Toitu te whenua
Land Information
New Zealand

Crown Pastoral Land Tenure Review

Lease name : CLUDEN STATION

Lease number : PO 213

Conservation Resources Report - Part 1

As part of the process of Tenure Review, advice on significant inherent values within the pastoral lease is provided by Department of Conservation officials in the form of a Conservation Resources Report. This report is the result of outdoor survey and inspection. It is a key piece of information for the development of a preliminary consultation document.

Note: Plans which form part of the Conservation Resources Report are published separately.

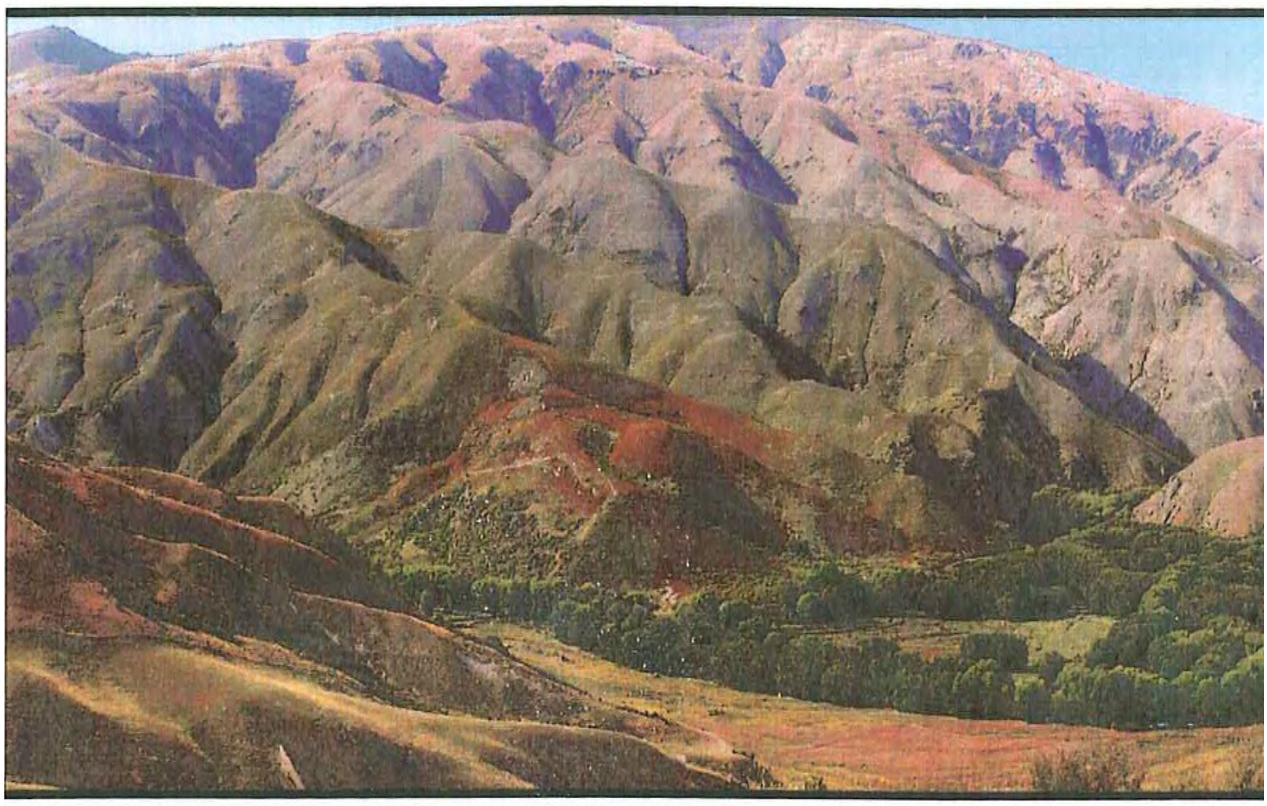
These documents are all released under the Official information Act 1982.

February 05

DOC CONSERVATION RESOURCES REPORT ON TENURE REVIEW OF

CLUDEN PASTORAL LEASE

UNDER PART 2 OF THE CROWN PASTORAL LAND ACT 1998



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PART 1: INTRODUCTION

The lessee of Cluden Pastoral Lease has applied to the Commissioner of Crown Lands for a review of the property's pastoral lease tenure. Cluden Station is leased by N. Purvis, H.J. Ross and P.B. Pedofsky.

The 12390 ha property is located on Cluden Hill Road, approximately 11 kms north of Tarras. State Highway 8 bisects the property at its western end, near the Lindis River. It extends over 15kms east and over the Chain Hills to the boundary at Dunstan Creek. The north boundary is the ridgeline of McPhies Ridge and the southern boundary rises to the crest of the North Dunstan Mountains. The altitudinal range is from about 300m to 1550m. The homestead is situated on freehold land near Tarras township.

The Pastoral Lease is made up of developed river flats near the Lindis River, dryland hillslopes, moderately steep hill country, some of which has been oversown and top dressed, and undeveloped predominantly native country extending up to the Chain Hills and Dunstan Mountain tops.

The property is in the Central Otago Ecological Region, and the Dunstan and Lindis Ecological Districts. A Protected Natural Areas Programme (PNAP) survey of these ecological districts has been carried out (Ward *et al*., 1994). Three areas were recommended for protection on Cluden Pastoral Lease. RAP A1: North Dunstan is an alpine area of tussockland, cushionfield and wetland; while RAP A2: Lower Cluden Tributary and RAP B1: Mid Cluden Tributary both support a variety of shrublands and minor tussockland (see Appendix 1 for details).

No parts of the lease are currently subject to protection for conservation purposes.

Adjoining the property to the south is Lauder Basin Conservation Area (Otago Conservation Management Strategy Inventory Number G40110). There is a s.58 Land Act (1948) marginal strip present along the Lindis River, and s. 24 Conservation Act (1987) marginal strips along Cluden Stream, Big Spur Creek and an unnamed Cluden tributary below RAP A2.

The tenure review inspection of Cluden Pastoral Lease was undertaken on 1 – 5 December 2003 by a range of specialists.

PART 2: INHERENT VALUES: DESCRIPTION OF CONSERVATION RESOURCES AND ASSESSMENT OF SIGNIFICANCE

2.1 LANDSCAPE

Location and Landscape Context

Cluden Pastoral Lease is located on the dry northwest face of the North Dunstan Mountains within the Upper Clutha Valley.

In a regional context, Cluden Pastoral Lease is within the schist zone of Central Otago although the east end towards Dunstan Creek falls within the schist / greywacke transition zone.

All of the Cluden faces with a north facing aspect are similar in terms of landscape character. Dunstan Creek, the Chain Hills and the summit plateau, however, have a different character resulting from geomorphic, altitudinal and vegetation differences.

The St Bathans Range to the east is a dominating physical feature that is never far from view.

The majority of the property drains north and northwest to Cluden Stream. Cluden Stream joins with the Lindis River within the property boundary.

Methodology

A field inspection occurred on 1-2 December 2003 in fine weather conditions.
The Pastoral Lease is divided into defined landscape units (LUs). These units reflect areas of similar landscape character. Landscape character is the quality that makes an area different from another and can be defined as follows:

> *'Landscape character results from a particular combination of characteristics formed by the interaction of natural processes and cultural (human) activities.'*
> **NZ Institute of Landscape Architects**

For each unit, a landscape character description is included followed by a description of the key visual and scenic attributes. An evaluation summary is then presented, using a range of criteria to assess each unit and assist with determining each unit's high inherent values. The criteria include:

- Intactness: - refers to the condition of the natural vegetation, patterns and processes and the degree of modification present.
- Legibility: - refers to its expressiveness - how obviously the landscape demonstrates the formative processes leading to it.
- Aesthetic Factors: - include criteria such as *distinctiveness* - the quality that makes a particular landscape visually striking. Frequently this occurs when contrasting natural elements combine to form a distinctive and memorable visual

pattern. A further criteria assessed under aesthetic factors is *coherence*. This is based on characteristics including intactness, unity, continuity, and compatibility. Intrusions, alterations, disruptions tend to detract from coherence.

- Historic Factors: - refers to historically valued attributes in the context of a high country landscape
- Visibility: - refers to the visibility from public places such as highways, waterways or local vantage points.
- Significance: - is the significance of the characteristics and features, or combination of characteristics and features within individual units. If they are locally, regionally or nationally significant.
- Vulnerability: - is a measure of each landscape unit's susceptibility to further ecological deterioration, which would impact on landscape values.

Landscape Units

For this assessment, Cluden Pastoral Lease is divided into four landscape types (refer Map 4.2.2 and Appendix 2). These include:

- Little Cluden/Archies Flat (LU1)
- Cluden (LU2)
- McPhies Ridge (LU3)
- Dunstan Creek (LU4)

Landscape Unit 1 (LU 1) - Little Cluden / Archies Flat

Character Description

This small unit includes the land west of State Highway 8 and immediately south between the highway and the Lindis River.

Above the highway, the unit consists of rolling low hills up to 511m, which are subdivided into paddocks. It is all essentially developed farmland. Power pylons are a dominant visual feature.

Below the road, the landscape unit forms a bowl shaped area sloping down from the highway onto alluvial flats associated with the Lindis River. Grey shrubland and briar are dominant on the east-facing slope, while west-facing and adjacent slopes are notable for their dry, barren condition. Gully erosion is a feature of watercourses on these dry faces devoid of vegetation. For much of the year, willows lining the Lindis River provide a green contrast to the surrounding dry brown hills.

