areas with priority rank of 90 or above), approximately 70% of species / features would be present within those areas. For fauna, this area would include approximately 90% of the species distribution and for flora, this number is 60%. Increasing protected areas to 20% would increase flora species presence to approximately 80% of species. On average, protection of approximately 30% of the area would include around 90% of species.

Approximately 90% of the Buller Plateaux stream extent would be included if 25% of the land was protected. The number of streams that were categorised for the zonation analysis under-represented the diversity of the plateaux stream network, which is why distribution cover of 100% is achieved with less land protection than shown by the flora, fauna and feature average curves.

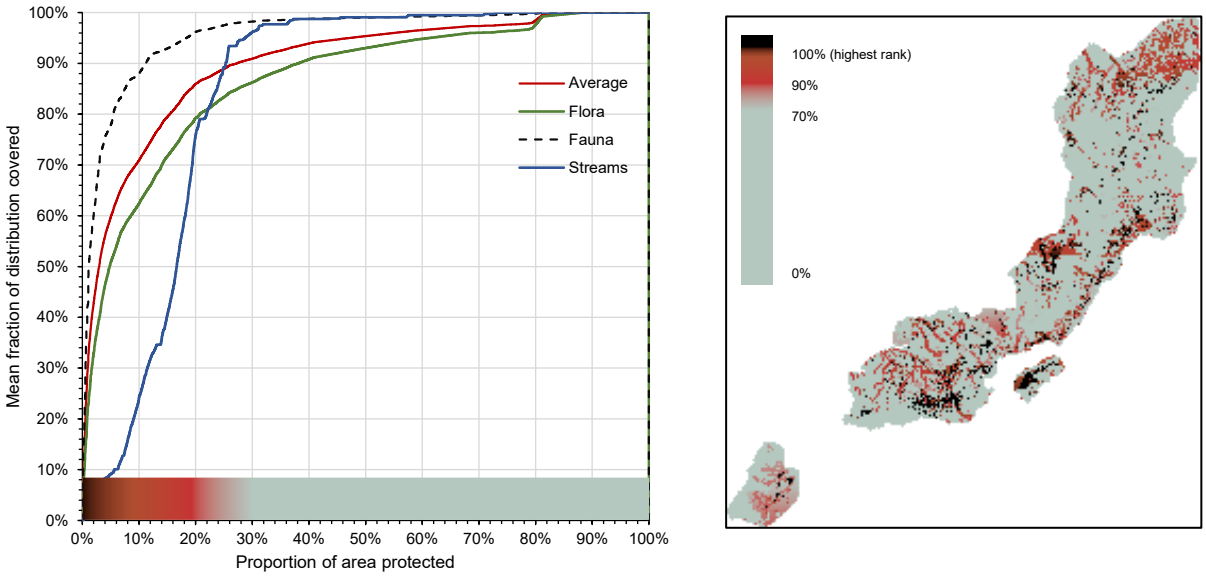


Figure 4: Zonation performance curves for each input group at the Buller Plateaux.

Performance curves for individual species present are useful to identify specific areas and/or habitat classes for management. For example, if the top 20% of areas (i.e., priority areas with ranks 0.8–1.0) were protected, 73% of the forest gecko and 100% of West Coast green gecko distribution would be retained as shown in Figure 5A.

Similarly, if the top 20% of areas for bryophytes were protected, all bryophytes would be captured as shown in Figure 5B. This also applies to snails (Figure 5C), coal measures tussock (Figure 5D), great spotted kiwi (rōroa) (Figure 5E) and South Island fernbird (Figure 5F).

3.1.2 Feature Richness

Locations with the highest number of features (i.e., species and feature richness) are identified in Figure 6. The scale 0–20 in Figure 6 represents the number of species and features in each 1ha cell. Red areas contain the greatest number of species and/or features, while the darker blue areas contain the fewest.

As shown in Figure 6, the highest number of species and/or features are located in three general areas:

1. to the north and east of the Stockton project area;
2. to the north and east of the Mount Frederick South project area (south of Mt Frederick itself); and
3. within and north of the Escarpment Extended project area.

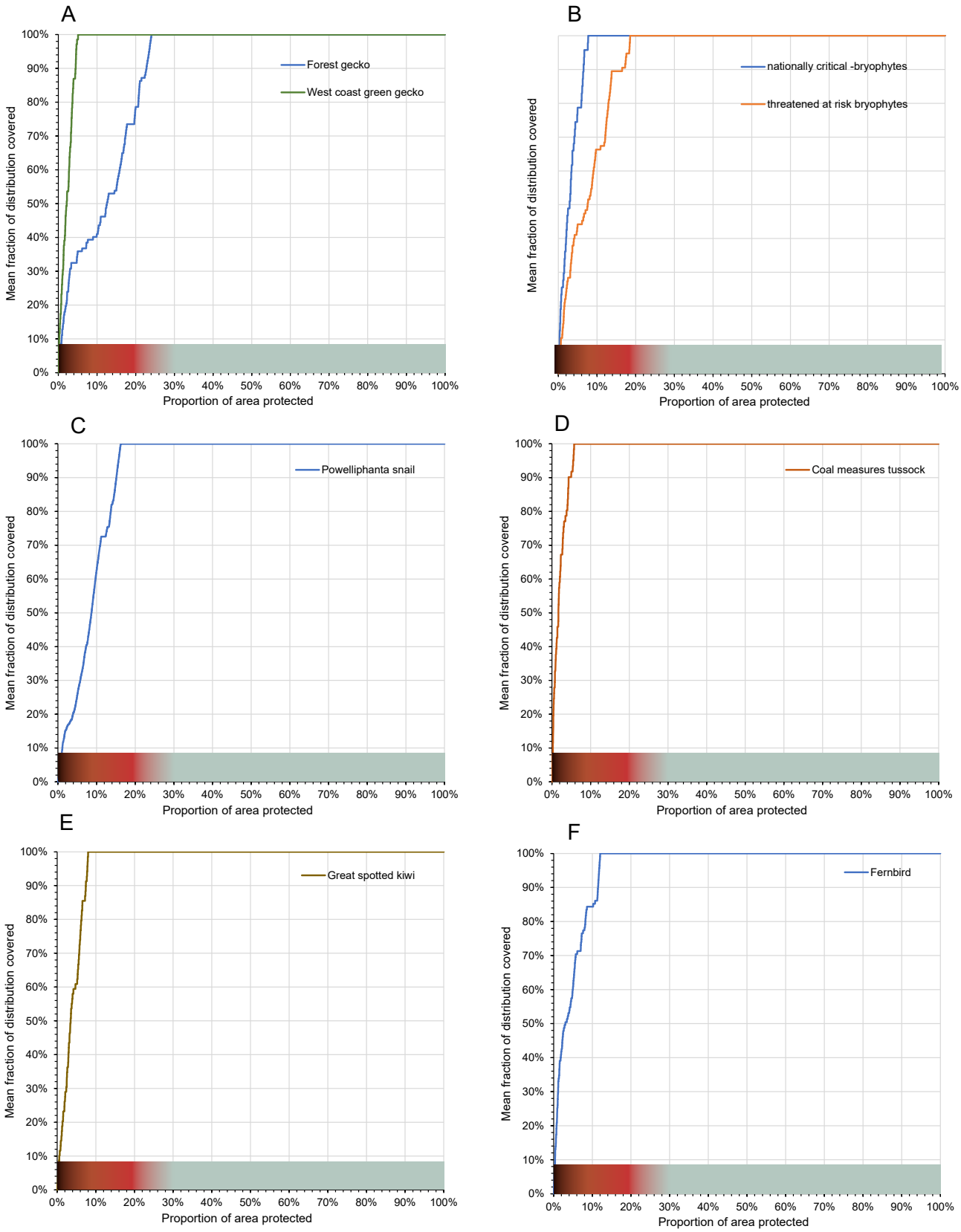


Figure 5: Individual Zonation performance curves for A) Lizards, B) Bryophytes, C) snails, D) coal measures tussock, E) rōroa, and F) Fernbird at the Buller Plateau.

3.1.3 Priority Rank Heatmap

Selected species distribution maps are provided in Appendix A, which show the locations of highly weighted features in relation to the priority rankings.

The areas identified as having high feature richness (i.e., species and land types) in Figure 6 show that feature richness is not the key driver in determining the conservation priority ranks on the Buller Plateaux. For example, the Mount Frederick and Te Kuha areas have low diversity compared to Mount Stockton and the Escarpment Mine areas, but have high conservation priority ranks as shown in Figure 7.

In the case of Mount Frederick, the high ranks are a result of several 'Threatened' and/or 'At Risk' plant species being present, whilst at Deep Creek the low AMD stream, and presence of snails and vegetation types with moderate habitat scores have led to the high overall scores.

The zonation analysis using Approach 1 identified eight main locations at the Buller Plateaux with high priority rankings (i.e., >0.7) as shown in Figure 7.

The highest priority areas were:

- South of Mt Frederick;
- Within the Extended Escarpment Project Area;
- North of Mount Stockton including Weka Creek, Mangatini Stream;
- The summit and upper slopes of Mt William;
- Te Kuha;
- West of Cypress Mining area;
- The summit of Mount Rochfort; and
- West of the UWHR Project sub-area.

Together these eight areas cover c. 3,453ha within the mapped area (30% of total area). The majority of these high priority areas would not be affected by the BPCP. Of the high priority areas identified, 361ha (10.5%) would be removed by the BPCP, with the worst affected areas being the Escarpment Extended and Mount Frederick South Project areas as set out in Table 7. The location of these high priority areas in relation to the Project Area is shown in Figure 7.

Table 7: High conservation priority cells (score >0.7) comprising each proposed disturbance area for the Buller Plateaux Continuation Project.

Project Area	Total area (approx.)	Disturbance within Project Area (loss)	High priority land within Project area (a)	High priority land within Disturbance area (loss) (b)	Proportion of high priority land in disturbance area lost (b/a)
Mount Frederick South	215ha	153ha	34ha	22ha	0.65
Escarpment Extended	574ha	459ha	338ha	279ha	0.83
Stockton	1,892ha	93ha	522ha	42ha	0.08
UWHR	283ha	38ha	132ha	18ha	0.14
Mapped Area	11,582ha	743ha	1,026ha	361ha	0.35

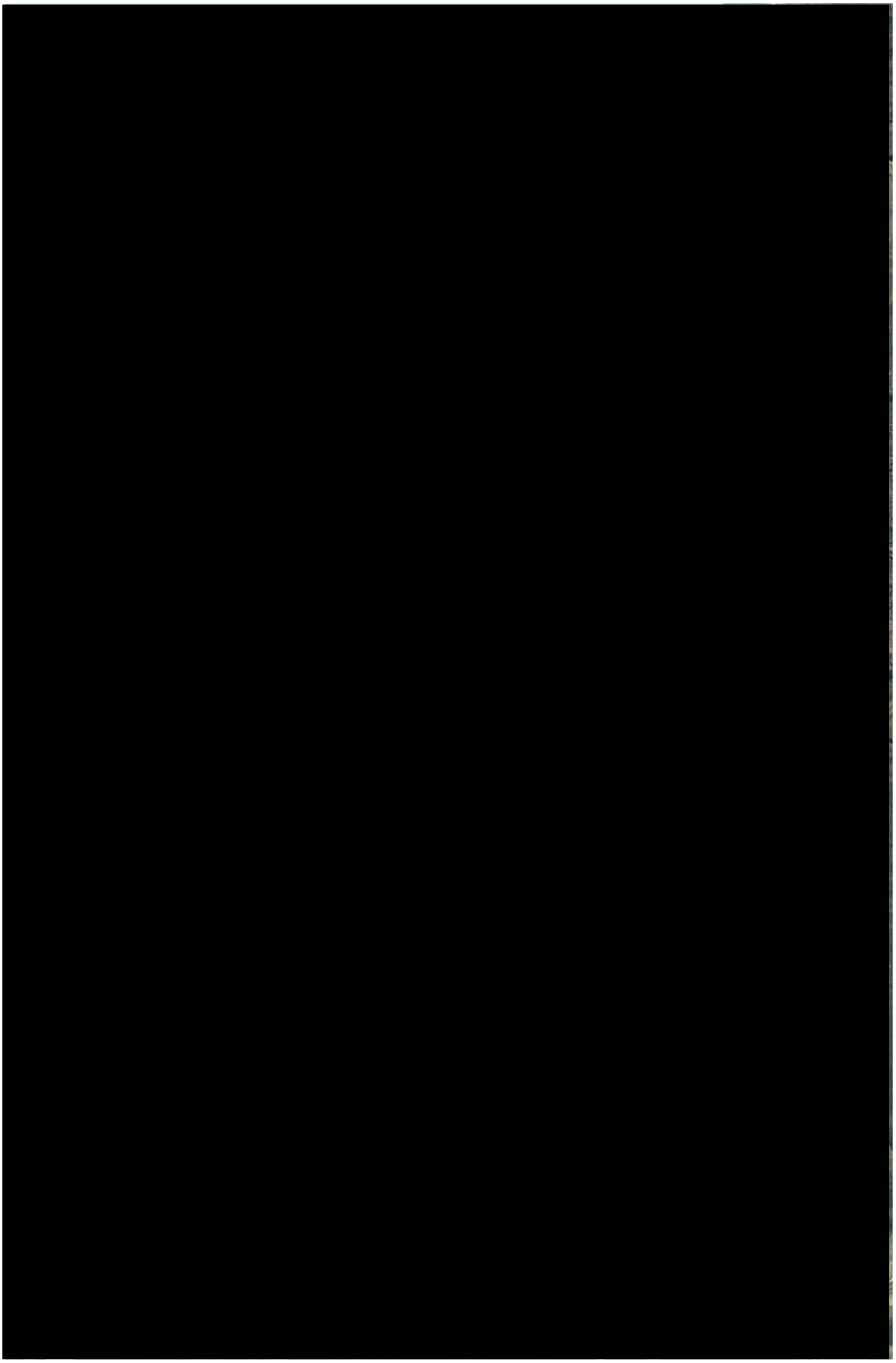


Figure 6: **Species and vegetation class richness heatmap derived using Zonation. Red areas have high species richness; blue areas have low species richness.**

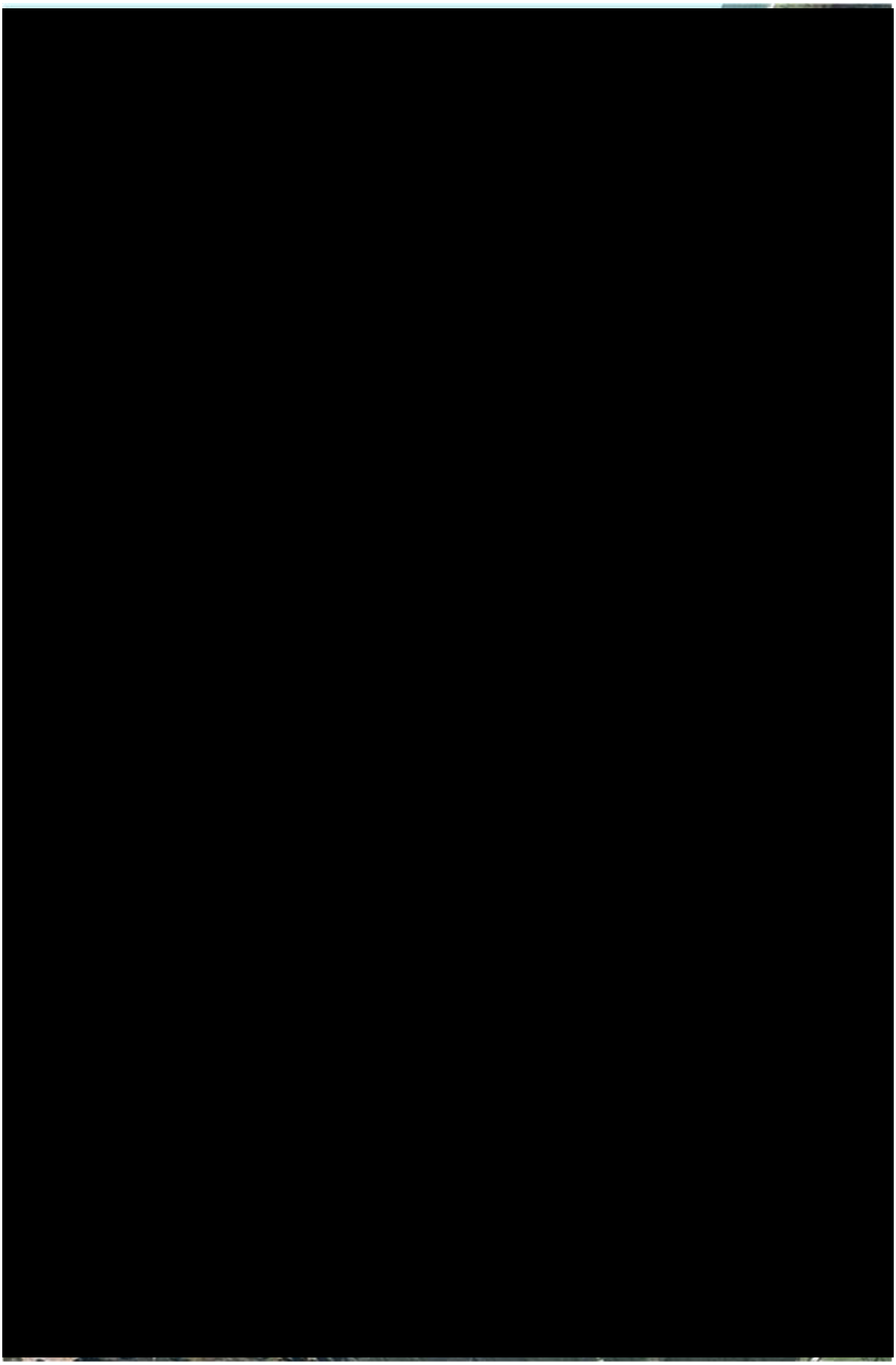


Figure 7: Conservation priority areas ranked from low (blue) to high (red) and project disturbance areas.

A comparison of Figure 7 and Figure 8 highlights the similarities and some differences between this assessment and that by Gruner (2013). The two analyses were conducted 12 years apart. Note that the colour scale in Figure 8 is the reverse of the scale used here (red is low value, blue is highest value in Figure 8) and that the two studies have a different boundary and extent. There have been additional surveys in all the Project sub-areas since Gruner's analysis.

The priority heatmap generated using the first approach is generally consistent with Gruner's (2013) assessment. The unconstrained map (Scenario 1 in Gruner 2013, reproduced as Figure 8, showed the highest value areas in that scenario were located along the Mt Augustus/Mt Frederick ridgeline, from the slopes of Mt Stockton south into the St Patricks Stream and the upper Waimangaroa River catchments, in the Whareatea River catchment, around Myers Stream and along the Te Kuha ridgeline. The same area ranked highly (between 0.7 and 1.0) in this study due to the presence of 'Threatened' and 'At Risk' bryophytes, high value indigenous vascular flora and high stream values.

The areas immediately north and west of the Escarpment Extended project area also scored highly in the conservation priority/heat maps derived here and shown in Figure 7 and 8.

The high priority area along the UWHR includes a 100m buffer (50m either side) allowing for edge effects and general access during the construction works. More recent surveys have identified a large number of new records for bryophytes, snails, geckos and kiwis along the UWHR (including Ecological Solutions Limited, 2025a, Baber, 2024 and Nichol, 2020). Whilst Figure 6 shows that the UWHR has low species richness, it has high priority cell ranks, which is driven by the scores given to the species occurring there and their relative vulnerability and irreplaceability.

Low conservation priority areas identified using the first approach were also similar to those identified by Gruner (2013). Gruner (2013) also identified low value areas around the Coal Creek catchment at Denniston and around the Millerton and Stockton settlements, on the western slopes below Mt Augustus and Mt Frederick, and in the lower Orowaiti, Ballarat Creek and Coal Creek catchments which were outside the area considered here.

The location of the high priority areas just north of Mount Stockton were similar in both studies, although the present study extended further in that area as well.

The main difference between Gruner (2013) and this study is the identification of high priority areas in the southern part of the proposed UWHR and higher priority ranks associated with the Te Kuha area in this study. Interestingly, the high priority area along the UWHR was identified as high priority in both analyses.

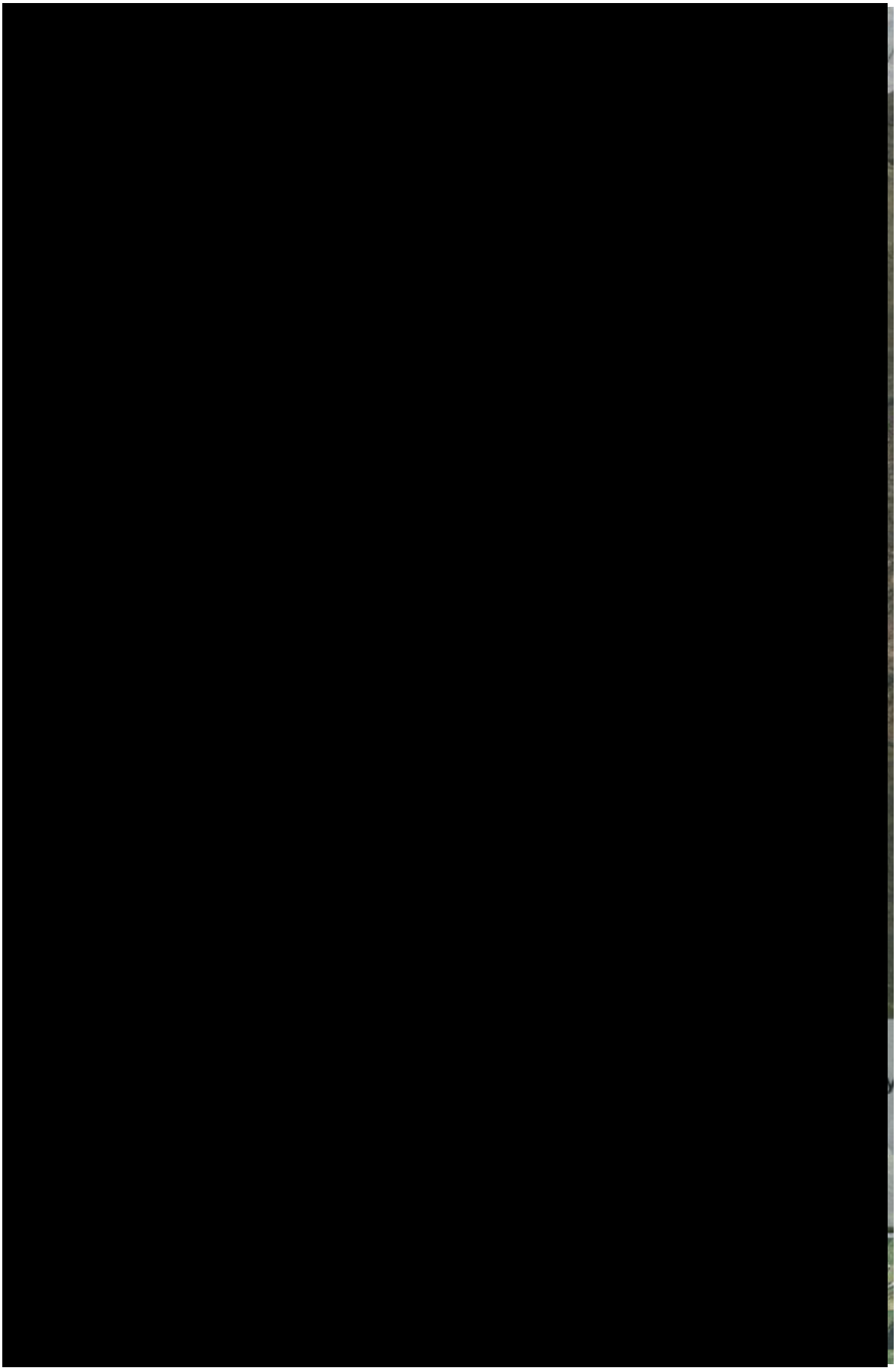


Figure 8: Conservation priority areas (Gruner 2013). Ranked from low (red) to high (blue) and disturbance areas.

3.1.4 Area Statistics

The individual project areas on the Buller Plateaux range between 213–1,845 ha at Mount Frederick South and Stockton, respectively (shown in Table 7, Section 3.1.3), although the actual area of new disturbance would be less (also shown in Table 7).

Highly ranked (i.e., priority) areas covered 338ha in the Extended Escarpment project area, 132ha along the UWHR, 522ha within the Stockton Project Area and a total of 3,453ha within the mapped area. The proportion of each Project Area occupied by high conservation priority cells (i.e., >70%) is set out in Table 7. Within the Project Area the new disturbance comprises c. 35% of the high priority areas.

3.2 Approach 2

3.2.1 Performance Curves

The average performance curve for the 16 vegetation and land cover layers, as well as the priority rank map for cells with ranks 0.7–1.0 are shown in Figure 9A and 9B respectively.

The proportion of land required to be protected is shown on the x-axis and the y-axis is the mean proportion of vegetation or land cover classes that would be retained given the proportion of land protected. As shown in Figure 9A, if 10% of the Buller Plateaux (i.e., areas with priority rank of 90 or above) was protected, approximately 40% of vegetation types and associated values would be retained within these areas. Increasing the extent of protected areas to include 60% of the priority areas would increase the retention of ecological values to approximately 80%. Protection of approximately 80% of the priority areas is required to retain 90% of the features.

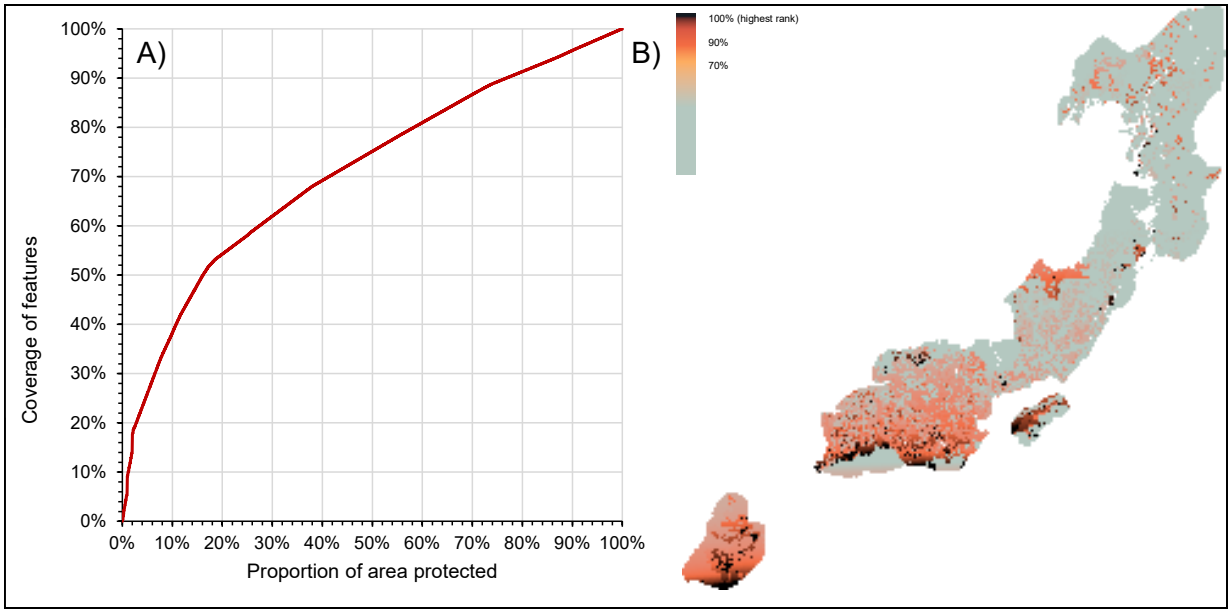


Figure 9: A) Mean performance curve for input layers into Zonation using Approach 2 B) High priority areas (rank 0.7–1.0) identified.

3.2.2 Priority Rank Heatmap

The priority conservation rank heat map for all species is shown in Figure 10. Conservation rank maps for each species group are shown in Appendix B. The overall map presents the results from all species scores (out of a possible 54) while the individual maps provide conservation priority ranks for each individual species group within each vegetation type.

Approach 2 identified four main areas with priority rankings above 0.7 (i.e., high priority areas) as shown in Figure 10. These areas are:

- Denniston Plateaux including and surrounding the Extended Escarpment Project area;
- The headwaters of Deep Creek (north of the proposed Mt Fred South Project area and south of Mt Frederick);
- The summit of Mt William; and
- Te Kuha.

The vegetation types identified as high priority occupy large areas at both Te Kuha and within the Extended Escarpment Project Area and surrounds as shown in Table 8. The large amount of priority habitat partly explains why the extent of high priority areas required to protect all the features in Approach 2 is larger than the area identified using Approach 1 – the priority rank heatmap is based on species and features being present within those vegetation types, rather than at specific locations. The high priority locations (i.e., those with ranks above 0.7) are shown in Figure 10.

Figure 7 and Figure 10 have some similarities, including that the highest priority areas (i.e., ranks >0.7) are located within the Extended Escarpment Project area, at Mt William and at Te Kuha.

Vegetation within the priority area identified at the Deep Creek headwaters is dominated by mixed silver and mountain beech forest, which provides important habitat for birds (see Appendix B). The priority area also includes approximately 11ha of low pākihi habitat, which scores highly for vascular plants, snails, invertebrates and lichens of conservation concern.