Visual & Scenic Values

The unit is typical of the dry low barren hills of the lower North Dunstan Mountains and are unremarkable in the context of the surrounding landscape. While the unit undoubtedly has

inherent visual and scenic values, these are typical of the area rather than being special or outstanding.

The majority is visible from SH 8 Lindis highway.

Evaluation Summary for LU1

Criteria	Value	Comment
Intactness	Low	Highly modified
Legibility	Medium	Not highly expressive of formative processes
Aesthetic Factors	Medium	Not striking or distinctive but typical of the area
Historic Factors	Low	Stone building associated with pastoralism on valley floor
Visibility	High	Most is highly visible from SH 8
Significance	Low	
Vulnerability	Low	Ecological degradation already occurred.

Landscape Unit 2 (LU2) – Cluden

This very large unit occupies the majority of the property, extending from the Lindis River in the west to the Chain Hills in the east. It has been broken further into the sub-units below because of its size.

- (LU2a) Low and mid faces
- (LU2b) Upper slopes (above approximately 1000m) and Crest
- (LU2c) Upper Richmond Creek

Character Description

(LU2a) Cluden (Low and Mid Faces)

This area is fairly homogenous in character. It includes the lower end of a series of incised gullies and intervening spurs that drain either directly to the Lindis River (at the western end) or north to Cluden Stream. The majority of the area is extensively modified by pastoralism. In summary, the subunit is characterised by dry, barren and rocky, north and northwest faces. Vegetation includes a mix of:

- depleted short tussock, extensive briar and hawkweed, scabweed and bare ground. The scabweed and bare ground impart a denuded grey/white appearance on the lower slopes.
- scattered grey shrubland is also extensive but predominantly on steep faces and adjacent to riparian zones.
- lower areas at the base of the slope include induced matagouri, depleted short tussock, introduced pasture species and weeds.

Rock outcrops and bands are extensive throughout the landscape unit. Prominent bluffs and buttresses are also associated with gully systems. The outcrops and bluffs are predominantly confined to the east side of the gully, with the opposite side is less steep and more rounded. The rugged rocky outcrops and bands are a distinctive feature within the incised Cluden faces.

(LU2b) Cluden (Upper Slopes and Crest)

LU2B is a continuation of the Cluden faces from approximately the 1000m contour to the boundary on the crest of the range.

Induced short tussock cushionfield is dominant in a broad belt extending all the way to the ridge crest in the west. Within this belt snow tussock is either absent or depleted. Sunny faces are more depleted than shady faces with snow tussock persisting on the shady side. Spaniard and hawkweed are significant components.

Further east and within RAP A1, snow tussock is intact and extends up onto a broad north-west sloping summit plateau. This is a highly distinctive landscape of smooth tussock covered undulating ridges forming part of the extensive and highly impressive North Dunstan Mountains summit plateau. Slim snow tussock is the dominant vegetation. Within the dominant tall tussock are numerous alpine flushes, ridge pavements, and cushionfields. Cushionfields are often associated with tors on exposed sites dominated by dracophyllum and blue tussock. Naturalness at the summit crest is very high.

(LU2c) Cluden (Richmond Creek)

This sub–unit takes in a partial catchment of upper Richmond Creek including the west face of the Chain Hills between Dunstan Pass and Cluden Pass and the remainder of this tributary catchment of Cluden Stream. It is a more open valley system than the remainder of the Cluden faces unit. The valley floor and lower slopes of the catchment are heavily modified with predominantly scattered short tussock, matagouri, pasture/hawkweed mix. An exception is a quite diverse stand of shrublands on the face above the true left of the Creek.

Higher up on the Chain Hills side, snow tussock becomes the dominant cover but is depleted. Snow tussock density improves with altitude. Hawkweed remains significant at the ground layer. Patches of greywacke scree are a feature on this face. Close to the ridge, rock outcrops and bluffs are significant features. Access tracks scar the open tussock slopes on this side of the valley.

Visual and Scenic Values

Visual and scenic values on the Cluden faces as a whole are variable. The lower and middle mountain slopes, are typical of the North Dunstan Mountains with dry rocky faces and incised gullies containing rocky bluffs and small remnant shrublands. Vegetation patterns elsewhere are highly modified and depleted. While these areas do contain scenic values they are unremarkable in the context of the North Dunstan Mountains. The level of modification and degradation detracts from natural landscape values. Tracks are extensive and are present on most spurs.

The upper slopes and crest in contrast are considered to contain very significant and important landscape values. The induced short tussock belt while denuded of tall tussock contains impressive landforms and is part of a greater upper range alpine landscape. The rock exposure and bluffs within the upper reaches of the incised gullies are impressive along with the cushionfield vegetation patterns on the range tops. There are spectacular panoramic views of the St Bathans Range and west to the Pisa Range.

The summit plateau is an outstanding landscape and part of the large upland plateau landscape of the North Dunstan Mountains. In summary, visual values (and landscape values as a whole) for the upper range and crest are derived from the following characteristics:

- the impressive scale of the summit plateau.
- the distinctive undulating plateau landform patterns.
- the unifying and distinctive colour of the dominant tussock cover. Tussock forms the dominant vegetation pattern from the short tussock zone and up onto the plateau surface. The tall tussock includes extensive tracts of the distinctive slim snow tussock.
- the striking contrast of features such as alpine flush zones, wetlands, rock pavements and tors.
- visual values associated with weather and light.
- spectacular views to the St Bathans Range and ranges to the north and west.
- spectacular bluffs and rock exposure associated with upper incised gullies.

Evaluation Summary of LU2

Criteria	Value	Comment
Intactness	Variable	High on summit plateau but reduced below tall tussock zone
Legibility	High	Patterns and processes highly legible
Aesthetic Factors	High	Visually striking and highly distinctive especially within summit plateau
Historic Factors	Low	
Visibility	Low	Upper slopes and skyline ridge visible from SH8 but plateau surface largely hidden
Significance	High	Important tract of an Otago upland landscape
Vulnerability	High	Fragile alpine landscape. Vulnerable to any change

Landscape Unit 3 (LU3) – McPhies Ridge

Character description

The McPhies Ridge unit is comparatively small, forming a distinct topographical unit and local landmark comprising the south face of McPhies Ridge from Cluden Stream to the North property boundary.

The characteristics are similar for the entire unit. Rock bluffs and exposures are common throughout. Some sections are very steep, forming a tight gorge within Cluden Stream. Vegetation is relatively consistent and includes grey shrubland, pasture, depleted short tussock, and briar. Being south facing the ridge is less degraded than the opposite north faces, although it is still extensively modified. Several tracks provide vehicle access to the top of the ridge.

Visual & Scenic Values

McPhies Ridge forms part of the Cluden Stream gorge landscape. Visual values are derived from the wild, rocky, and rugged character of the gorge. Some sections are very rocky and bluffy, and visually impressive. Grey shrublands are also significant in places. The gorge,

while scenic, is typical of others in the area. The unit has low to moderate visibility from SH 8.

Evaluation Summary for LU3

Criteria	Value	Comment
Intactness	Low to Medium	Grey shrublands significant
Legibility	Medium	
Aesthetic Factors	Medium	Not striking or distinctive but typical of the area
Historic Factors		
Visibility	Low	Low visibility from public places
Significance	Low	
Vulnerability	Low	Low vulnerability to ecological change

Landscape Unit 4 (LU4) – Dunstan Creek

Character description

This unit covers the eastern most part of the property that falls within the Dunstan Creek catchment between Dunstan Peak and Cluden Pass. It includes a segment of the western side of Dunstan Creek adjacent to the Upper Dunstan Creek gorge.

The unit is part of a largely intact backcountry tussock landscape with the dramatic St Bathans Range towering above on the eastern side. The western side within the Pastoral Lease forms tussock covered slopes. The slopes have been oversown and topdressed, and hawkweed is a significant component. The section immediately above the gorge is steep and rocky. Tall tussock maintains a continuum from valley floor to the ridge though is depleted on lower slopes. The unit is within the transition zone between schist and greywacke and exhibits both schist outcrops and greywacke screes.

Visual & Scenic Values

Dunstan Creek as a whole is recognised as an area with high visual and scenic values derived from the impressive mountainlands including the Dunstan and St Bathans Ranges. Other factors that contribute to its distinctive character and significance are its location on the schist/greywacke belt, the continuity of tussock cover from valley floor to ridgeline, and valley floor wetlands.

While only a small part of Dunstan Creek is located within Cluden Pastoral Lease, this unit is an important part of the whole Dunstan Creek valley. Though modified by grazing and aerial oversowing and topdressing it retains a tussock continuum in visual terms.

Evaluation Summary for LU 4

Criteria	Value	Comment
Intactness	Medium to High	Snow tussock depleted on lower slopes
Legibility	High	
Aesthetic Factors	High	Part of a striking and distinctive high country landscape
Historic Factors		
Visibility	Low	
Significance	High	Part of the highly significant upper Manuherikia landscape with regional and national significance
Vulnerability	High	Vulnerable to further ecological deterioration

Significance of Landscape Values

Areas identified as having important inherent landscape values on Cluden Pastoral Lease are identified on Map 4.2.2. They include:

- The Upper Cluden Faces above approximately the 1000m contour, and the Summit Crest (LU2b),
- Dunstan Creek and Upper Chain Hills Tall Tussock Zone (LU2c in part, and LU4)

Upper Cluden Faces and Summit Crest

The Upper Cluden faces and the Summit Crest area as a whole contain important inherent landscape values. The area forms an important part of the upper block mountain ranges within the Upper Clutha Valley. These upland ranges provide the backdrop and make a significant contribution to Central Otago's identity and sense of place.