Vegetation at the summit of Mt William mostly comprised two main vegetation types: mixed silver and mountain beech forest and tussock / flax shrubland. The former provides habitat for significant bird species and the latter provides habitat for significant vascular plants and lizard species. Snails are not known to occur at Mt William. A third vegetation type (mānuka-mountain beech-podocarp shrubland) occupies approximately 36ha at Mt William and provides habitat for two lizard species and bryophytes of conservation interest (see Appendix B).

At Te Kuha there were three common vegetation types including: beech-podocarp-broadleaved forest, mānuka-mountain beech-podocarp shrubland and mānuka-tussock-wire rush shrubland, which provides habitat for significant bird species, lizards and bryophytes, invertebrates and lichens. No *Powelliphanta* snails have been recorded at Te Kuha.

Table 8: Extent of vegetation and land cover types in High Priority areas using Approach 2 and the species that each type supports.

Vegetation and land cover types	Extent (ha.)				Key species groups from Table 6 associated with vegetation and landcover types.
	Deep Creek Headwaters	Escarpment	Mt. William	Te Kuha	
Forest					
Mixed beech-podocarp-broadleaved forest	0.00	104.28	19.03	293.74	Birds
Southern rātā-mountain beech-podocarp forest	12.83	641.93	1.79	0.00	Birds
Silver beech-mountain beech forest	81.23	0.00	40.34	0.00	Birds
Shrubland					
Mānuka-mountain beech-podocarp shrubland	3.11	270.02	36.75	369.04	Lizards, bryophytes
Mānuka/Gahnia-wire rush shrubland	0.00	62.00	0.00	0.00	Lizards, bryophytes
Weedy shrubland	0.00	56.56	0.00	0.00	-
Mānuka-tussock-wire rush shrubland	0.00	326.76	0.00	129.33	Snails, other terrestrial invertebrates, lichens
Mānuka-flax/wire rush shrubland	0.50	25.11	0.00	0.00	Snails, bryophytes
Leatherwood shrubland	32.59	4.68	4.53	0.00	-
Low vegetation					
Low pākihi	11.17	545.52	0.71	14.22	Vascular plants, snails, other terrestrial invertebrates, lichens
Weedy pākihi	0.00	2.28	0.00	0.00	-
Tussock-flax shrubland	2.33	14.26	45.39	0.00	Vascular plants, snails
Exotic grassland	0.00	1.09	0.00	0.00	-
Herbfield	0.00	0.00	0.00	0.25	-
Non-vegetated land cover					-
Bare Rock	6.30	176.22	14.58	0.00	Vascular plants, lizards
Vegetation cleared	0.00	173.84	0.00	0.00	-
Water	0.00	5.47	0.00	0.06	-

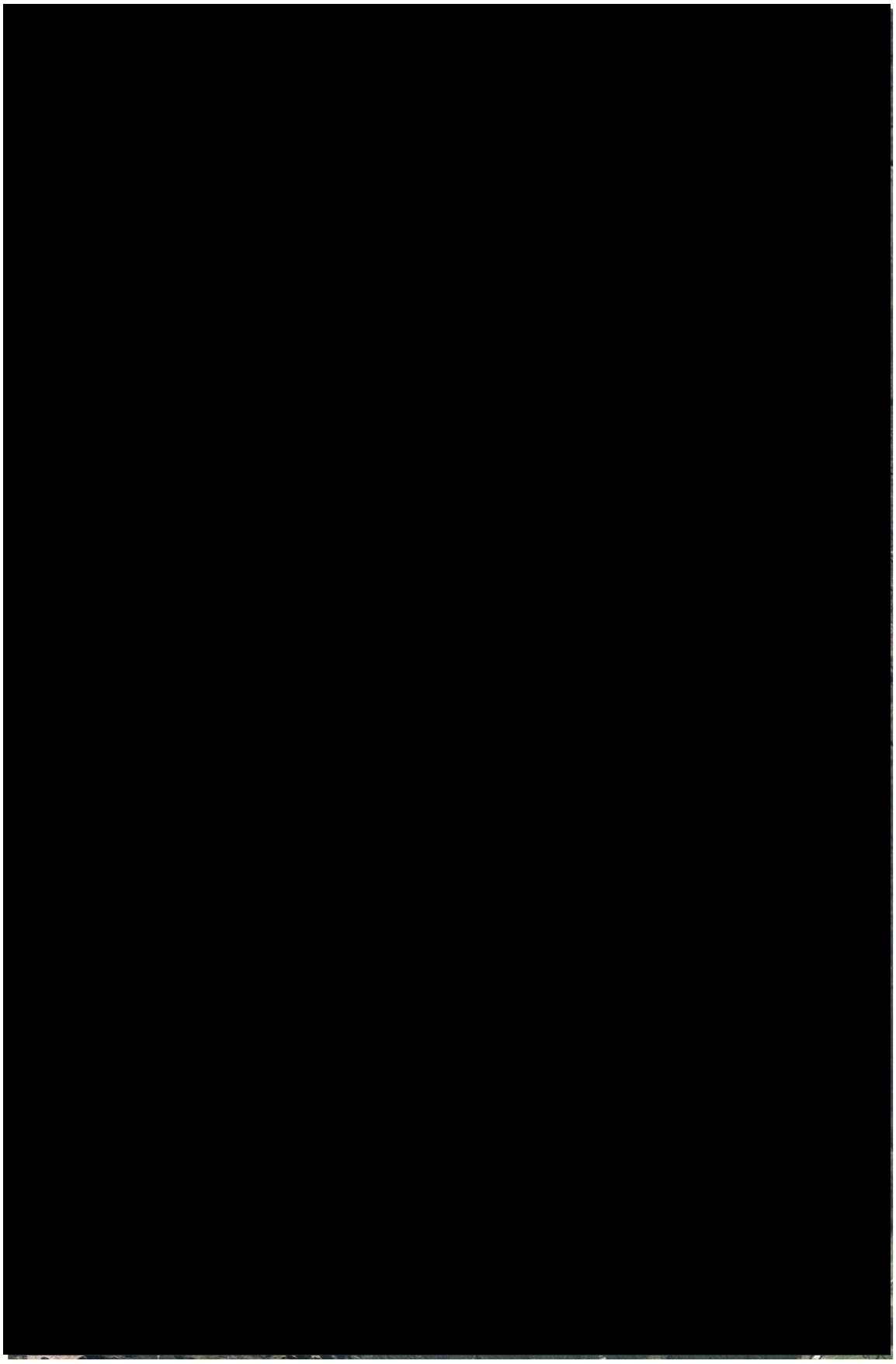


Figure 10: Conservation priority rank heat map created using Approach 2 in Zonation.

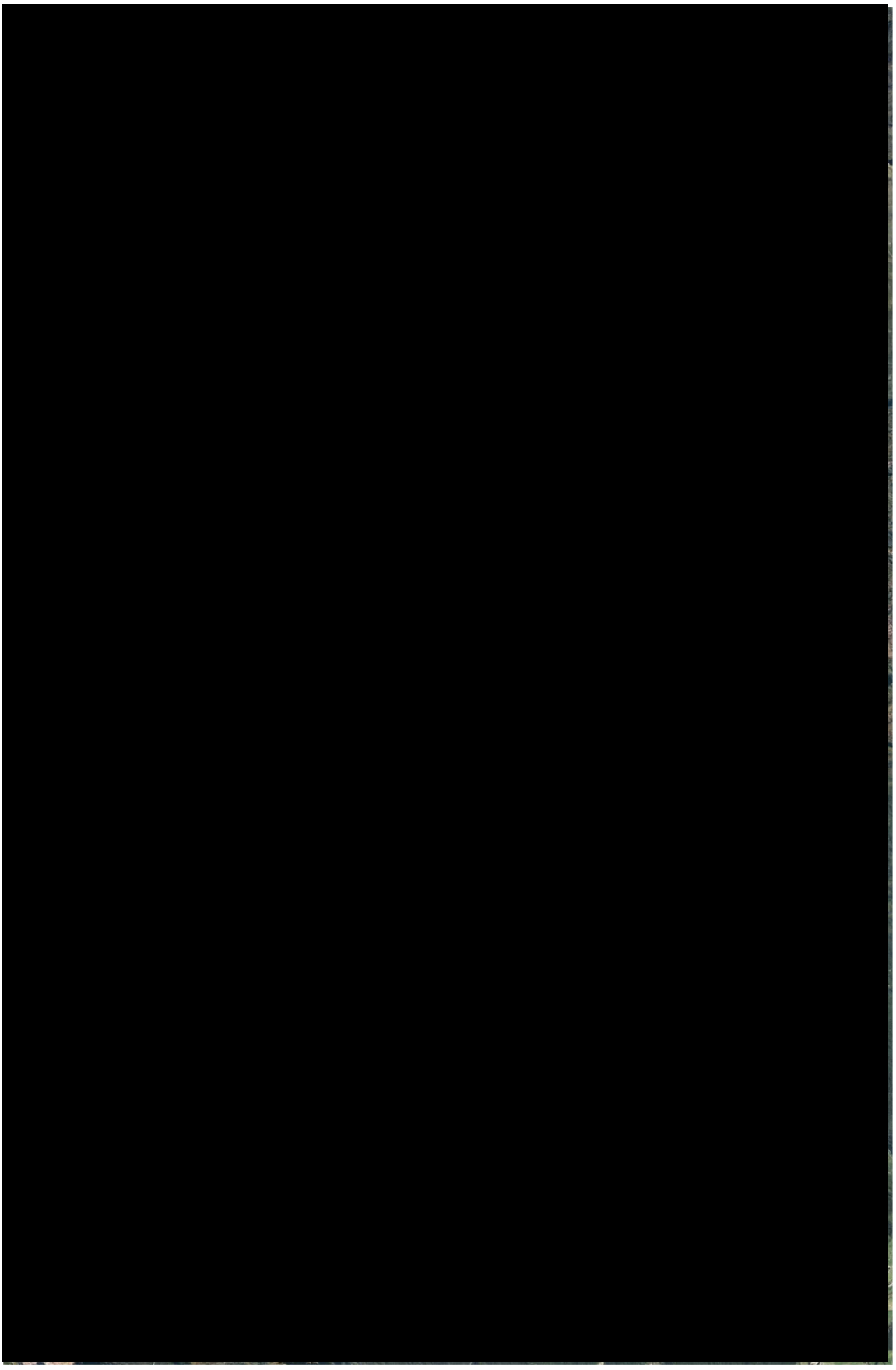


Figure 11: Conservation priority rank heatmap for all species showing high rank (0.7–1.0) locations only created using Approach 2 in Zonation.

4.0 Discussion

4.1 Limitations and opportunities

The application of Zonation to biodiversity data has resulted in simple ranking maps based on feature weights (assigned using professional judgement and relevant local experience) and distribution (confirmed via previous surveys, many of which were for proposed developments and focused primarily on the affected areas). As such, the priority rank maps do not include condition layers, retention layers, costs or hierarchical masks.

The Zonation results presented in this report are unconstrained rankings, meaning that they ignore a number of attributes of the landscape including variations in habitat condition, land that has already been, or cannot be, legally protected, costs associated with acquiring or protecting land and any costs associated with any rehabilitation or active management (e.g., pest control) required.

Condition layers, or quality of habitat information, could be incorporated relatively easily into the existing model to account for the loss of, or potential improvement in, specific areas of concern (e.g., the remaining *Powelliphanta augusta* habitat), or could be included to predict or reflect the ecological condition of an area after rehabilitation (e.g., following vegetation direct transfer or planting).

Retention layers could also be added to the existing model to reflect, to what extent, a species or other ecological value can be retained in the landscape in the absence of conservation action (Moilanen et al. 2024).

Hierarchical masks could be applied so that land available for conservation is given a certain value, land unavailable for conservation given another value, and areas already protected a third value. Since most of the land affected on the Buller Plateaux is either administered by Land Information New Zealand or the Department of Conservation and the protected areas are not necessarily guaranteed management, a hierarchical mask was not considered helpful in the present study.

Costs can be added to account for land acquisition, risk costs, restoration costs and other financial, ecosystem management or biodiversity costs. Defining the costs of particular biodiversity protection varies according to method, frequency, target species (to control or to protect), monitoring required and other variables, and was considered beyond the scope of this analysis.

Gruner (2013) applied some of these tools resulting in six different scenarios, each accounting for public conservation land, coal measures as values and coal bearing rock removal. Gruner (2013) analysed the performance of different scenarios calculated by Zonation, and found with regard to biodiversity conservation, that her Scenario 1 was the most favourable since it retained the highest average proportion of biodiversity features throughout the removal process.

4.2 Conservation Priority Areas

Because Approach 2 used vegetation layers as a proxy for habitat value for species of conservation concern, the mapped high priority areas are more aggregated than in Approach 1 due to the location and distribution of the high scoring vegetation types. This has resulted in a much larger area being identified as required to retain the majority of the species and features using Approach 2 than in Approach 1.

Both approaches identified the western slope and summit of Mt. William and the headwaters of Deep Creek immediately south of Mt Frederick as important areas for conservation prioritisation. Approach 2 identified four key areas as high priority for conservation including:

- The headwaters of Deep Creek;
- Areas within and surrounding the Extended Escarpment Project sub-area;
- The summit and upper slopes of Mt. William; and
- Te Kuha.

Approach 1 yielded a similar result except:

- Approach 1 identified eight priority areas in total, the others being north of Mount Stockton, west of Cypress Mining area, west of the UWHR and the summit of Mt Rochfort.
- Approach 2 identified a larger extent of high priority areas at Te Kuha due to the extent of contiguous vegetation.
- The priority areas identified along the UWHR and north of the Stockton Project areas using Approach 1 were valued lower (and were smaller in extent) in Approach 2 because Approach 2 did not rely on specific location data.
- The priority area at the headwaters of Burnett Creek identified in Approach 1 was not ranked as highly using Approach 2.

4.3 Effects Management

This analysis has identified approximately 3,453ha of 'high priority for conservation' land within the mapped area. Of that 361ha would be removed by the BPCP leaving 3,092ha of high priority areas which would be retained in indigenous vegetation. Depending on the values present, either alone or in conjunction with other areas, these high priority locations may be suitable for management to offset the ecological values lost as part of the BPCP. The location and extent of the remaining high conservation priority land is set out in Table 8.

The current disturbance areas would result in a loss of approximately 361ha of high priority ranked land across the proposed project sites. Reducing the magnitude of the loss of high priority areas could realistically be achieved through the effective application of the effects management hierarchy by remediation including vegetation direct transfer and other mitigation actions within these areas, including, but not limited to, actions such as salvage and relocation of snails and management of threatened and at risk vascular and non-vascular plant species.

Realigning the disturbance footprints to avoid high ranking areas would be the most certain option to reduce the potential loss. In areas that cannot be avoided, the remediation of areas using vegetation direct transfer as described in Ecological Solutions Limited (2025c) would provide the best outcome in terms of maintaining ecological values in the medium-long term. Mitigation measures including landscape scale pest mammal control form part of the proposal and are intended to assist in minimising the risk of losing species and habitats from high priority areas which are being removed by maintaining them in the surrounding areas. These mitigation measures are set out in the relevant management plans.

4.4 Conclusion

The output maps provided in this report are a decision tool to provide guidance in relation to what high conservation priority areas would be lost due to the BPCP and where the remaining conservation opportunities exist. These remaining high priority areas are proposed to be used to maximise the value of offsetting and compensation proposals, including the location of predator proof exclosures.

Both Approach 1 and Approach 2 identify high priority areas within and surrounding the Escarpment Extended Project area. In our view, the survey effort bias inherent in Approach 1 and indicated by the location of high priority areas associated with areas subjected to extensive survey (e.g., along the UWHR, at Cypress mine and to the north of Stockton Mine), is removed using Approach 2.

Approach 2 results in those areas (i.e., UWHR, Cypress Mine, north of Stockton Mine) not being identified as a high conservation priority. The priority areas identified using Approach 2 are associated with five widespread vegetation types that provide important habitat for birds, lizards, bryophytes, snails and other terrestrial invertebrates. Approach 2 is less biased towards previous survey effort, but is reliant on professional judgement of habitat quality and may overestimate the value of certain habitats where high value species (e.g., snails or 'Threatened' bryophytes) are not found. Approach 2 produced heatmaps which covered a wider area and were less 'patchy' than the heatmaps produced using Approach 1 because they were not reliant on specific locations.

Additional input feature layers and constraints analysis could provide more nuanced solutions and may identify alternative options not identified here.

5.0 References

Avifauna References

Buckingham, R. 2002. Bird and *Powelliphanta* Snail Survey, Whareatea West Exploration Permit (EP 40 591), Denniston Plateau, Buller (p. 30). Wildlife Surveys.

Buckingham, R. 2008. An Investigation of Terrestrial Ecosystems for the L&M Coal Ltd Escarpment Mine Project: Avifauna and *Powelliphanta* snails (p. 64). Wildlife Surveys Limited.

Ecological Solutions Limited. 2025a. Assessment of Rehabilitation Outcomes at Stockton Mine. Unpublished report prepared for BT Mining Limited. In prep. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2025b. Buller Coal Plateau Vegetation Mapping. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. In prep. Ecological Solutions Limited, Kāeo.

Nichol, R. 2020. Baseline Bird Survey within Marshalls North and Marshalls South, Stockton Plateau. Unpublished report by Richard Nichol Ecology, March 2020.

Nichol, R. 2021. Stockton Rehabilitation Areas: Baseline Bird Monitoring.

Nichol, R. 2023. Five-minute bird count data 2011-2023, Denniston Plateau] [Unpublished raw data]. Richard Nichol Ecology. Retrieved 15/11/2024.

Nichol, R. 2024. Stockton Rehabilitation Areas: Bird Monitoring 2024.

McLennan, J. 2012. Fauna of the Denniston CML37-161 Denniston Plateau (p. 35). John A. McLennan Environmental Services Ltd.

Robertson H. A., Baird K. A., Elliott G. P, Hitchmough R. A., McArthur N. J., Makan T., Miskelly C. M., O'Donnell C. J., Sagar P. M., Scofield R. P., Taylor G. A. and Michel P. Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington. 43 p

Roxburgh, S., Hamilton, M. 2008. Priority 6 – Millerton North Flora & Fauna Survey Report. Survey report for Solid Energy New Zealand Ltd by MBC Contracting Ltd.

Roxburgh, S., Hamilton, M. 2008. Millerton East – Priorities 2 & 7 (Part 2) Flora & Fauna Survey Report. Survey report for Solid Energy New Zealand Ltd by MBC Contracting Ltd.

Surveys, W. 2003. Cypress Mine Project: Survey for Kiwi and Bats (p. 25). Solid Energy New Zealand Limited.

Toft, S. Bruce, R. 2002. A Survey for Terrestrial Fauna on the Millerton Block, January 2002.

Thomas, B. 1999. An Assessment of Impacts on Terrestrial Fauna of the Northern Opencast Mine Development of the Upper Waimangaroa Valley, Buller Coalfield (LC9899/107; p. 17). Landcare Research NZ Ltd.

Thomas, B., Toft, R. 1997. Surveys for Fauna in the Upper Waimangaroa Valley (LC9697/101; p. 39). Landcare Research.

Bryophyte and Lichen References

Braggins, J.E. and Kusabs, A. 2006. Report on a survey to locate alternative populations of endangered bryophytes adjacent to the Stockton mine site. Prepared for Michell Partnerships.

Brown, E.A., and Renner, M.A.M. 2014. The genus *Acromastigum* in Australia. Telopea 17: 251–293.

de Lange, P. J., Galloway, D. J., Blanchon, D. J., Knight, A., Rolfe, J. R., Crowcroft, G. M., and Hitchmough, R. 2012. Conservation status of New Zealand lichens. New Zealand Journal of Botany, 50(3), 303–363.

de Lange, P.J., Blanchon, D., Knight, A., Elix, J., Lucking, R., Frogley, K., Harris, A., Cooper, J. and Rolfe, J. 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27. Department of Conservation, Wellington. 64 pp.

de Lange, P.J., Glenny, D., Frogley, K., Renner, M.A.M., von Konrat, M., Engel, J.J., Reeb, C. and Rolfe, J.R. 2020. Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31. Department of Conservation, Wellington. 30 pp.

Ecological Solutions Limited. 2025a. Assessment of Rehabilitation Outcomes at Stockton Mine. Unpublished report prepared for BT Mining Limited. In prep. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2025c. Buller Plateaux Continuation Project Escarpment Extended Project Sub-Area Baseline Surveys. Unpublished report prepared for Bathurst Resources Limited. In prep. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2025d. Buller Plateaux Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited. Kāeo, Northland. October 2024. 91 pages + appendices.

Ecological Solutions Limited. 2025e. Buller Plateaux Continuation Project Mt Fred South Project Sub-Area Baseline Surveys. Unpublished report prepared for Bathurst Resources Limited. In prep. Ecological Solutions Limited, Kāeo.

Engel, J.J. and Glenny, D. 2008. A Flora of the Liverworts and Hornworts of New Zealand. Vol. 1. Monographs in Systematic Botany from the Missouri Botanical Garden. Vol. 110. Missouri Botanical Garden, St. Louis.

Engel, J.J. and Glenny, D. 2019a. A Flora of the Liverworts and Hornworts of New Zealand. Vol. 2. Monographs in Systematic Botany from the Missouri Botanical Garden. Vol. 134. Missouri Botanical Garden, St. Louis.

Engel, J.J. and Glenny, D. 2019b. A Flora of the Liverworts and Hornworts of New Zealand. Vol. 3. Monographs in Systematic Botany from the Missouri Botanical Garden. Vol. 135. Missouri Botanical Garden, St. Louis.

Galloway, D.J. 1985. Flora of New Zealand: Lichens. Government Printer.

Galloway, D.J. 2007. Flora of New Zealand Lichens, Revised Second Edition: Including lichen-forming and lichenicolous fungi. Manaaki Whenua Press, Landcare Research.

Galloway, D.J. and Elix, J.A. 1980. *Knightiella* Müll.Arg., a monotypic lichen genus from Australasia. New Zealand Journal of Botany 18: 481-486.

Glenny, D. 1999. Bryophyte survey at Stockton Plateau: Happy Valley tussock-land and surrounding areas. Landcare Research Contract Report LC9899/050. Prepared for

Solid Energy Ltd.

Glenny, D. 2002. Terrestrial Bryophytes – Survey (2003 revision). Landcare Research Ltd. Prepared for Solid Energy New Zealand Ltd.

Glenny, D. 2005. Report on Bryophytes on Mount Augustus Ridge, Stockton (unpublished Draft Report 19 April 2005). Prepared for Solid Energy New Zealand Ltd.

Glenny, D. 2007. Bryophytes and Lichens in Forests on Mount Frederick Ridge, Stockton Plateau. Landcare Research Contract Report: LC0708/034. Prepared for Solid Energy New Zealand Ltd.

Glenny, D. 2008a. Effect of flow in Mangatini Stream on bryophytes in the gorge below the present road culvert. Landcare Research (unpublished). Prepared for Solid Energy New Zealand Ltd. 3 pp.

Glenny, D. 2008b. Bryophytes survey of propped dam sites at T35 Stream and mid-Patrick Stream, Stockton Plateau. Landcare Research Contract Report LC0809/050. Prepared for Solid Energy New Zealand Ltd. 5 pp + appendices.

Glenny, D. 2012. Bryophytes and lichens in the proposed Escarpment Mine area, Denniston Plateau. Landcare Research Contract Report: LC 1131. Prepared for Buller Coal Ltd. October 2012.

Glenny, D. 2015. Bryophyte Survey of Te Kuha Ridge, Westport. Landcare Research Contract Report: LC2434. Prepared for Stevenson Group Ltd. December 2015.

Glenny, D. 2024. *Riccardia dimorpha* sp. nov. (Hepaticophyta, Aneuraceae) from Western Nelson, New Zealand, exhibiting sexually determined morphological dimorphism, an overlooked feature of some liverworts. Telopea 27: 73–83.

Glenny, D. 2015. Bryophyte Survey of Te Kuha Ridge, Westport. Landcare Research Contract Report: LC2434. Prepared for Stevenson Group Ltd. December 2015.

Glenny, D. and Bartlett, R. 2008. A new *Bazzania* species (Lepidoziaceae) from Stockton Plateau, Nelson, South Island, New Zealand. Fieldiana, Botany, new series, 47: 175–180.

Glenny, D. and Dawson, M. 2011. Bryophyte survey of northern Mt William Range. Landcare Research Contract Report: LC 281. Prepared for Solid Energy New Zealand Ltd. November 2011.

Glenny, D. and Fife, A.J. 2001. Bryophyte survey at Te Kuha Ridge. Landcare Research Contract Report LC0001/82. Prepared for Michell Partnerships Ltd.

Glenny, D. and Kusabs, A. 2005. Bryophyte Survey of Proposed Dam Sites at Mangatini Stream, Stockton Plateau. Landcare Research Contract Report LC0506/038. Prepared for Solid Energy New Zealand Ltd.

Jellyman, D.P. and Stark, D.J. 2013. Escarpment Mine: Baseline Report Aquatic Ecology.

Ludwig, L.R. 2015. The reproductive ecology of *Icmadophila splachnirima*, including aspects of the reproduction in additional members of Icmadophilaceae (Doctoral dissertation, University of Otago, Dunedin, New Zealand).

Meagher, D. 2020a. Proposed Road Alignment, Stockton Plateau – Bryophyte Surveys 2019 – 2020. Unpublished report by Zymurgy Consulting Limited for Bathurst Resources Limited. 15pp + appendices. Zymurgy Consulting, Surrey Hills, Australia.

Meagher, D. 2020b. Cypress Stream, Stockton Plateau — bryophyte monitoring 2020. Unpublished report by Zymurgy Consulting Limited for Bathurst Resources Limited. 13pp + appendices. Zymurgy Consulting: Surrey Hills, Australia.

Rolfe, J.R., Fife, A.J., Beever, J.E., Patrick J. Brownsey, P.J. and Hitchmough, R.A. 2016. Conservation status of New Zealand mosses, 2014. New Zealand Threat Classification Series 13. Department of Conservation, Wellington. 12 pp.

Suren, A.M and Glenny, D. 2002. Aquatic bryophyte communities of streams in the Upper Waimangaroa Valley [revised 2003]. NIWA. Prepared for Solid Energy New Zealand Ltd.

Terry J.A. 2017a. Bryophyte and lichen survey outside of the proposed Te Kuha coal mine footprint, near Westport, New Zealand. Unpublished report prepared by Jon Terry Ecology. Limited for Stevenson Group Limited, August 2017. Jon Terry Ecology Limited, Wellington. 19pp.

Terry J.A. 2017b. Bryophyte and lichen survey of rehabilitated sites at Stockton Coal Mine, near Westport, New Zealand. Unpublished report prepared by Jon Terry Ecology. Limited for Stevenson Group Limited, August 2017. Jon Terry Ecology Limited, Wellington. 16pp.

Herpetofauna References

Baber, M., King, S. 2015. Escarpment Mine Lizard Salvage and Monitoring Report. Prepared for Bathurst Resource Ltd by Tonkin & Taylor Ltd and MBC Contracting Ltd. 38 pp.

Baber, M. 2024. [Herpetofauna records Buller Plateau 1969-2020] [Unpublished raw data]. Retrieved 5/11/2024

Baber, M. 2020. Buller Plateau Project: Baseline Lizard Report. Prepared for Bathurst Resources Ltd by Alliance Ecology Ltd. 37 pp.

Department of Conservation. 2024. Denniston ACO Monitoring 2021-2025. [Unpublished raw data]. Retrieved 4/12/2024

Ecological Solutions Limited. 2025b. Buller Coal Plateau Vegetation Mapping. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. In prep. Ecological Solutions Limited, Kāeo.

Lettink, M. 2011. Lizard survey of Mt William North. Prepared for Wildlife Surveys Ltd by Fauna Finders. 9pp.

Lettink, M. 2012. Lizard survey of the footprint of the proposed Escarpment Mine, Denniston Plateau, North Westland. Unpublished Report prepared by Fauna Finders for the Royal Forest & Bird Protection Society of New Zealand Inc. 10 pp.

Thomas, B., Toft, R. 1997. Surveys for fauna in the Upper Waimangaroa Valley. Landcare Research Contract Report: LC9697/101. Prepared for Kingett Mitchell and Associates Ltd by Maanaki Wenua Landcare Research. 39 pp.

Invertebrate References

Buckingham, R. 1998. Surveys for *Powelliphanta* land snails in the upper Waimangaroa Valley, Blackburn-Orikaka pakihi, Mount Stockton and Mount Rochfort localities, South Island West Coast, New Zealand. Contract report No. 24/1. Preapred for Solid Energy International by Wildlife Surveys.

Buckingham, R. 2002. Bird and *Powelliphanta* snail survey Whareatea West Exploration Permit (EP 40 591), Denniston Plateau, Buller. Prepared for Restpine Limited By Wildlife Surveys Ltd. 30pp.

Buckingham, R., Riddell, K. 2004. A survey for the endemic land snail *Powelliphanta*

"patrickensis" within the proposed Cypress Mine area and a proposed predator exclusion fenced area: October - November 2004. Unpublished draft report for Solid Energy NZ Ltd by Wildlife Surveys Ltd. 4pp.