The summit plateau and tall tussock zone within Cluden Pastoral Lease is an integral part of the North Dunstan summit plateau outstanding landscape. In summary the attributes of the summit area include:

- The distinctive rounded and undulating plateau landscape combined with the unifying and distinctive colour and texture of the dominant tussock cover and associated plant communities. The summit plateau within Cluden Pastoral Lease together with the adjoining areas outside the lease to the south and east forms an extensive intact snow tussockland landscape of outstanding naturalness and significance. Slim snow tussock of this stature and condition is some of the best in the district.
- The striking contrast of features such as alpine flush zones, wetlands rock pavements and tors within the context of the dominant tussock.
- Spectacular and panoramic views to the St Bathans Range and ranges to north and west.
- The adjacent area down to approximately the 1000m contour, although highly modified in terms of tall tussock, retains a high level of natural character and forms a continuation of the upper range landscape.
- Short tussock and alpine cushionfield form dominant vegetation patterns within this zone. These patterns combined with highly impressive rock tors, and bluffs and buttressing associated with upper incised gullies, contribute to high inherent landscape values.

Dunstan Creek and Upper Chain Hills

This area forms a small part of Upper Dunstan Creek that in turn is part of the Upper Manuherikia landscape. The Upper Manuherikia is widely recognised as an outstanding high country tussockland landscape.

The tussock grasslands, combined with rock outcrops and screes contained within the Pastoral Lease, retain their natural character and are integral to the valley system as a whole. While modified on the lower slopes, the area retains the appearance and integrity of tussock grassland.

2.2 LANDFORMS, GEOLOGY, SOILS AND LAND ENVIRONMENTS OF NEW ZEALAND

Landforms

The majority of Cluden Pastoral Lease lies within the Cluden Land System, being located at the northerly part of the north-west slope of the Dunstan Mountains. It is characterized by a regular pattern of long round ridges derived from a tilted peneplain surface, with sizable valleys entrenched 200-300m deep between them. The valley sides are predominantly slumped, although some stable buttress rock outcrops and colluvial slopes do occur (Ward *et al*., 1994).

The eastern end of the property, consisting of western faces of the meandering gorge of Dunstan Creek, lies within the Sawtooth Land System. The rock here is mainly semi-schist in a transition zone to the greywacke of the St Bathans District. Stable colluvial slopes are predominant but localized slumping is also notable. Lower slopes in the entrenched gorge are steep with extensive rock bluffs.

The area in the vicinity of Richmond Hut and Cluden Pass lies within the Chain Hills Land System. The Chain Hills are “formed on a fault-bounded block of semi-schist, separated from the schist to the west by a fault system following the line of saddles linking the headwaters of all the east flowing Lindis tributaries, and separated from the Torlesse greywacke of the St Bathans Range in the east by a fault in Dunstan Creek at the ecological district boundary. The landform style is distinctive and matches the rock types in being intermediate between that of the Georges Land system to the west and the St Bathans district to the east. Smooth colluvial slopes and a moderate scale of dissection are characteristic, with minor localised slumping and minor talus” (Ward *et al*., 1994).

There is no evidence of the Dunstan Mountains ever having generated glaciers. Schist tors and periglacial soil hummocks are well developed on the higher parts of the upland surface. The absence of glaciation has resulted in a simple topographic pattern, with steep slumped slopes characteristic of the dissected fault scarp on the south-east face, contrasting with the long north-east slope.

Geology

The Dunstan Mountains typify the Central Otago pattern of fault-block mountain ranges uplifted along faults on their south-eastern edges and tilted to the north-west. The flat surface of the Dunstan Mountains is largely inherited from the Cretaceous to Cenozoic Otago Peneplain, part of the Waipounamu Erosion Surface (WES) (LeMasurier & Landis, 1996; Youngson & Landis, 1997). The WES has a complex fluvio-marine origin and is of early to

middle Cenozoic age. Along the Dunstan Range tops, the WES has been eroded along fault scarps and in gorges (Turnbull, 2000).

The rock underlying most of the area is Haast schist of the Rakaia terrane (Turnbull, 2000), a metamorphic derivative of older marine sediments. Undifferentiated Rakaia terrane rocks are increasingly schistose towards the Dunstan Mountains.

Soils

Soils are derived mainly from Haast schist, loess and alluvial gravels. The schist readily breaks down to release abundant fine mineral material for soil formation. However, the resulting soils are generally light and many have been strongly affected by partial loss of vegetation. Sheet erosion, by wind deflation and water, has left many soil profiles reduced to stony subsoils.

The underlying soil pattern is dominated by an altitudinal and rainfall sequence of zonal soils and related steepland types, from brown-grey to yellow-grey to yellow-brown earths. Brown-grey earths (Alexandra steepland, Conroy Hill, Ardgour terrace and Linnburn terrace soils) have formed in the driest zone where rainfall is generally less than 500mm per annum. Yellow-grey earths (Arrow steepland and Blackstone soils), occupy the lower mountain slopes, grading into high country brown earths (Dunstan steepland, Waenga Hill, Bourke terrace and Alpine Steepland Soils) above 700-1000m a.s.l. This sequence reflects increasing leaching and acidity with decreasing fertility.

The valley floors are dominated by terrace gravels and loess of Pleistocene age, but include limited areas of recent soils on alluvium of flood plains and fans. Many of these have been intensively modified either by agricultural development or by gold dredging.

The Soil Bureau (1968) recorded saline soils present in the vicinity of Archies Flat in the Lindis valley, but these have been modified through agricultural development.

Land Environments New Zealand (LENZ)

The environmental distinctiveness of an area can also be assessed through the Land Environments of New Zealand (LENZ). This is a classification of New Zealand lands using a comprehensive set of climate, landform and soil variables chosen for their roles in driving geographic variation in biological patterns (Leathwick *et al.,* 2003). LENZ is a useful tool for measuring conservation initiatives against the New Zealand Biodiversity Strategy (see section 3.5). It is presented at four levels of detail containing 20, 100, 200 or 500 environments nationally. At the level II environment (100 environments nationally) the areas investigated at Cluden Pastoral Lease fall predominantly within Environments Q2, Q1 and N4 with small contributions of N5, Q3, N8 and K3 (see Appendix 3). The extent of these environments as Crown land managed mainly for conservation purpose is shown in Table 1 below.

With the exception of Q1 which constitutes a quarter of this property, the protection of all other environments fall well short of the 20% suggested as adequate for the protection of native biodiversity.

Table 1	
LENZ Level II Environments	**Percent protected for conservation purposes**
K3	1.8
N4	1.3
N5	0.6
N8	2.0
Q1	30.3
Q2	5.6
Q3	13.8

Significance of Landform, Geology, Soils, and Land Environments of New Zealand

The property, running from west to east represents a transition from a schist substrate in the Cluden land system to the Torlesse greywacke of the St Bathans Range. The underlying geology has resulted in characteristically smooth slopes to the west and steep slopes to the east.

There are no significant soils identified on the property.

The property includes six LENZ units (i.e. K3, N5, N8, Q2, and Q3) at Level II, which, on a national level, are inadequately protected for conservation purposes.

2.3 CLIMATE

Climate is typical of the intermontane basins of Central Otago, with semi-arid conditions prevailing in the lower western part of the property. The area occupies a rain shadow between major mountain ranges to the north, west, and east. Average rainfall in the Lindis River valley is in the order of 500mm per annum and exceeds 1000mm on the crest of the Chain Hills and North Dunstan Mountains (where a significant proportion falls as snow over winter months). Rainfall is higher over summer months than the rest of the year, largely due to convective storms formed by high ground temperatures during settled weather patterns. Winds are predominantly from the westerly quarter. Soil water deficits are severe in summer at low altitude and on sunny mid altitude aspects. Summers are warm and winters cold and frosty with periodic snow to the base of the property.

2.4 VEGETATION

Introduction

To the south, the property adjoins the Lauder Basin Conservation Area, and comprises intact slim snow tussockland, alpine flushes, cushionfields and narrow-leaved snow tussockland.

Adjoining the eastern property boundary within the Dunstan Creek catchment is RAP B2-Sawtooth which is an area dominated by narrow-leaved snow tussockland (of poor quality), mixed shrubland and communities of rocky outcrops.

On the western flanks of the Chain Hills, immediately north of the property, vegetation communities include induced short tussock grasslands, narrow-leaved snow tussocklands,

slim snow tussocklands and mixed *Olearia odorata* shrublands, including scattered kowhai trees.

A Protected Natural Areas Programme (PNAP) survey of the Dunstan, Lindis and Pisa ecological districts was carried out by Ward *et al.* in 1994. Three areas were recommended for protection on Cluden Pastoral Lease. RAP A1: North Dunstan is an alpine area of tussockland, cushionfield and wetland; while RAP A2: Lower Cluden Tributary and RAP B1: Mid Cluden Tributary both support a variety of shrublands and minor tussockland. An additional area recommended for protection adjoins the property in the southern Chain Hills: RAP B2: Sawtooth Creek.

A later survey to determine the status of threatened species *Carmichaelia kirkii* and *Pachycladon cheesemanii* within the Wanaka Area (Wardle, 1999) noted that the riparian shrubland within the catchment of RAP A2 contained the largest known healthy adult population of *Carmichaelia kirkii* in Otago. Wardle recommended the protection of an area which includes RAP A2, extending upstream to include more riparian shrubland with *Carmichaelia kirkii* along the stream, and the significant bluff systems which support *Pachycladon cheesemanii*.

Ecological Setting

The vegetation history of Central Otago has been discussed by McGlone *et al.* (1995). Successive modification over several thousands of years has transformed the mountain-sides of Central Otago from forest dominated environments to largely tussockland. It is clear that fire has had a major influence on the vegetation throughout all but the most recent history. The modern vegetation patterns therefore carry a strong imprint of fire.

Molloy *et al. (*1963) showed from buried charcoals that forests were formerly widespread in the interior of the South Island. Evidence of large scale forest destruction about 800 years ago is widespread elsewhere in New Zealand and is attributed to Polynesian fires (McGlone, 1983). However in Central Otago, the driest region of New Zealand, McGlone has inferred from pollen preserved in peat bogs that fire-induced vegetation mosaics of forest (matai, celery pine, silver beech and Hall's totara were locally dominant), shrubland and tussockland were present at least as far back as 2500 years ago, well before human occupation. Changes towards a cooler and drier climate may have reinforced the effects of fire at this time.

No forest remains on Cluden Pastoral Lease, although some woody species present are indicative of former forests. Replacing the former forests, narrow-leaved snow tussockland expanded its range downslope to all but the driest low altitude faces and drought-prone alluvial terraces of the valley floor where fescue had a competitive advantage. During the first decades of pastoralism and gold mining, much woody vegetation was eliminated, and frequent firing of tussocklands, together with high stock numbers, resulted in the depletion of lower altitude zones, where rabbits reinforce the pattern of severe depletion. Large areas became established in a sparse scabweed cushionfield, which today, has a significant presence of weeds such as sweet briar and hawkweeds.

Native shrublands of low to mid altitudes have persisted, especially on the most fertile strips alongside some entrenched streams, and around rocky bluffs which have protected places from fires and some grazing pressure. It is here that the most diverse shrublands survive. Saline soils were present in the lower western part of the property, which were likely to have supported unique plant species and vegetation sequences. Pastoral development and irrigation practices have converted these areas to pasture and hay paddocks.

At high altitudes, the former extensive snow tussocklands were transformed in places by summer fire and subsequent grazing, resulting in cushion herbfields on the summit ridges, and short tussocklands on sunny faces lower down.

Methodology

An inspection of botanical values was carried out on1 – 4 December 2003. The survey covered most of the property by driving over many of the farm tracks, by walking parts and by surveying distant parts through binoculars.

Two relatively minor areas were not visited: the lower Dunstan Creek faces, and the far southwest areas (i.e. parts of Lethbridges, Apple Tree, Rats Tail and Vercoes blocks- see Map 4.2.3). The latter were viewed through binoculars.

Indigenous Plant Communities

A total of 151 native plant species have been recorded on Cluden Pastoral Lease (see Appendix 4).

For the purpose of describing the vegetation, five land units encompassing the following farm management blocks (see Map 4.2.3) are used:

- West of Lindis River (*Little Cluden and un-named Blocks*)
- Lower Country (*Lethbridges, Apple Tree, Lower Ewe, Blue Slip, Breakneck, Richmond Hut, Faris Knob and Roughneck Blocks*)
- McPhies Ridge (*McPhies 1, 2 and 3 Blocks*)
- Southwest corner of Upper Country (*Rats Tail, lower Vercoes, lower Three Corners Blocks*)
- Dunstan Mountain Tops and Chain Hills (*upper Vercoes, upper Three Corner, Harleys, Top Richmond, Shaws, Back Richmond, Dunstan and Greenos Blocks*)

West of the Lindis River

The land to the west of the Lindis River is largely farmland with much of it having been ploughed and grassed. A few kanuka (*Kunzea ericoides)* are present above the main road (SH8) while the hill slopes below support exotic grassland with open tree daisy (*Olearia odorata)* - matagouri (*Discaria toumatou*) - sweet briar (*Rosa rubiginosa*) shrubland also present. Crack willows (*Salix fragilis*) grow at the margins of the Lindis River.

The Lower Country

The lower country includes Lethbridges, Apple Tree, Lower Ewe, Blue Slip, Breakneck, Richmond Hut, Faris Knob and Roughneck blocks.
With the exception of several deep gorges in the Lower Ewe, Blue Slip and Breakneck blocks and the southern half of Richmond Hut block, the vegetation found within this country is moderately to severely depleted. Many of the lower slopes are up to 80% bare ground with vegetation cover dominated by the native scabweed (*Raoulia australis*) (15% cover), the small, native grass *Rytidosperma maculatum* (5%) and exotic sheep's sorrel (*Rumex acetosella*) (5%). Also present is a sparse scattering of small, hardy, native plants including *Raoulia apice-nigra, Raoulia parkii*, fuzzweed (*Vittadinia australis*), *Poa maniototo*,

Geranium sessiliflora, Carex breviculmis, Stellaria gracilenta and occasional chewed down porcupine shrub (*Melicytus alpinus*). The rare herbs *Aceana buchananii, Leptinella serrulata* and *Convulvulus verecundus* are present. Clumps of silver tussock (*Poa cita*) and hard tussock (*Festuca novae-zelandiae*) survive in places.

Exotic species are more common and include storks bill (*Erodium cicutarium*), horehound (*Marrubium vulgare*), woolly mullein (*Verbascum thapsus*), scarlet pimpernel (*Anagallis arvensis*), St. John's wort (*Hypericum perforatum*), winged thistle (*Carduus tenuiflorus*), Californian thistle (*Cirsium arvense*), Scotch thistle (*Cirsium vulgare*), grassland forget-me-not (*Myosotis discolor*), downy brome (*Bromus tectorum*) and squirrel-tailed fescue (*Vulpia bromoides*). In places, mouse-ear hawkweed (*Hieracium pilosella*) is prominent. Sweet briar occurs as scattered plants with increasing density in gullies.

The higher slopes support similar vegetation, but with more exotic grass species present including sweet vernal (*Anthoxanthum odoratum*), soft brome (*Bromus hordeaceus*) and Kentucky bluegrass (*Poa pratensis*). Hard tussock can be dominant in small areas such as on west faces. Shrubs are often more prominent with large areas of sweet briar present. Native shrub species include patches of matagouri, tree daisy, porcupine shrub and occasional mingimingi *(Coprosma propinqua*)

The steeper rocky faces above the Cluden Stream contain scattered shrublands dominated by briar but with matagouri, porcupine shrub, mingimingi, tree daisy, bush lawyer (*Rubus schmidelioides),*native broom *(Carmichaelia petriei)* and occasional kowhai (*Sophora microphylla*). *Coprosma intertexta* and the liane *Parsonsia heterophylla* are sometimes present.

Native shrublands are a feature of some of the steep-sided rocky valleys that drain into the Cluden Stream located within the Lower Country. In the lower-mid reaches of a tributary valley of Cluden Stream, east of Big Spur Creek within the Lower Ewe block, an area of diverse riparian shrubland is found (GR G40 398 932). This dense mixed shrubland was identified as a Recommended Area for Protection (RAP A2; Ward *et al*, 1994), and is dominated by mingimingi with abundant tree daisy, mountain wineberry *(Aristotelia fruticosa)* and matagouri. Other species include koromiko (*Hebe salicifolia*), native broom, porcupine shrub, the lianes *Muehlenbeckia complexa,* bush lawyer, *Parsonsia heterophylla*, threatened broom *Carmichaelia kirkii,* and clematis *Clematis marata.* Less diverse matagouri shrubland with some briar and mingimingi occurs away from the stream, and partially buffers the mixed shrubland. Tree daisy is prominent on some moist shady faces. Some of the shrublands within the upper tributaries of this catchment have been killed by herbicide spraying (i.e. within lower Ewe and Three Corner blocks).

The mid and upper parts of a small unnamed gully located in the western part of Blue Slip block support mixed shrubland dominated by matagouri and briar, with tree daisy, *Coprosma rugosa,* mingimingi, native broom and the climbers *Muehlenbeckia complexa* and clematis also present. During the PNA survey, the threatened native climber *Carmichaelia kirkii* was recorded within the lower-mid part of the catchment where the shrubland is most dense (approx GR G40 405 953).

Further east, another un-named Cluden Stream tributary within the eastern part of Blue Slip block (GR. G40 427 957) supports a dense diverse mixed shrubland which is 20m wide on either side of the creek. Dominant shrub species include matagouri, mingimingi and tree daisy with briar, porcupine shrub, mountain wineberry, native broom, koromiko and *Hebe subalpina* also present. During the PNA survey, the threatened native scrambling broom *Carmichaelia kirkii* was recorded within the lower-mid part of the catchment where the shrubland is dense (approx. GR G40 428 957). Associated rocky bluffs and boulderfields support the shrubs weeping mapou and *Hebe rakaiensis*, with native herbs *Celmisia*

gracilenta and *Raoulia subsericea*, and fern *Asplenium richardii*. In a flush above the shrubland, occasional *Olearia lineata* shrubs were recorded during the PNA survey.