Buckingham, R. 2008. An Investigation of Terrestrial Ecosystems for the L&M Coal Ltd Escarpment Mine Project: Avifauna and *Powelliphanta* snails. Prepared for Resource and Environmental Management (Nelson) Ltd by Wildlife Surveys Ltd. 64pp.

Buckingham, R. 2010. An investigation of Terrestrial Fauna (Avifauna and *Powelliphanta* snails) within proposed transportation routes and processing sites. Addendum: Escarpment Mine Project. Prepared for L&M Coal Ltd via Resource and Environmental Management Nelson Ltd by Wildlife Surveys Ltd. 43pp.

Buckingham, R. 2011. Survey for terrestrial fauna at the proposed Mt William North mining area. Prepared for Solid Energy New Zealand Ltd by Wildlife Surveys Ltd. 74pp.

Charteris, M. 2006. *Powelliphanta* land snails at Z12 Area, Stockton Mine. Contract Report for Solid Energy New Zealand Ltd by Waybacks Ltd. 13pp.

Ecological Solutions Limited. 2025b. Buller Coal Plateau Vegetation Mapping. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. In prep. Ecological Solutions Limited, Kāeo.

Lloyd, B. 2012. Analyses of *Powelliphanta* Snail Survey Data for the Escarpment Mine Project. Prepared for Buller Coal Ltd by Lloyd's Ecological Consulting. 56pp.

Lloyd, B. 2024. Surveys for *Powelliphanta patrickensis* Snails in Areas Rehabilitated After Mining. Prepared for Bathurst Resources Ltd by Lloyd's Ecological Consulting. 31pp.

Lloyd, B. 2024. Capture-recapture Monitoring *Powelliphanta patrickensis* Snails in Denniston Permanent Protection Area, 2014–2024. Prepared for Bathurst Coal Ltd by Lloyd's Ecological Consulting Ltd. 39pp.

Toft, R.J. 2011. Terrestrial Invertebrates in the Mt William North Project Area. Prepared for Solid Energy New Zealand Ltd.

Walker K., Walton K., Edwards E., Hitchmough R., Payton I., Barker G. and Michel P. 2022. Conservation status of New Zealand indigenous terrestrial Gastropoda (slugs and snails). Part 3. Rhytididae (carnivorous snails), 2022. New Zealand Threat Classification Series 42. Department of Conservation, Wellington. 32 p.

Stream Classification References

ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, Australia.

Hogsden, K. and Watson, A. 2024. Buller Plateau Stream Quality Classification. NIWA 2024. Retrieved 3 December 2024.

Vascular Plants References

de Lange, P.J., Gosden, J., Courtney, S.P., Fergus, A.J., Barkla, J.W., Beadel, S.M., Champion, P.D., Hindmarsh-Walls, R., Makan, T., Michel, P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington. 105 pp.

Ecological Solutions Limited. 2025a. Assessment of Rehabilitation Outcomes at Stockton

Mine. Unpublished report prepared for BT Mining Limited. In prep. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2025b. Buller Coal Plateau Vegetation Mapping. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. In prep. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2024a. Drill Site Inspections at Mt Fred South. Unpublished letter from Michaela Lambert to Campbell Robertson, Bathurst Resources Limited. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2024b. Repatriation of Species of Significance Plants from Escarpment Mine. Unpublished report prepared for Bathurst Resources Limited. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2025f. Cypress Mining Area VDT Storage Transects Annual Monitoring Report 2025. Unpublished report prepared for Bathurst Resources Ltd by EcoLogical Solutions Limited. Kāeo. 39pp.

Holdaway, R.J., Wiser, S.K. and Williams, P.A. 2012. Status Assessment of New Zealand's Naturally Uncommon Ecosystems. Conservation Biology, 26: 619-629. https://doi.org/10.1111/j.1523-1739.2012.01868.x

Lloyd, B.D., Overmars, F. 2012. Proposed Escarpment Mine: Vegetation Survey of Trent Stream Area and Southern Denniston Plateau. Prepared for Buller Coal Ltd by Lloyd's Ecological Consulting Ltd and Sustainability Solutions Ltd.

Ministry for the Environment, Department of Conservation. 2007. Protecting our Places: Information about the Statement of National Priorities for Protecting Rare and Threatened Biodiversity on Private Land. Published in April 2007 by the Ministry for the Environment Manatū Mō Te Taiao PO Box 10362, Wellington, New Zealand. ISBN: 0-478-30135-9 Publication number: ME 805.

Nichol, R., Overmars, F. 2008. Vegetation and Flora Baseline Survey, L&M Coal Ltd Escarpment Mine Project, Buller Plateau. Prepared for Resource and Environmental Management Ltd.

Nichol, R. 2021. Ecological Impact Assessment Mine Creek Sump Proposal - Stockton. Unpublished draft report prepared for BT Mining Limited by Richard Nichol Ecology.

Wiser SK, Buxton RP, Clarkson BR, Richardson SJ, Smale MC, West C, Williams PA. 2007. New Zealand Naturally Uncommon Ecosystems factsheets. www.landcareresearch.co.nz/publications/naturally-uncommon-ecosystems. Date accessed: 05/08/2025.

Vegetation Classification References

Ecological Solutions Limited. 2025b. Buller Coal Plateau Vegetation Mapping. Unpublished report prepared by Ecological Solutions Limited for Bathurst Resources Limited. In prep. Ecological Solutions Limited, Kāeo.

Ecological Solutions Limited. 2025d. Buller Coal Plateau Contextual Study. Unpublished report prepared for Bathurst Resources Limited by Ecological Solutions Limited. Kāeo, Northland. October 2024a.

Zonation References

da Costa-Pinto, A. L., Kujala, H., Bovendorp, R. S., Malhado, A. C., Ladle, R. J. 2024. Planning for a future of changes: Prioritising areas for conservation of small mammals

in the Caatinga, Brazil. *Diversity and Distributions*, *30*(8), 1–14. https://doi.org/10.1111/ddi.13895

Fuentes-de la Rosa, D. L., Aguilar-Cámara, A., Camarena-Hernández, A., Ochoa-Ochoa, L. M. 2024. Big impacts with small efforts: spatial prioritization for amphibian conservation in the Sierra Madre del Sur, Mexico. Animal Conservation, 28, 410–423. https://doi.org/10.1111/acv.12993

Grand, J., Meehan, T. D., DeLuca, W. V., Morton, J., Pitt, J., Calvo-Fonseca, A., Dodge, C., Gómez-Sapiens, M., González-Sargas, E., Hinojosa-Huerta, O., Nagler, P., Restrepo-Giraldo, C., Shafroth, P. B., Villagomez-Palma, S., & Wilsey, C. B. 2024. Strategic restoration planning for land birds in the Colorado River Delta, Mexico. *Journal of Environmental Management*, *351*(December 2023). https://doi.org/10.1016/j.jenvman.2023.119755

Gruner, I. 2013. Conservation Planning for the Buller Coal Plateau. Unpublished Technical Report. 15 May 2013.

Lehtomäki, J., Moilanen, A., Toivonen, T., & Leathwick, J. (2016). *Running a Zonation Planning Project* (pp. 1–60). Helsinki. https://doi.org/10.13140/RG.2.1.4919.5289

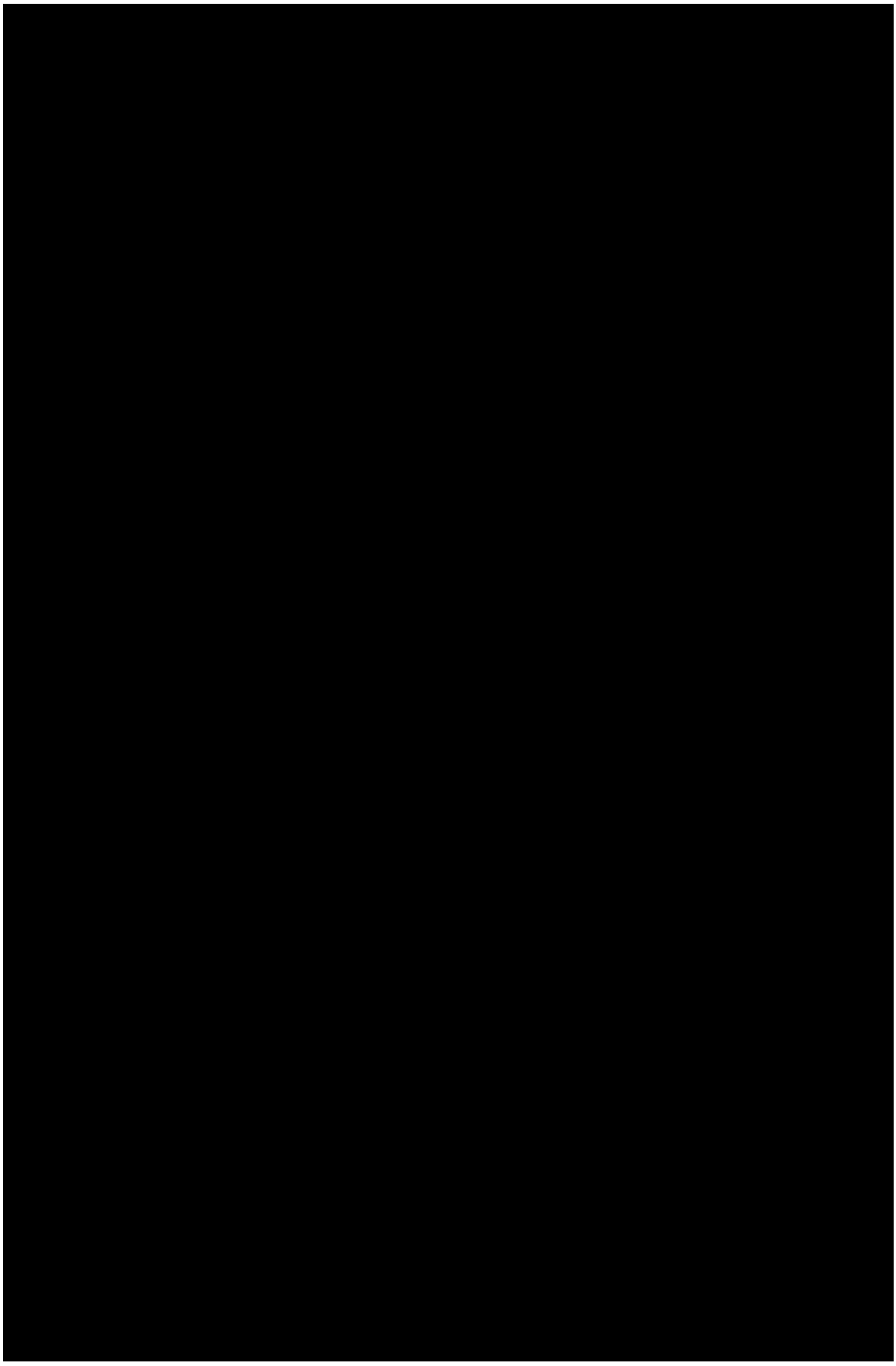
Moilanen, A., Kohonen, I., Lehtinen, P., Kivistö, I., Jalkanen, J., Virtanen, E., and Kujala, H. Zonation 5 v2.0 user manual. March 2024.

Ribeiro, B. R., & Atadeu, M. 2019. Systematic conservation planning: Trends and patterns among highly-cited papers. *Journal for Nature Conservation*, *50*(January), 125714. https://doi.org/10.1016/j.jnc.2019.125714

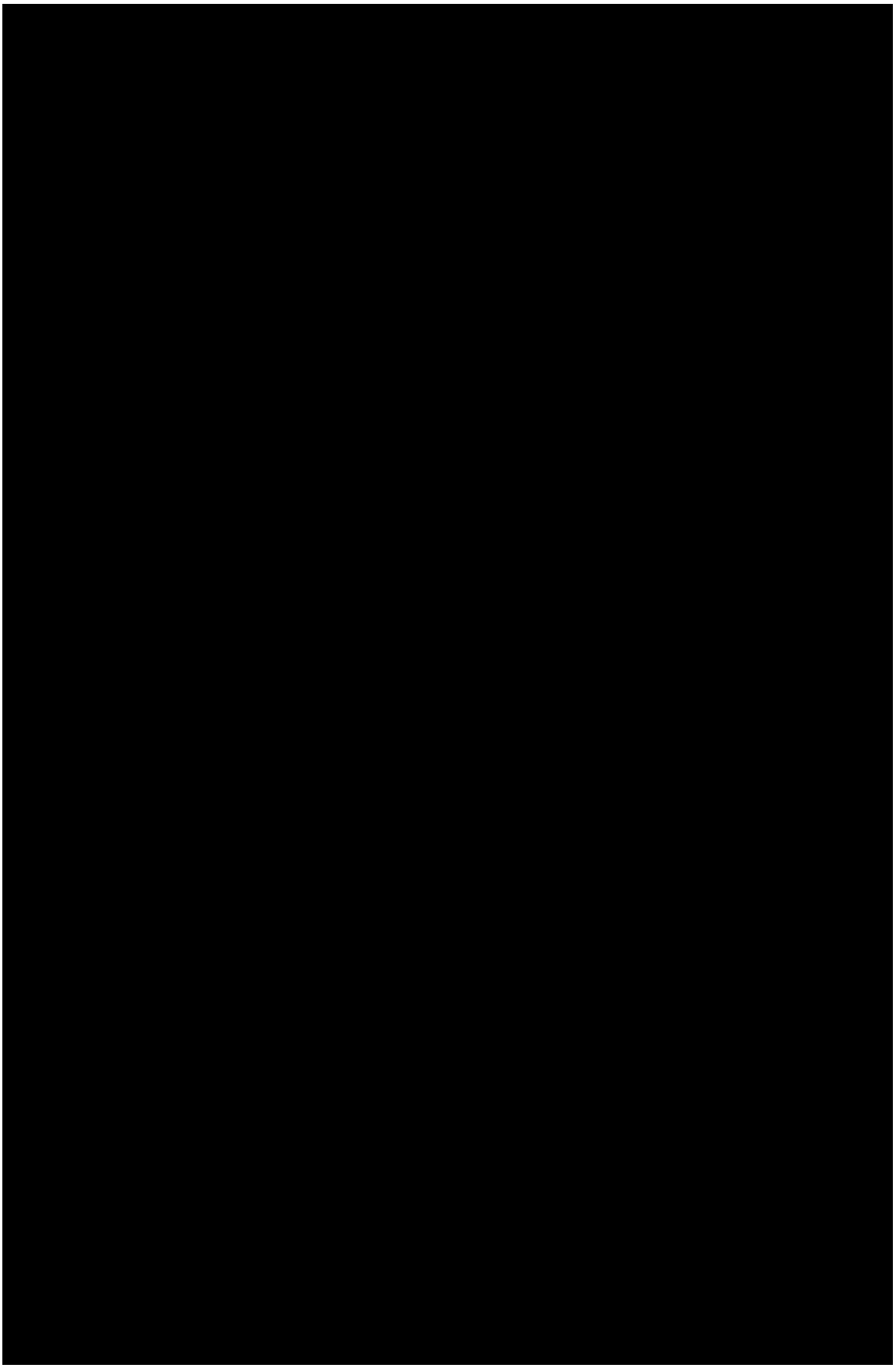
Yuan, M., Li, L., Yu, H., Xiong, J., Yu, J. 2025. Considering human interference to prioritize spatial conservation in a transboundary river basin using zonation. *Scientific Reports*, *15*(1), 1–13. https://doi.org/10.1038/s41598-025-04124-y