Further east, a dense mixed riparian shrubland is located within the Breakneck and west Roughneck blocks, extending down into McPhies 3 block (GR G40 432 970). This shrubland was identified as an RAP (RAP B1) during the PNA survey (Ward *et al.*, 1994). The shrubland is dominated by mingimingi, mountain wineberry, koromiko, matagouri and Tree daisy, and is of greater diversity and stature than the other shrublands described above. Matagouri, including scattered large plants up to 4m tall dominate shrubland on the lower slopes and side gullies. A small amount of the threatened climbing broom *Carmichaelia kirkii* was recorded beside the main Cluden Stream during the PNA survey. Large (3m tall) *Olearia nummularifolia* and coral broom were recorded in the upper portion of the RAP area (Ward *et al*., 1994).

An unnamed stream, draining into the Lindis River, located in the southern portion of Lethbridges block, supports a riparian shrubland, which is more open and with a higher component of sweet briar than the shrublands described above. However, a mature *Olearia lineata*, reaching over 3m, is present at GR G40 361907 along with *Carmichaelia kirkii*. The understorey is comprised mainly of introduced species, including gooseberry (*Ribes uva-crispa*). A few young kanuka are growing on the hillsides above the riparian shrubland.

Rocky outcrops and bluffs are a feature of many of the tributaries within the Lower Country. Over one hundred plants of the rare native cress *Pachycladon cheesemanii* have previously been recorded on a series of rocky outcrops and bluffs located within the RAP A2 catchment (Wardle, 1999).

A degraded wetland with *Carex secta, Carex coriacea,* Maori onion *(Bulbinella angustifolia),* silver and hard tussock and much exotic grass is found in the Richmond Valley with an area of shrubland containing matagouri, tree daisy, *Olearia bullata, Coprosma intertexta,* mingimingi and clematis. A few plants of narrow-leaved snow tussock (*Chionochloa rigida*) also persist.

The rare sedge *Carex muelleri* forms extensive patches amongst golden speargrass, mouse eared hawkweed and scattered fescue tussock in the vicinity of the track passing through the upper Richmond Hut block.

McPhies Ridge

McPhies Ridge runs along the northern side of Cluden Stream, and includes McPhies 1, 2 and 3 blocks. These hillslopes are generally south facing. The upper slopes are gentle and support exotic grassland species, with sweet briar present. The lower slopes are steeper and support dense shrubland. While sweet briar dominates, a diversity of native herb and shrub species including mingimingi, Tree daisy and matagouri are present, especially where numerous small bluffs and rock outcrops also occur. One such dense shrubland occurs in McPhies 1 block where a small stream cuts behind a bluff system at the west end, and a fence line delimits the east side.

A second diverse shrubland lies within McPhies 3 block, and is contiguous with the RAP B1 shrubland, which is described in the previous section. Here, in addition to the common shrub species, weeping mapou, native broom, *c*lematis and *Muehlenbeckia complexa* grow along the bottom of a small gorge. The threatened cress and an unnamed, weeping *Melicytus* species are both found on rock bluffs just above the Cluden Stream opposite the junction where the stream flowing through RAP B1 joins the Cluden Stream.

Pachycladon cheesemanii was previously found on ledges on an overhanging bluff on the true right of Cluden Stream within McPhies 2 block (Wardle, 1999).

The rare herbs *Acaena buchananii* and *Leptinella serrulata* occur along the gravely Cluden Stream terraces.

Upper Country – Southwest corner

The Upper Country includes the Rats Tail, lower Vercoes and lower Three Corner blocks. Vegetation composition here is similar to that described for the mid parts of the Lower Country, with perhaps less bare ground and more grassland. However, around rock outcrops and on west to southwest slopes and in deeper gullies, the vegetation is often dominated by native species of grasses and herbs or shrubs. Sweet briar is present.

Small patches of the rare *Coprosma intertexta* are occasionally found around rock outcrops and in deep gullies. Tree daisy and matagouri are more common, usually with briar and can form dense patches on some slopes. *Raoulia parkii* can also be found around rock outcrops, and along the track on the block boundary between Rats Tail and Three Corner. Blue tussock (*Poa colensoi*) and plume grass (*Dichelachne crinita*) also occur in these places. At higher latitudes, the threatened dwarf broom *Carmichaelia vexillata* is locally common within the grassland.

Further upslope, a prominent tor and boulderfield have acted as fire refugia, resulting in a diversity of native species being present. Species include *Coprosma ciliata,* mountain daisy (*Celmisia densiflora),* Haast's groundsel (*Brachyglottis haastii),* golden Spaniard (*Aciphylla aurea), Anisotome flexuosa,* native daphne *(Pimelea oreophila),* narrow-leaved snow tussock (*Chionochloa rigida)* and blue tussock.

Dunstan Mountain Tops and Chain Hills

Blocks included in this description are the upper Vercoes, upper Three Corner, Harleys, Top Richmond, Shaws, Back Richmond, Dunstan and Greenos blocks. This area includes most of the land above about 1100 m, as well as diverse native shrublands and narrow leaved snow tussockland where they survive below this altitude, such as on Back Richmond.

The western part of this area is often dominated by degraded fescue tussockland with mouse ear hawkweed prominent. The natives component here can include Golden speargrass, *Raoulia subsericea, Leucopogon fraseri* and the rare dwarf broom (*Carmichaelia vexillata*). The condition of native vegetation improves towards the east.

Slim snow tussockland (*Chionochloa macra)* of moderate to high density dominates the broad summit ridge of the Dunstan Mountains (within the upper parts of Three Corner, Top Richmond, and Harleys blocks), and has previously been identified as an RAP during the PNA survey (RAP A1; Ward *et al.,* 1994; Appendix 1). Common associated species are false Spaniard (*Celmisia lyallii*), blue tussock, *Raoulia grandiflora, R. subsericea, Rytidosperma pumilum* and native daphne. The slim snow tussockland extends downslope to about 1350m where narrow leaved snow tussockland becomes more common, before grading into an induced fescue tussockland at about 1300m asl. Some slim snow tussock have been locally grazed hard in the lower parts of the RAP.

Cushionfields dominated by *Dracophyllum muscoides* and *Raoulia hectori* are present along the main Dunstan Mountains ridgetop, above about 1450m asl. Common plants present include *Dracophyllum pronum, Chionohebe densiflora, Anisotome imbricata, Leptinella*

villosa, Colobanthus buchananii, Celmisia sessiliflora, Hebe buchananii, Hebe lycopodioides, Aciphylla hectori, Abrotanella inconspicua, Luzula pumila, Phyllachne colensoi, Kelleria dieffenbachii, Carex pterocarpa, Gentiana divisa, Geum leiospermum, and *Craspedia* sp. A population of the rare forget-me-not *Myosotis cheesemanii* is also present (GPS 42114 89371).

Alpine flushes are associated with slim snow tussockland along the tops. Dominant species include *Oreobolus pectinatus, Oreobolus strictus, Gentiana amabilis, Psychrophila obtusa, Ranunculus gracillipes, Ranunculus maculatus, Euchiton laterale, Coprosma atropurpurea, Carex gaudichaudiana, Isolepis aucklandica, Luzula leptophylla, Juncus antarcticus, Epilobium komarovianum, Abrotanella caespitosa, Plantago uniflora, Acaena saccaticupula, Anisotome* sp. bog and several other species. A population of the tiny rare plantain *Plantago obconica* was found at one location.

Further along the tops and at lower altitudes within the Dunstan Mountain blocks, hard tussock tends to dominate with patches of mouse ear hawkweed and grass species.

Spectacular and large bluff systems are found in the Top Richmond block. Diverse native shrublands, with little briar, occur on and around the bluffs. Species present include the weeping *Melicytus* sp., weeping mapou (uncommon elsewhere), *Corokia cotoneaster, Coprosma ciliata, Helichrysum intermedium* and bracken (*Pteridium esculentum*).

Below the bluff systems is a gorge with talus slopes and dense riparian shrubland. Shrub species include *Olearia cymbifolia,* tall weeping mapou, tree daisy, *Coprosma intertexta,* mingimingi, *C. ciliata, Corokia cotoneaster,* matagouri, mountain wineberry, bush snowberry (*Gaultheria antipoda),* native broom, koromiko, *Hebe rakaiensis,* and occasional *Dracophyllum longifolium* and coral broom at the margins of the shrubland. The lianes *Muehlenbeckia complexa, Parsonsia heterophylla* and clematis are present, with the following native herbs mountain daisy (*Celmisia gracilenta*), golden Spaniard, Maori onion (*Bulbinella angustifolia*) and *Dolichoglottis lyallii* also common. Toetoe (*Cortaderia richardii*) is growing in the gully bottom.

Below about 1300m asl., much of the vegetation cover in this block is degraded tussockland with mouse eared hawkweed common. There are patches of hard and silver tussock with *Raoulia parkii* and the rare dwarf broom (*Carmichaelia vexillata*), and *Carex muelleri* also present. Within the gullies and on west faces, there are also small wetlands and patches of relatively dense tussockland and shrubland.

Further east, Shaws block, with its mainly steep, east-facing slopes, contains diverse dense shrublands with matagouri, mountain wineberry, native broom, tree daisy, *Olearia cymbifolia, Coprosma* species, porcupine shrub, *Melicytus* sp. and briar. This shrubland extends into the Richmond Hut block.

On the Chain Hills, dense narrow leaved tussockland clothes all except the lower slopes of the Back Richmond, upper Dunstan and Greenos blocks. Other native plants associated with the narrow-leaved snow tussocks include false Spaniard, golden Spaniard, *Raoulia subsericea,* rare dwarf broom *Carmichaelia vexillata,* native daphne and blue tussock. Coral broom is also locally present. The exotic weeds mouse ear and king devil (*Hieracium praealtum*) hawkweeds are common.

Significance of Vegetation

Map 4.2.3 outlines the significant ecological values on Cluden Pastoral Lease.

At least 150 native vascular plant species are present on Cluden Pastoral Lease. At least 13 species are listed as threatened and a further two as Data Deficient in the most recent threat classification system (de Lange *et al*, 2004), A list of these species with their status, description and distribution is provided in Table 2. Also included are species which are regionally uncommon.

In addition, the tiny gentian *Gentiana lilliputiana* (Range restricted) is likely to occur along the Dunstan Mountain tops, within alpine bogs and slim snow tussockland. Its Type locality is the North Dunstan Mountains where it is found not far south of the Cluden area. It is an annual and only readily seen when in flower i.e. around January to February.

Table 2: Plant species that are listed in the most recent threat classification (de Lange *et al*., 2004) or are uncommon within the ecological district.

Threat of extinction classification (Hitchmough, 2002)	**Plant Species**	**Details**
Nationally Critical	*Myosotis cheesemanii*	Herb. >100 plants in cushionfield along farm track on North Dunstan Mountains (Three Corner block GPS 42114 89371). Known only from two other sites- Pisa Range (Type locality) and adjacent Lauder Conservation Area.
Nationally Endangered	*Carmichaelia kirkii*	Scrambling broom. Recorded in 4 tributaries of Cluden Stream (Ward *et al*., 1994). Stream flowing through RAP A2 has largest adult population (65) in Otago (Wardle, 1999). While not re-found at other two sites, it could be present as the habitat is still suitable and the plant is difficult to distinguish from other shrubs it is tangled amongst.
Serious Decline	*Carmichaelia vexillata*	Dwarf broom. Common in places- scattered populations in tussockland of Chain Hills, and in depleted grasslands above Cluden Stream. Large populations in mid altitude blocks including Back Richmond, Top Richmond, Three Corner, Rats Tail and Vercoes.
Gradual Decline	*Aceana buchananii*	Herb. Relatively common- along gravel edges of Cluden Stream, beside farm tracks and is minor component of depleted low to mid altitude vegetation. Reduction in vegetation cover may benefit this species as it requires an open habitat with full light.
	Carmichaelia crassicaule	Shrub. Few - in tussockland on western slopes and along top of Chain Hills, the upper slopes of Back Richmond and Dunstan blocks, and in RAP B2.
	Pachycladon cheesemanii	Herb. Common on dry bluffs. 115 plants previously found (Wardle, 1999) in RAP A2 catchment and Cluden Stream. 16 more plants found along Cluden Stream (GPS 43023 97129). Likely to present on the bluff systems throughout property, especially in shrubland areas.

Gradual Decline *cont.*	*Leptinella serrulata*	Herb. Common- along gravel edges of Cluden Stream and is minor component of depleted low to mid altitude vegetation.
Sparse	*Carex muelleri*	Sedge. Locally common- in grassland/shrubland in mid-upper Richmond valley; in degraded short tussockland in upper Richmond Hut and lower Top Richmond blocks.
	Convulvulus verecundus	Herb. Few. Found in depleted open lower country amongst scabweed near track up spur just east of Big Spur Creek.
	Coprosma intertexta	Shrub. Uncommon in shrubland. Found in several of the gully shrublands e.g. in Shaws block, and around some rocky outcrops e.g. along track through Rats Tail.
	Olearia lineata	Tree daisy. Occasional. In flush above shrubland in Blue Slip West Block; one mature tree in shrubland in southern Lethbridges block.
	Plantago obconica	Herb. Uncommon- Found in at least one of the large alpine bogs near summit area of Dunstan Mountains within RAP A1 (GR G40 443924).
	Ranunculus maculatus	Buttercup. Uncommon- Recorded in alpine bog near summit area of Dunstan Mountains within RAP A1.
Data Deficient	*Melicytus* sp.unnamed	Hanging shrub. Uncommon. This open sparingly branched shrub hangs down from bluffs. It occurs with *Pachycladon cheesemanii* at the Cluden Stream site (GPS 43023 97129), and from a bluff in Top Richmond block. It is likely to be found at a few other similar sites.
	Vittadinia australis	Fuzz weed. Sparsely scattered on degraded lower slopes, extending up to ~750m asl. in Lethbridges block
Uncommon Species within Ecological District	*Cortaderia richardii*	Grass. Toe toe.
	Myrsine divaricata	Shrub. Weeping mapou.
	Sophora microphlla	Tree. Kowhai.
	Carex secta	Sedge.
	Olearia nummularifolia	Shrub.
Uncommon Species on Property	*Corokia cotoneaster*	Shrub.
	Kunzea ericoides	Shrub. Kanuka.
	Dracophyllum longifolium	Shrub. Inaka.
	Olearia cymbifolia	Shrub.

Cluden Pastoral Lease contains a wide variety of ecosystems, plants and vegetation types of the northern Dunstan Ecological District. Ecosystems reflect both a climatic gradient and the underlying geology. Much of the land has been substantially modified by fires since

Polynesian settlement and by a combination of fires grazing and browsing over the last 150 years. The impact of fire is particularly evident in the distribution of shrubland remnants.

The significance of vegetation within each land unit is outlined below.

West of Lindis River (Little Cluden and un-named Blocks)

The vegetation here is not significant, being either agriculturally developed, or largely modified. There is no record of saline communities persisting around Archies Flat.

Lower Country (Lethbridges, Apple Tree, Lower Ewe, Blue Slip, Breakneck, Richmond Hut, Faris Knob and Roughneck Blocks)

Diverse shrublands are a rare ecosystem, particularly those in the montane bioclimatic zone, where their former extent has been drastically reduced by fire and pastoralism. The significance of shrubby remnants has recently been given prominence by Walker *et al.* (2002). Cluden Pastoral Lease has several important areas of diverse riparian shrubland and associated bluff systems which occupy Cluden Stream tributaries. These are representative of the ecological district. Parts of two of these shrublands have previously been identified as RAPs during the PNA survey (i.e. RAP A2 – Lower Cluden Tributary and RAP B1 - Mid Cluden tributary; Ward *et al.*, 1994). RAP A1 is "an excellent example of the diverse *Coprosma*-matagouri dominated shrubland in riparian zones of steep sided valleys characteristic of the dry (550-650 mm annual rainfall) northwest Dunstan Mountains and adjacent areas of the Lindis District" (Ward *et al.*, 1994).

The climbing broom *Carmichaelia kirkii (*ranking of 'Nationally Endangered') has been recorded in five riparian shrublands, with one of the largest known healthy adult populations within Otago being recorded in the Cluden tributary containing RAP A2 (Wardle 1999). Taxa in this category are facing a very high risk of extinction in the wild. This plant is subject of a draft national recovery plan (Norton in prep.) which promotes the formal protection of its habitat.

A large population of the threatened cress *Pachycladon cheesemanii* (Gradual decline) inhabits the extensive bluff system adjacent to RAP A2 (Wardle, 1999), with plenty of suitable (unsurveyed) habitat present elsewhere within the area.

The Lower Country, while extensively degraded, supports several threatened species which thrive in open environments. These include *Aceana buchananii* (Gradual decline), *Leptinella serrulata* (Gradual decline), and *Convulvulus verecundus* (Sparse). Open grey shrublands with herb-mat grasslands occupying the open, rolling sunny faces and toe slopes within Richmond Valley (Roughneck block), while depleted, include some of these threatened species.

The wetland located in Richmond Valley is an uncommon ecosystem in the ecological district. The majority of this wetland is located on the adjacent property. While significantly degraded, the wetland supports the following species of note: *Coprosma intertexta* (Sparse) and *Carex secta* (uncommon in ecological district).

The presence of kowhai (on steep rocky faces above Cluden Stream) and *Myrsine divaricata*, which grows on rocky outcrops above riparian shrublands is significant, as these woody species are characteristic of previous forest cover and have survived locally on the property.

McPhies Ridge (McPhies 1, 2 and 3 Blocks)

The majority of McPhies Ridge is modified by briar. However, of importance are two pockets of diverse native shrubland associated with Cluden Stream and an area of bluffs. The threatened species *Pachyladon cheesemanii*, *Carmichaelia kirkii* and unnamed *Melicytus* sp. have been recorded at the most eastern site.

The gravelly riverbed of the Cluden Stream provides important habitat for the threatened herbs *Aceana buchananii* and *Leptinella serrulata*.

Southwest corner of Upper Country (Rats Tail, lower Vercoes, lower Three Corners Blocks)

Vegetation cover is largely degraded, with localized points of native diversity centred around rocky outcrops (including the threatened *Coprosma intertexta*) and in deep gullies. The threatened *Carmichaelia vexillata* is common in the degraded grassland.