APPENDIX A

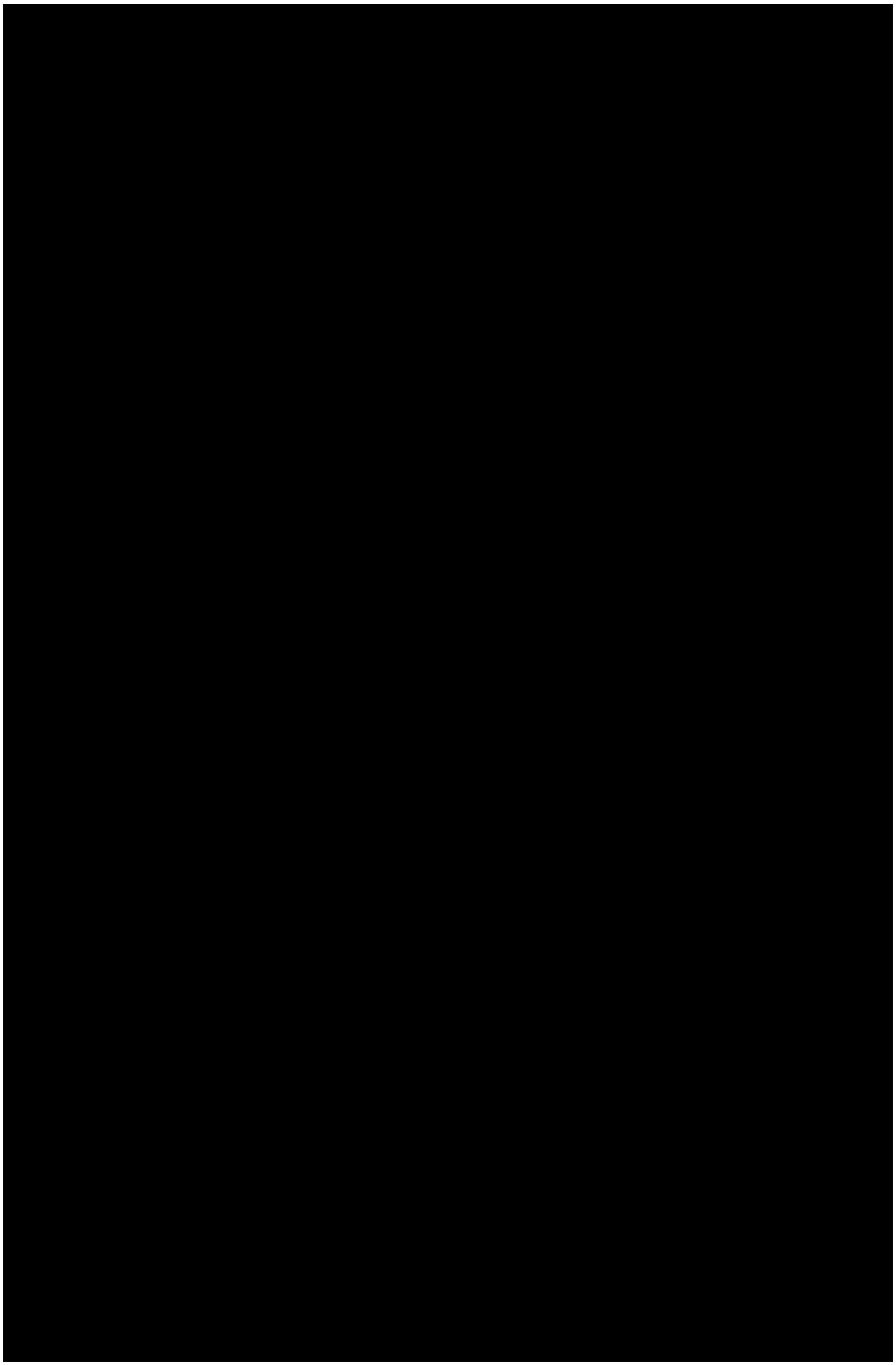
Species distribution maps – Approach 1



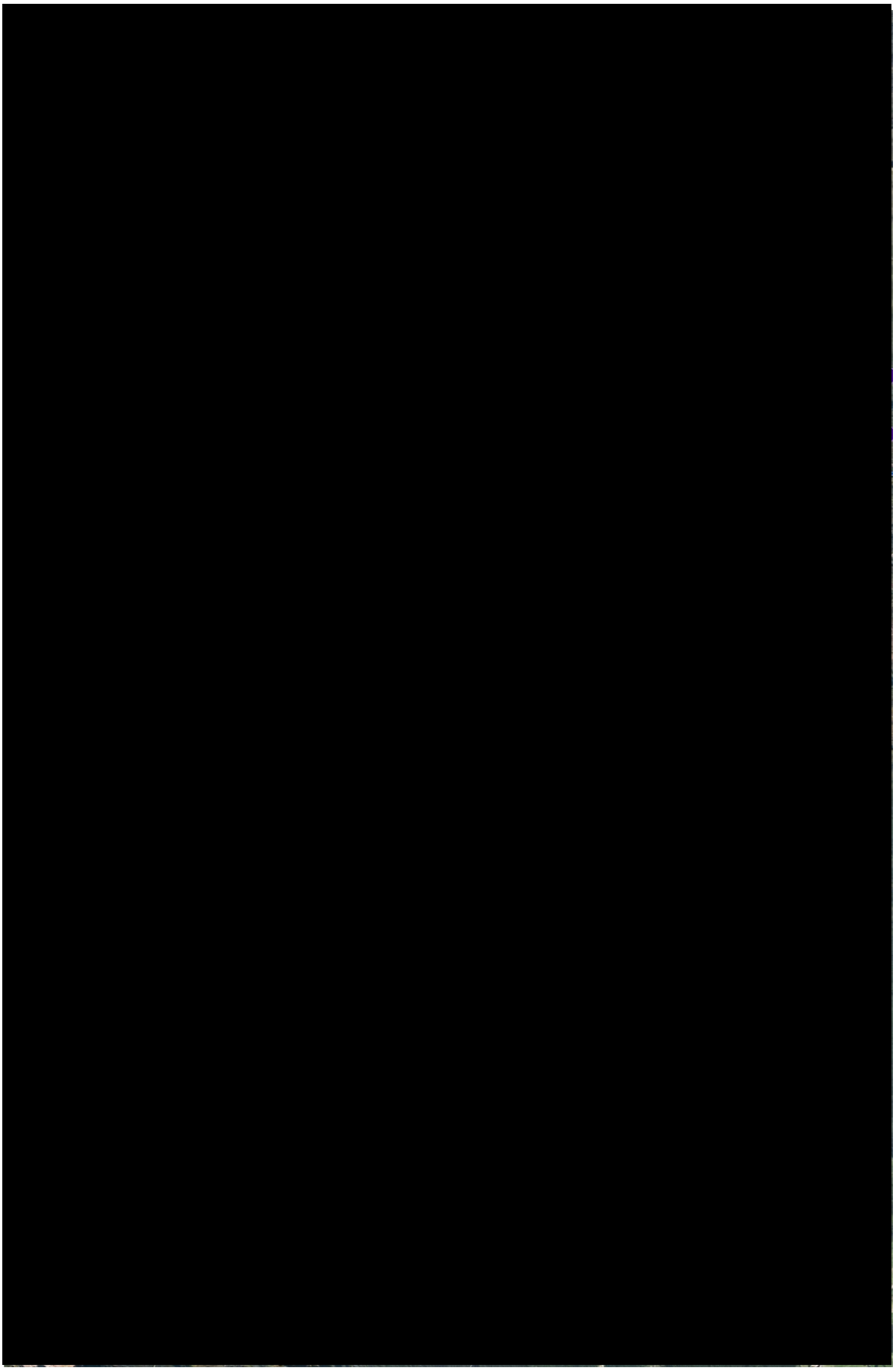
Confirmed Snail (*Powelliphanta patrickensis*) locations on the Buller Plateaux.



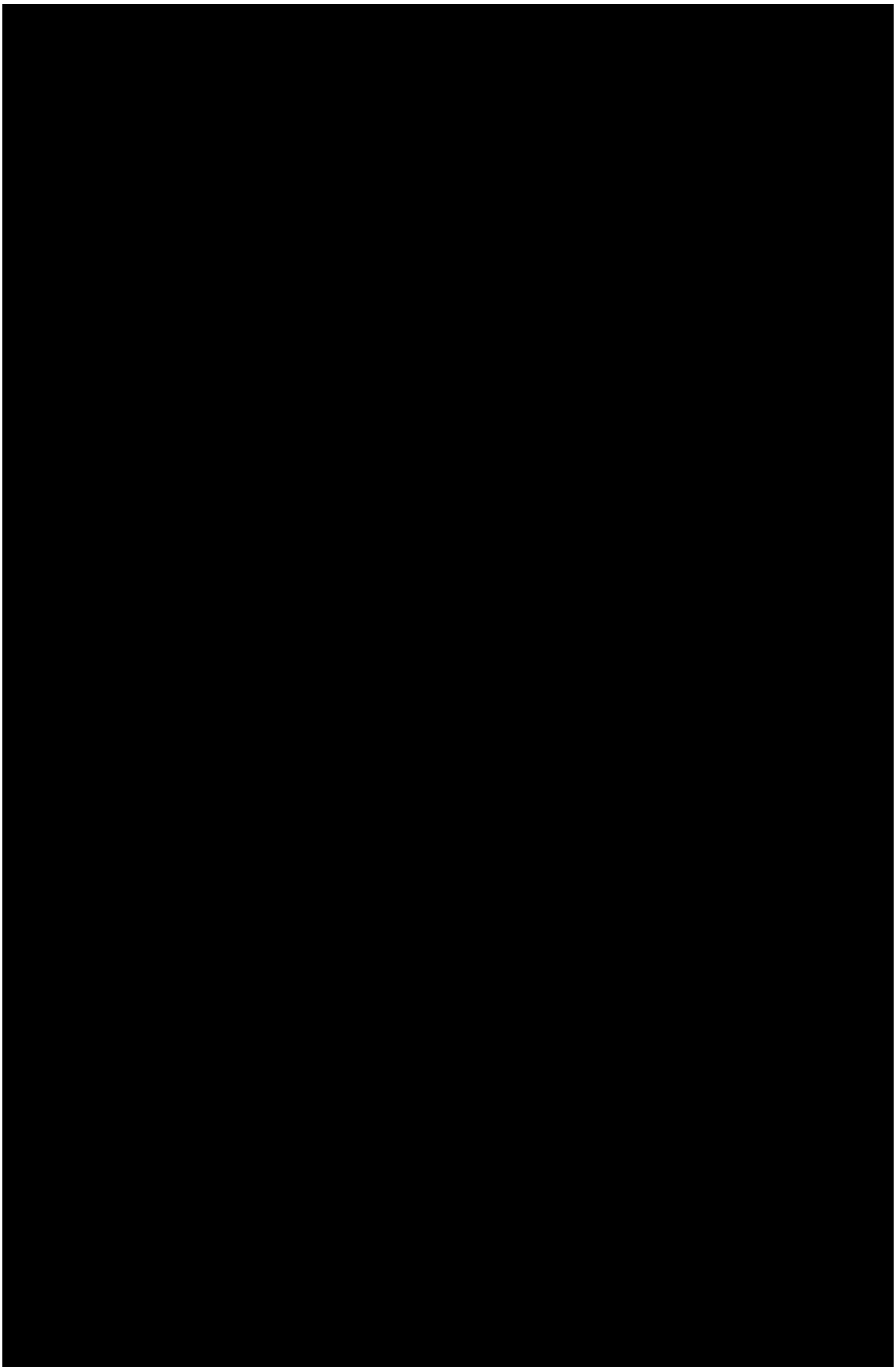
Confirmed west Coast green (*Naultinus elegans*) and forest gecko (*Mokopirirakau granulatus* locations on the Buller Plateaux.



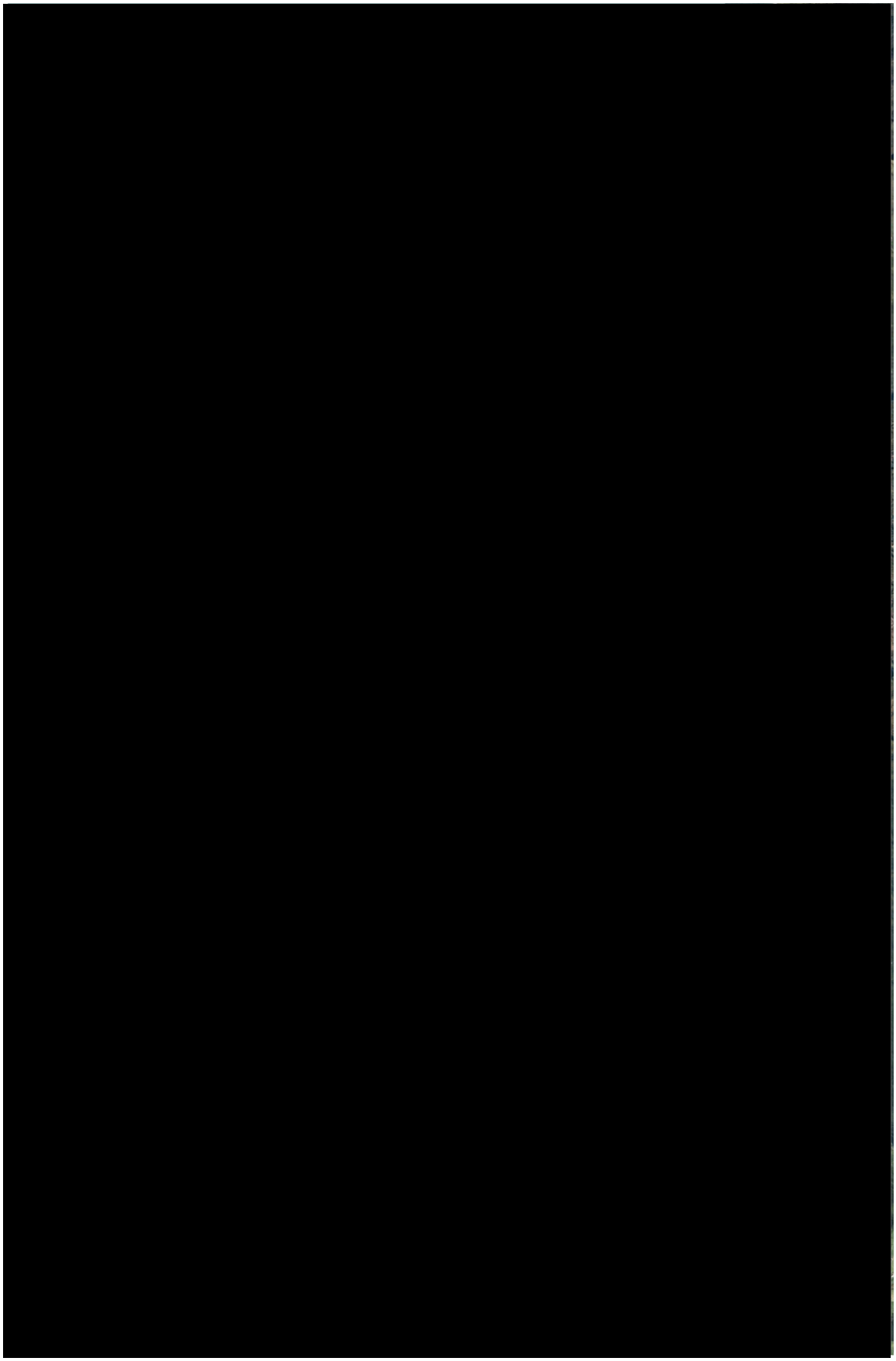
Confirmed coal measures tussock (*Chionochloa juncea*) records on the Buller Plateaux.



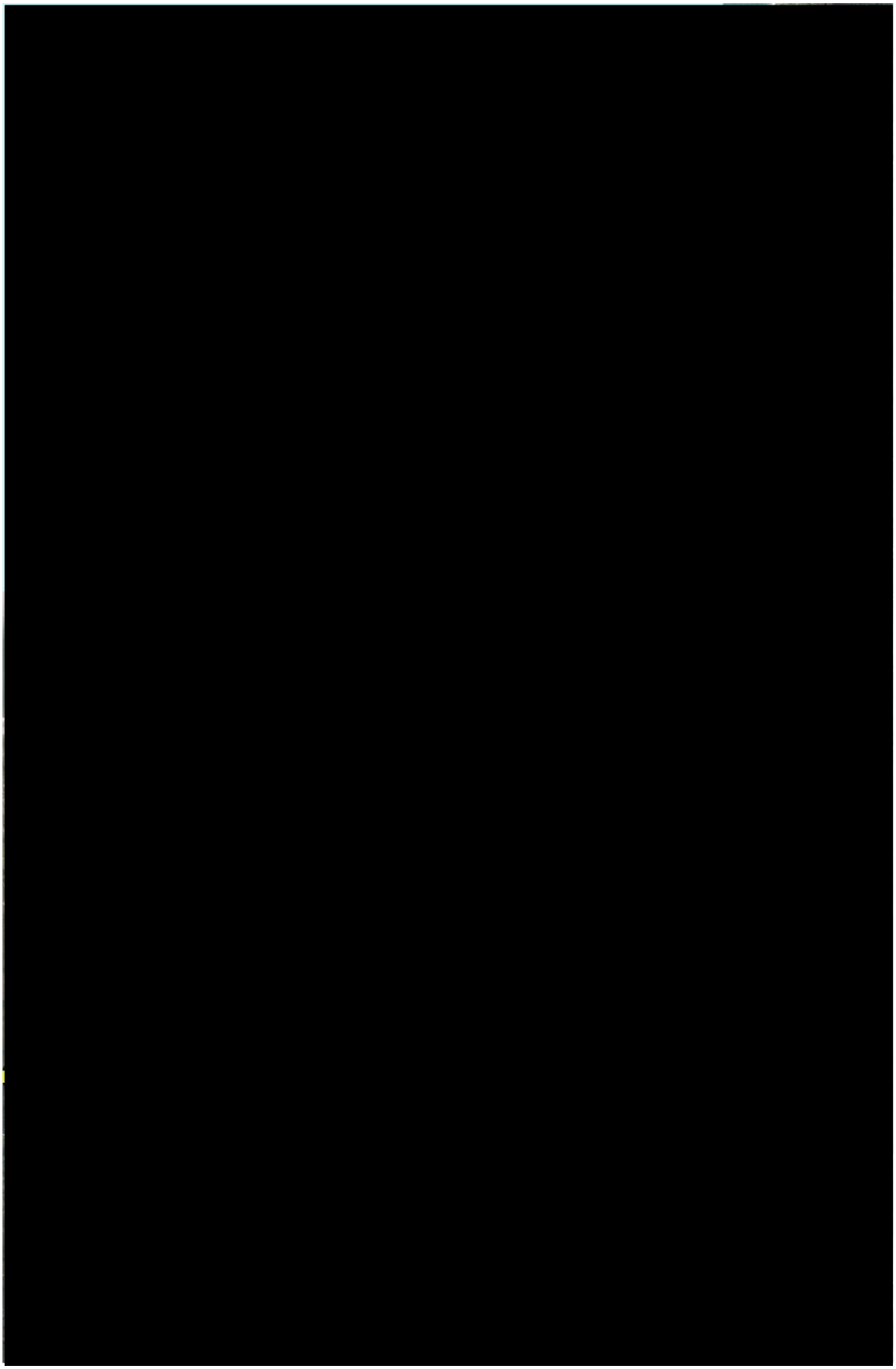
Confirmed bryophyte locations on the Buller Plateaux.



Confirmed great spotted kiwi (*Apteryx maxima*) distribution on the Buller Plateaux (based on call counts and limited radio tracking data).



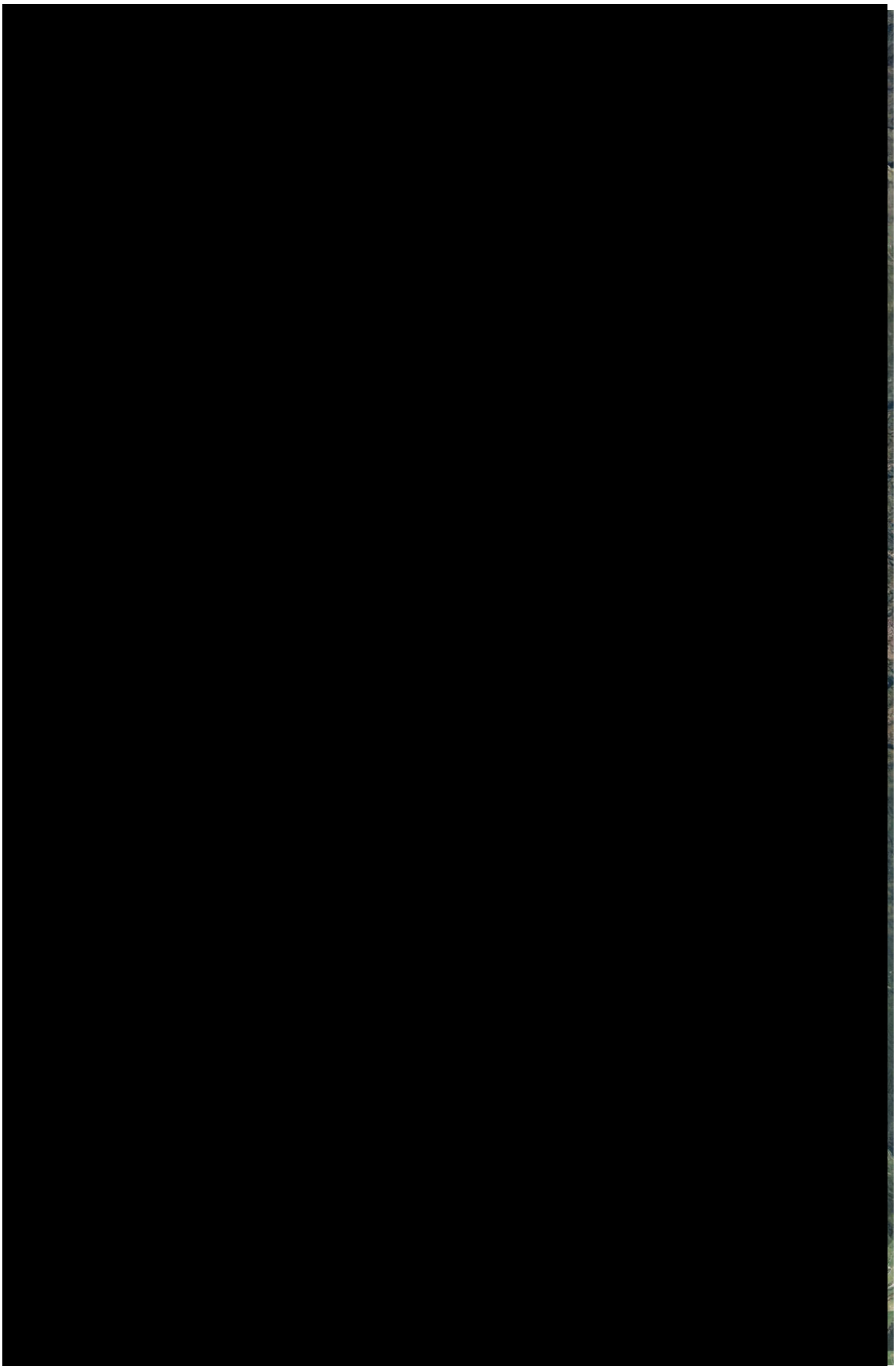
Confirmed fernbird (*Bowdleria punctatus*) distribution on the Buller Plateaux.



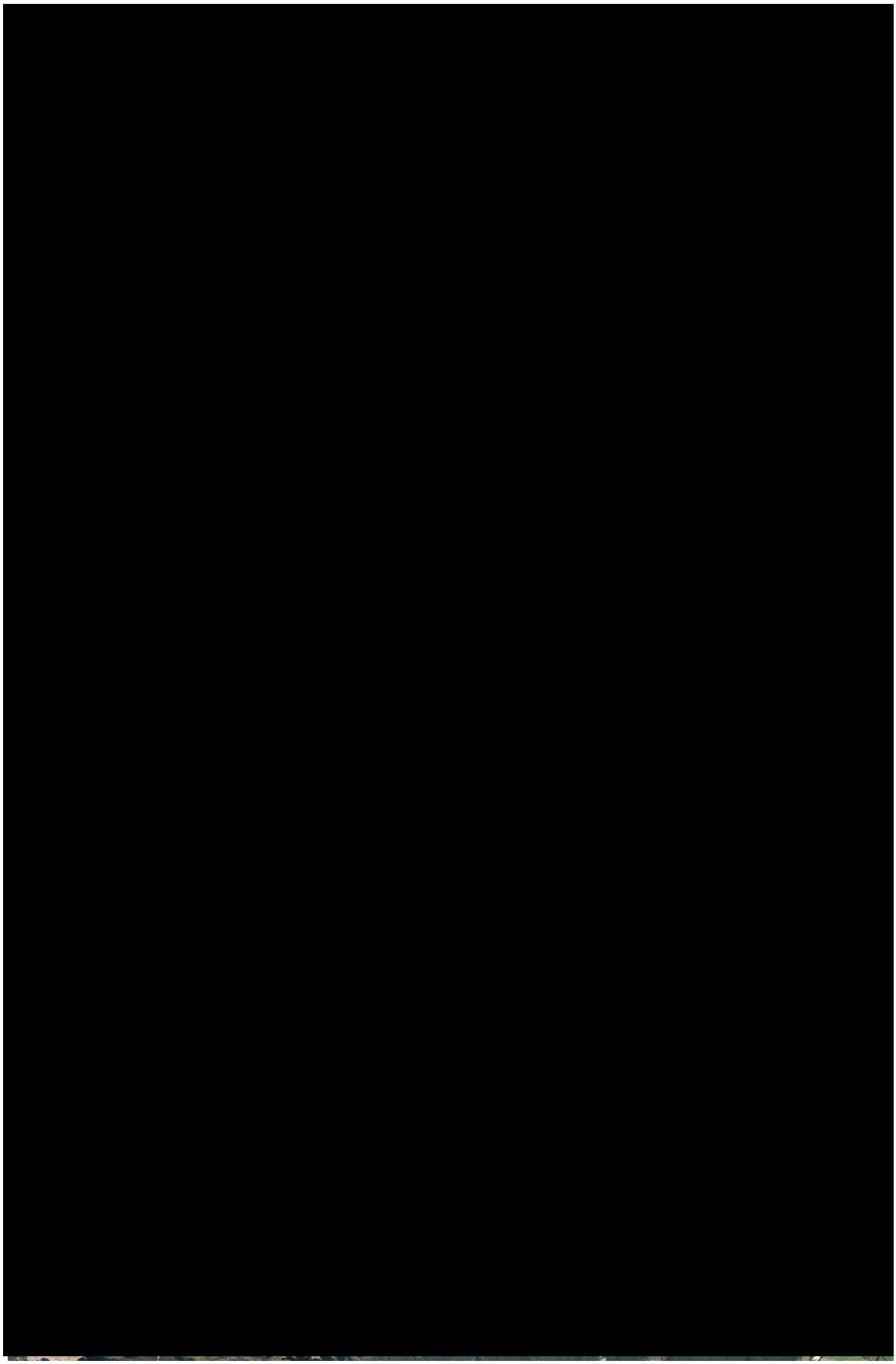
Stream classification on the Buller Plateaux (from NIWA).