Dunstan Mountain Tops and Chain Hills (upper Vercoes, upper Three Corner, Harleys, Top Richmond, Shaws, Back Richmond, Dunstan and Greenos Blocks)

The Dunstan Mountain tops are important for their diversity of tussockland, cushionfield, wetland, boulderfield and shrubland communities, as well as for linking RAP A1- North Dunstan with montane shrubland areas including RAP A2-Lower Cluden Tributary.

Much of the slim snow tussockland (*Chionochloa macra*) present on the Dunstan Mountain summit is in excellent condition, and has previously been identified as an RAP (RAP A1, Ward, *et al.*, 1994). The presence of this relatively palatable tussockland is important as they were once extensively widespread within Otago but have undergone a substantial retreat following pastoralism. Since the PNA survey was conducted, some parts of the RAP have been over-grazed (e.g. around point 1248m asl.), resulting in an open tussockland of poor condition.

In conjunction with slim snow tussockland present on the adjoining Lauder Conservation Area, this is the most extensive area of such tussockland in the Lindis, Pisa and Dunstan Ecological Districts. Elsewhere, fire induced cushionfields dominate under conditions of similar altitude, terrain and annual precipitation (Ward, *et al.*, 1994).

The discovery of the rare forget-me-not *Myosotis cheesemanii* (ranking of Nationally Critical), in cushionfields on the Dunstan Mountain tops is highly significant as only the third population known nationally. The other two sites are within the ecological district i.e. on the adjoining Lauder Basin Conservation Area, and on the Pisa Range (its Type locality). Taxa in this category have the highest threat of extinction ranking, and face an extremely high risk of extinction in the wild.

Plantago obconica (Sparse) is another threatened species recorded in the Dunstan Mountain alpine bogs.

Tussocklands surrounding the slim leaved tussockland are in moderate to good condition. These areas act as both a buffer zone and a linkage to diverse shrublands occupying the gullies and shady faces below.

The most extensive area of good condition diverse shrubland, occupies the shady faces within Shaws block, and includes threatened species *Coprosma intertexta* and *Melicytus* sp.n..

Olearia bullata is indicative of moister soils, and is relatively abundant here, compared with the rest of the ecological district.

Rocky outcrops and boulderfields in Top Richmond block support several uncommon and rare species.

In terms of the Chain Hills, some of the best narrow and slim-leaved snow tussocklands are found on the property, with scattered populations of threatened species *Carmichaelia crassicaule* (Gradual decline) and *C. vexillata* (Serious decline*)* present.

PROBLEM PLANTS

Sweet briar is the most significant introduced plant. It is widespread and dominates some shrublands and is a component of most shrublands although it was absent from a few places such as bluffs in Top Richmond block. It can be seen as a component of the shrublands.

Hawkweed is also widespread with mouse ear hawkweed (*Hieracium pilosella)* common on the degraded lower and mid altitude country and in some cases almost the only plant left apart from scabweed. King devil hawkweed (*Hieracium praealtum*) is also common, but less prominent than mouse ear and not as widespread. Tussock hawkweed (*Hieracium lepidulum*) occurs on bluffs in shrubland and is the least common of the hawkweeds. This hawkweed however, may pose a threat to the threatened cress *Pachycladon cheesemanii* where they grow together on ledges under rocky bluffs.

Scattered elderberry (*Sambucus nigra*) and gooseberry (*Ribes uva-crispa*) are locally scattered amongst the grey shrubland communities.

2.5 FAUNA

2.5.1 Invertebrates

Methods

Invertebrates were collected by hand or by ultraviolet light trapping at night. Weather was largely warm, dry and fine with some periods of overcast and light winds. The evenings remained warm and partly cloudy until after midnight.

Invertebrate Fauna Description

A total of 184 species of invertebrates were identified during the survey (see Appendix 5). These included moths (106 species), beetles (38 species), grasshoppers, bugs and weta.

The area has not been visited extensively by entomologists in the past but published information concerning habitats and adjacent regions is relevant (Patrick, 1989, 1994, 2000a, 2000b). Many of the communities present on the property have adapted to arid conditions. A number of insects recorded are endemic to intermontane areas and mountain tops of Central Otago. Many of the insects recorded are characteristic of wetland, stream, shrubland, short tussock, rock bluff and herbfield plant mats communities of eastern South Island, despite a history of soil loss and vegetation depletion resulting from fire, rabbits and grazing.

Areas of highest natural character for invertebrate fauna are confined to high altitudes, valley floors and shrubland occurring on deeper soils or refuges. Insects representative of semi-arid herbfield and bare ground are also of significance to the Dunstan Ecological District.

For the purpose of describing the invertebrate composition, seven land units encompassing the following farm management blocks (see Map 4.2.3) are used:

- Back Richmond, Greenos and Dunstan blocks
- Richmond Hut and Shaws blocks
- Roughneck, Faris Knob and adjoining unnamed block
- McPhies 1, 2 and 3 blocks
- Rats Tail, Lower Ewe, Blue Slip, two adjoining unnamed blocks, Breakneck and Top Richmond blocks
- Three Corner and Harleys
- Vercoes, Apple Tree, Holding, Lethbridges, Little Cluden and unnamed blocks

Back Richmond, Greenos and Dunstan Blocks

Separated from the Dunstan Mountains by upper Cluden Stream, these blocks encompass those parts of Chain Hills and Dunstan Creek flats that occur on the Pastoral Lease. The gently sloping apron lands rising from Cluden Stream and behind Faris Knob provide for short tussock inhabiting insects such as moths *Orocrambus corruptus* (dry sites), *Prepalla austrina* (larvae on *Leucopogon*), and *Cosmiotes ombrodoca* (larvae mine *Festuca* and sweet vernal). Represented in matagouri/coprosma shrubland are the moths *Capua semiferana* (in litter) *Graphania phricas* (larvae eat matagouri) and *Austrocidaria gobiata* and *A. similata* (larvae eat coprosma). The blue butterfly *Zizina oxleyi* is common on clovers here. Gently sloping, stream-fed damp areas are common and the moth *Parienia mochlophorana*, a local and uncommon species, is present here.

Above 900 m, where scattered snow tussocks are present, a good range of upland insects associated with tussock, herbs and rock outcrops is present.. Mountain stone weta *Hemideina maori*, Otago tussock weevil *Anagotis lewisi* and slender plume moth *Stenoptilia orites* (larvae eat *Brachyglottis* flowers) are typical of Otago mountains.

Invertebrates of the lower Dunstan Creek faces and flats were not surveyed. However, invertebrate communities structured by the cold winter climate, and associated with inter-montane grassland and wetland, are likely represented and important here.

Richmond Hut and Shaws Blocks

The mid to lower slopes of these blocks retain relatively good vegetation cover. The Cluden Stream corridor has a number of associated sedge/rushlands and flushes. An extensive area of steepland flushes on a shady slope is regionally significant for invertebrates inhabiting shrubs, herbs, damp swards and litter. A rich fauna of moths, bugs and beetles has been recorded from such vegetation elsewhere on the Pastoral Lease (Appendix 5) where habitats are less extensive and more confined. These include rare moths *Meterana exquisita* and *Pseudocoremia cineracia* (both with an extinction status of Gradual decline, Hitchmough, 2002) whose larvae eat shrubs *Olearia odorata* and *O. bullata.* The ground beetle *Megadromus memes/fultoni* (extinction status: Data deficient, Hitchmough, 2002) was recorded nearby and is most probably present along the tops.

Roughneck, Faris Knob and adjoining un-named Block

Although droughty and severely eroded, the soils here have a high natural nutrient status. Native vegetation is severely depleted but retains patches with natural character and insect associations of significance for Central Otago. Eighty five invertebrate species (including 58 moths) were recorded here.

The habitats of note in these blocks are:

- Areas of very dry open vegetation spanning 680-740 m on the gentle toe slopes of Richmond Valley.
- An area of ~3 ha of wetland plus ~5 ha of mixed shrubland on the floor of the valley downstream from the Yards below Richmond Hut.
- Some northwest facing gullies with sedgeland and short tussock flanked by mixed shrubland.
- The gorges of Cluden Stream and RAP B1 with rock bluff, mixed shrub and liane and permanent stream associated habitats.

The dry slopes support a number of notable insect species. Moth *Homoeosoma anaspila* has larvae on dryland daisy *Vittadinia* and moth *Leptocroca asphaltis* inhabits dry banks and females are flightless. An upland black cicada *Maoricicada* sp. is at unusually low altitude here. Another eighteen moths and the grasshopper *Phaulacridium otagoense* are recorded from dry herbfield and short tussock. Among shrublands on dry slopes and adjacent to wetlands are insects recorded inhabiting ground and canopy litter, flowers, roots, *Melicytus*, *Coprosma* spp., matagouri, *Clematis* and *Muehlenbeckia* (see Appendix 5). The assemblage is representative of semi-arid Central Otago shrublands.

Wetlands are depauperate in plant species and dominated by sedges, rushes and damp grass swards. These, however, add significant additional biodiversity to semi-arid lands where they have become minor in extent. Inhabitants include very abundant leaf hoppers (families Cixidae & Cicadellidae) and green longhorn grasshoppers *Conocephalus semivittatus*. Small day active beetle *Notagonum* sp. is predatory among low swards and longjaw spider *Tetragnatha* sp. hunts in taller sedges and rushes. Nine wetland moths and one seepage caddis *Oeconesis maori* were also recorded.