APPENDIX B

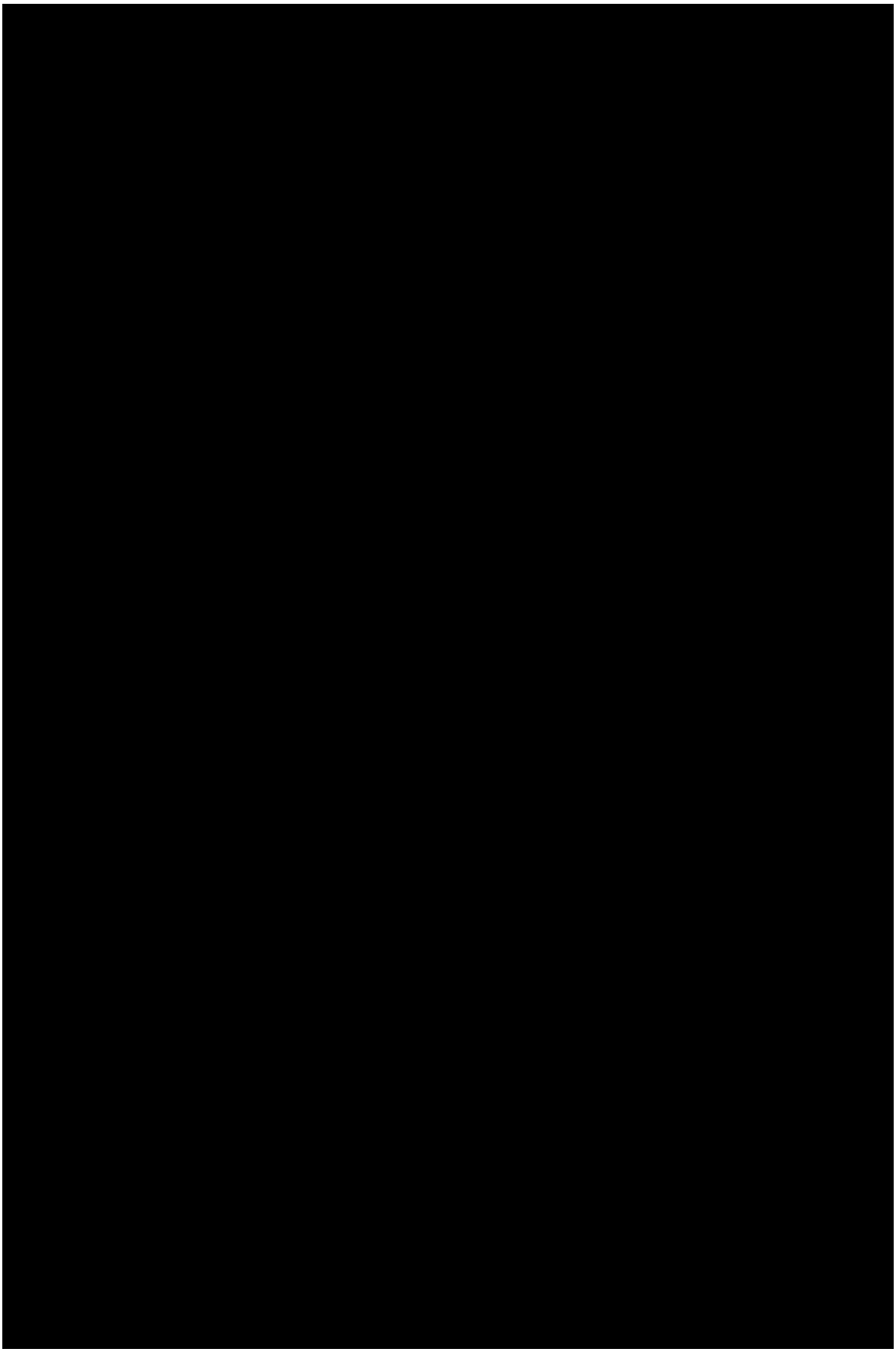
Conservation priority maps – Approach 2 (taxonomic groups)



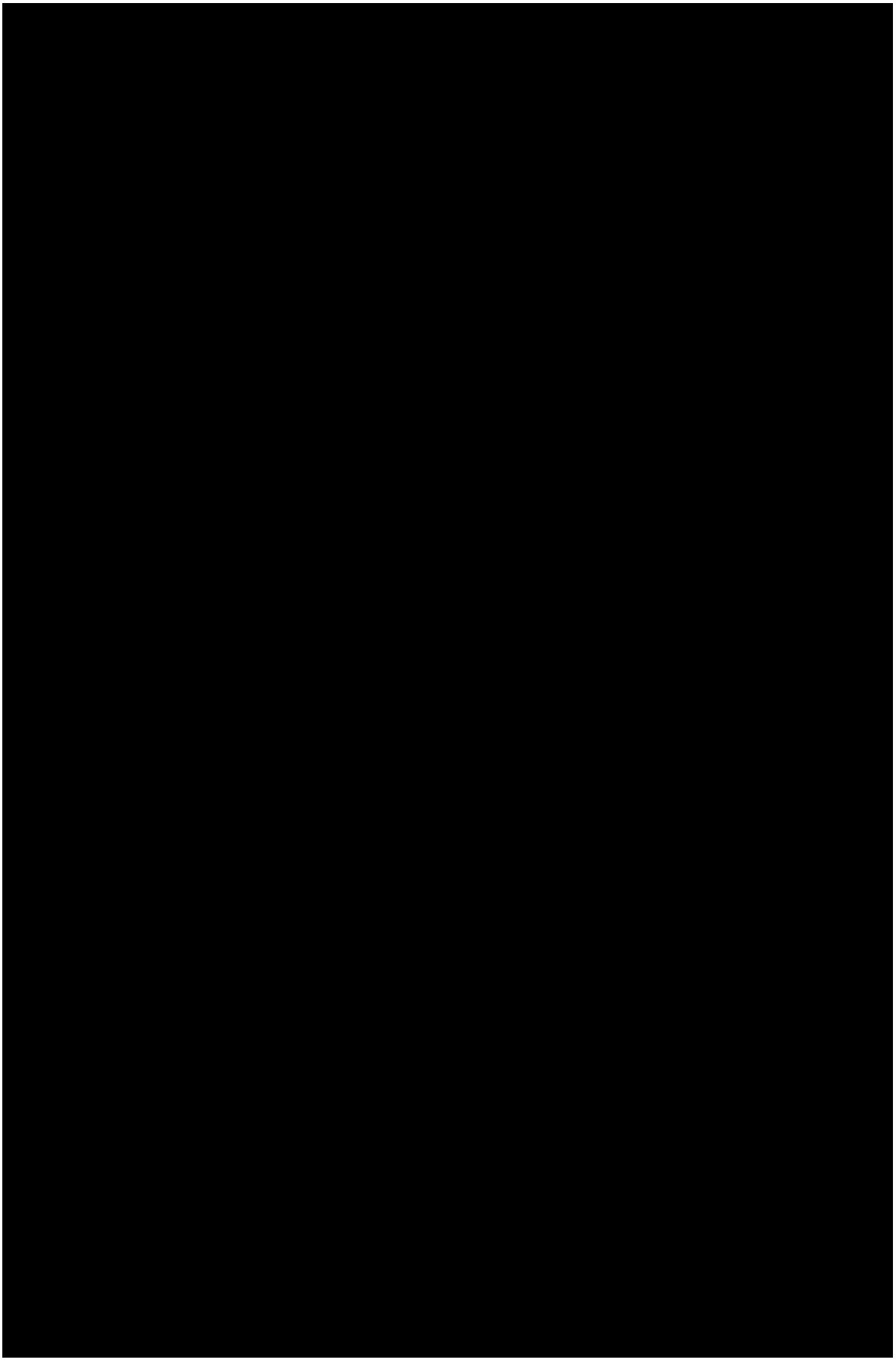
Conservation rank map for vascular plants at the Buller Plateaux.



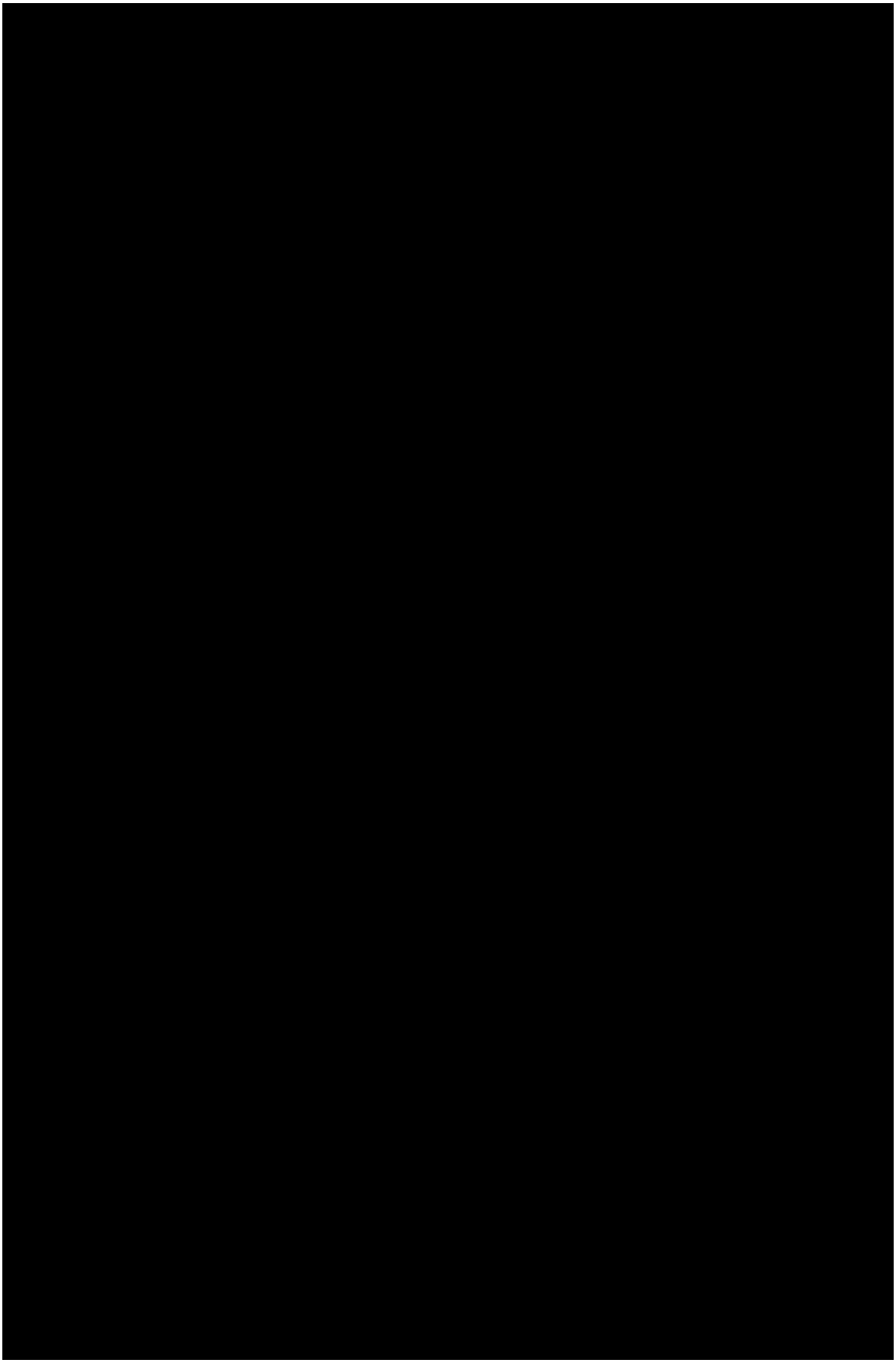
Conservation rank map for birds at the Buller Plateaux.



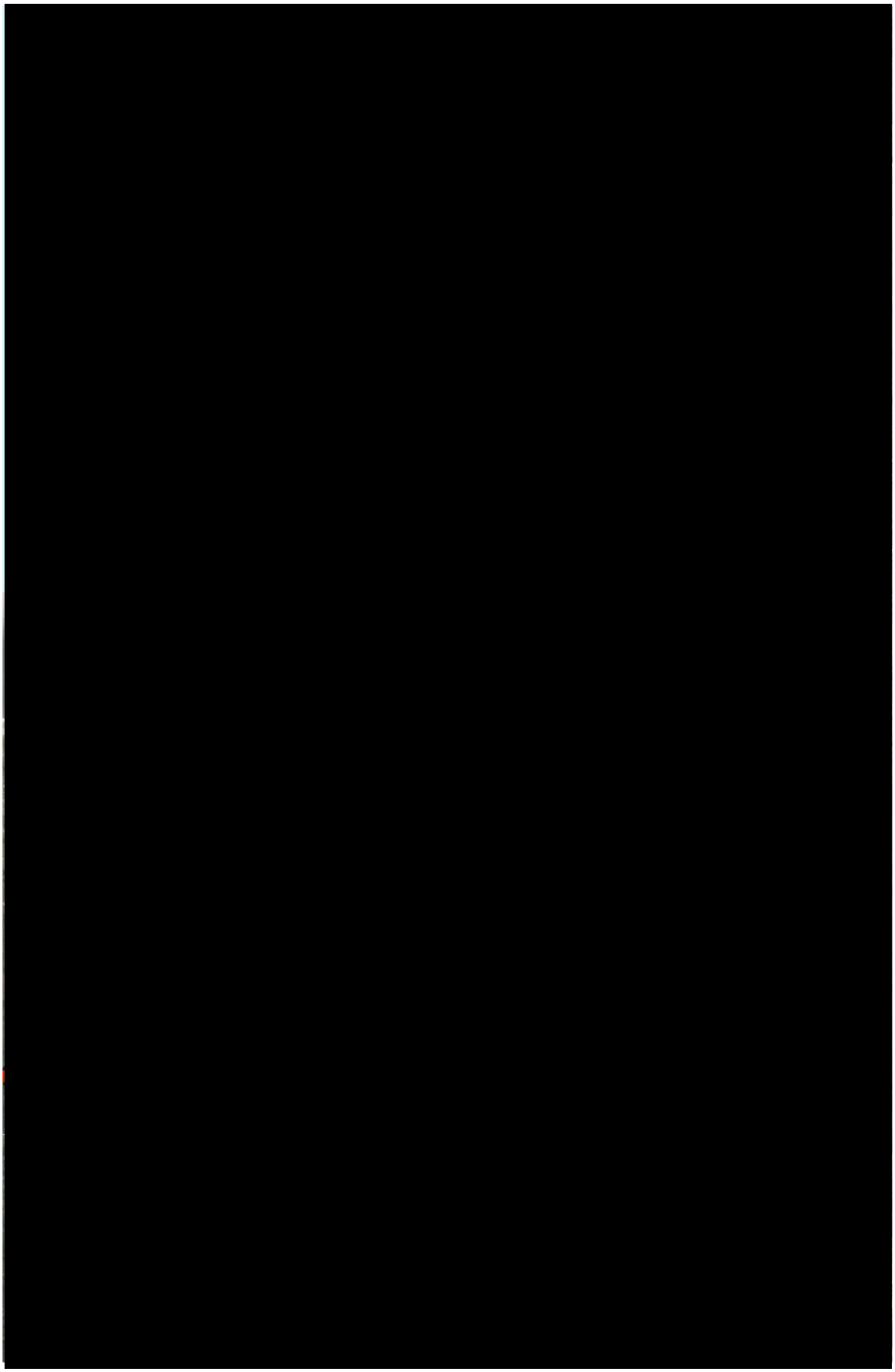
Conservation rank map for lizards at the Buller Plateaux.



Conservation rank map for *P. patrickensis* at the Buller Plateaux.



Conservation rank map for bryophytes and lichens at the Buller Plateaux.



Conservation rank map for terrestrial invertebrates at the Buller Plateaux.