Rock bluffs in the gorges are a refuge for a range of shrub and herb communities but are also faunal habitat. On rock-face mosses are four moths *Eudonia philerga, Helastia cineraeria, Gadira acerella* and *Glaucocharis elaina*. A number of moths have larvae on lichens. However, only the moth *Helastia christinae* was recorded.

Stream insects recorded are mostly widespread in small streams with natural character. Riparian shrubs are an important refuge for many stoneflies, caddis and mayflies. Of note is a population of short-winged flightless stonefly *Zealandoperla fenestrata* found in RAP B1.

McPhies 1,2,3 Blocks

The slopes below McPhies Ridge have soils of high natural fertility and little remaining natural character. However, the Cluden Stream corridor within these blocks retains a range of important and representative habitats of invertebrates. Plant cushions and mats along open floodplain are best represented on the Pastoral Lease in these reaches. They are habitat for a grasshopper *Phaulacridium otagoense*, bug *Nysius huttoni* and another Lygaeid bug species. Boulder butterflies *Bolderaria* n.sp. are common on mats of *Muehlenbeckia axillaris* here.

Habitat complexity is traced out along open shallow channel networks which have small areas of short tussocks, *Carex* spp. sedges and coarse woody debris. Red admiral butterfly *Bassaris gonerilla* is associated with an *Urtica* species nettle found along the stream in McPhies 3.

The junction of Cluden Stream and Big Spur Creek appears to represent a site of significant biodiversity. A night time light trap yielded 72 moths and 16 species of caddis (see Appendix 5). These are inhabitants of dryland herbfield, mixed short tussock, rock bluff, mixed dry shrubland, lianes, sedgeland, damp understorey herbs, damp grass swards, flushes, streams, speargrass and tall tussock and woody debris. Three rare moths include *Asaphodes stinaria* (threat of extinction status Nationally Endangered, Hitchmough, 2002), which has larvae on buttercup *Rannunculus foliosus* or *R. reflexus* in shaded damp sites or wetland. The other two rare moths both have larvae on shrub *Olearia odorata*. These are moth *Meterana exquisite* and moth *Pseudocoremia cineracia* (threat of extinction status Gradual decline, Hitchmough, 2002).

The lower parts of Cluden Stream and Big Spur Creek are at low altitude (380 metres asl), and have a range of communities significantly under represented in reserves elsewhere at this altitude and aridity (around 300-470 mm average rainfall for the steepland soils at the site, Soil Bureau, 1968).

Rats Tail, Lower Ewe, Blue Slip, two adjoining un-named blocks, Breakneck and Top Richmond Blocks

These comprise much of the northwestern slopes of the Dunstan Mountains found on the Pastoral Lease and span about 500 -1300 m asl. Soil loss following historical fire, grazing and rabbits has been significant. Remaining areas with some natural character for invertebrates are now confined to rock outcrop, rock fell/slump and narrow stream gullies. However, along spur tops, communities expanded and created by the disturbance have elements of interest.

The shrublands among the stream bluffs in the Top Richmond block are some of the most diverse on the Pastoral Lease. This is matched by equally significant faunal species richness. Day active invertebrates noted here include shrubland clapping cicada *Amphipsalta clapitans* and black cicada *Maoricicada* sp. basking on boulders. Also sunbathing among boulders were the moth *Notoreas* n.sp. with larvae on sprawling *Kelleria*, and the moth *Notoreas hexaleuca* with larvae on ?*Pimelea aridula*. Manuka beetles *Pyronota festiva* are common on a range of plants. Found under the stones here was a darkling beetle *Mimopeus* sp.; it is of limited distribution in Central Otago. The tussock butterfly *Argyrophenga* n.sp. 'western' remains in patches of *Chionochloa rigida* at 1100 m. At lower altitudes diminutive mixed grasslands include extensive patches of *Poa maniototo*, hard tussock, *Leucopogon fraseri*, adventive herbs –mouse eared hawkweed, bare ground and rare fuzzweed *Vittadinia australis*. Grasshoppers *Phaulacridium otagoense* and *Sigaus australis* are common here. Representative day active moths include *Diasemia graminalis* (dry herbfield), *Arctesthes catapyrrha* (seasonally dry plant mats) and *Prepalla austrina* (larvae eat *Leucopogon fraseri*).

Insects of dry shrubland, particularly *Olearia odorata, Coprosma* spp., and *Muehlenbeckia complexa* described elsewhere on the Pastoral Lease, add value to communities located in the slump region of Blue Slip, among spur outcrops as at Rats Tail and in the shrublands lower down the tributaries of Cluden Stream. Of note is the documented richness of the fauna and rare moths inhabiting Big Spur Creek in the Lower Ewe Block. Habitats here extend up to modest altitude along the stream in Rats Tail Block above.

Three Corner and Harleys Blocks

These blocks span a surprising altitude from 700 m to 1555 m at the summit of the Dunstan Mountains. As briefly described above, soil loss and other processes have depleted faunal communities below about 1350 m. The fauna described for disturbed and thinly vegetated soils is represented along with other more natural elements found in areas of deeper soil, rock or gully refugia as above. In the alpine areas above 1350 m, tall tussock, dry cushionfield, wet cushion and gently dipping wet flushes are all communities with significant inherent value for invertebrates. The beetle *Megadromus memes/fultoni* (extinction status: Data Deficient, Hitchmough, 2002) inhabits drier areas in tussock and cushionfield. Wetland habitats are complex and include for example three small predatory carabid beetles with different associations; *Scopodes* [*edwardsi*?] and *Scopodes* sp.1 have adults among wet cushions and sog areas. A small species in the genus *Notagonum* has adults living outside the margins of wet surfaces. Of note is a cranefly (Tipulidae) species present in wet sog that has short wings and is flightless. This is likely to be a local species on block mountains of the region.

Remaining eastern blocks including Vercoes, Apple Tree, Holding, Lethbridges, Little Cluden and un-named Blocks

This complex of blocks spans altitudes from 300-900 m and includes areas of very low annual average rainfall. Compared with other blocks on the Pastoral Lease, there is more loess cover and soil erosional processes include gully erosion. Near Archies Flat, areas previously described as having sodic soils (pH 9 and above, Soil Bureau, 1968) appear to have been cultivated with loss of native vegetation cover. Invertebrates were not surveyed in these blocks.

Significance of Invertebrate fauna

Of national significance is the invertebrate fauna of valley floor and slope-toe in the regions of Big Spur Creek-Cluden Stream junction and Richmond Valley. These have retained significant assemblages of invertebrates and are important habitats. Nationally, lowland arid herb-grassland, wetland, permanent stream and lowland arid shrublands (at 380-740m altitude) are recognised as under-represented in protected areas. The fauna inhabiting rock faces, damp enclaves, toe slopes, and streams are distinctive but also representative of the Central Otago Ecological Region. They have retained much natural character.

Other important habitats of invertebrates on the Pastoral Lease are more extensive and also more widely represented elsewhere. These include most of the high montane and alpine lands and also mid to low altitude refugia of gorge, outcrop, slump, gully shrubland and stream side vegetation. Invertebrates of Otago rain-shadow areas abound in these sites, some of which are significant for the Dunstan Ecological District.

Invertebrates of the lower Dunstan Creek faces and flats were not surveyed. However, invertebrate communities structured by winter cold climate associated with inter-montane grassland and wetland, are likely to be represented and significant here.

A summary of the threatened invertebrate species on the property is presented in Table 3.

Table 3: Invertebrate species that are listed on the Threat Classification Database (Hitchmough, 2002).

Threat of extinction classification (Hitchmough, 2002)	Invertebrate Species	Location/ comments
Nationally Endangered	*Asaphodes stinaria*	Moth; low valley region of Cluden Stream and tributaries. *A. stinaria* has larvae on buttercup *Rannunculus foliosus* or *R. reflexus* in shaded damp sites or wetland.
Gradual decline	*Meterana exquisita*	Moth; widespread at moderate to low altitude on the Pastoral Lease with larvae on the shrub *Olearia odorata*.
	Pseudocoremia cineracia	Moth; widespread at moderate to low altitude on the Pastoral Lease with larvae on the shrub *Olearia odorata*
Data Deficient	*Megadromus memes/fultoni*	Beetle; inhabits less wet areas in tussock and cushionfield in alpine Dunstan Mountains.

Other species of note are listed below:

- Moth *Parienia mochlophorana*, a local and uncommon species, recorded in wet sward on the Chain Hills apron.
- Moth *Homoeosoma anaspila* has larvae on the threatened dryland daisy *Vittadinia* ['Data deficient' (Hitchmough 2002)] which is present on lower thinly vegetated slopes. This moth is specifically associated with the daisy, so is likewise a notable semi-arid ecosystem record.
- Moth *Leptocroca asphaltis* inhabits dry banks. Females are flightless limiting their dispersal and indicating a long term natural association in the landscape.
- Moth *Eudonia legnota* is common below 750 m. This is a local and uncommon moth better known in Canterbury basin areas.
- An upland black cicada *Maoricicada* sp. is at unusually low altitude (720 m) in Richmond Valley.
- A short-winged flightless population of stonefly *Zealandoperla fenestrata* is found in RAP B1. Wing reduction in stoneflies is a feature of the New Zealand fauna and it is likely that species of limited geographic distribution are evolving in the endemic genus *Zealandoperla*.
- A darkling beetle *Mimopeus* sp. is in mid altitude rocky areas (1100 m) on the Dunstan Mountains. It is of limited distribution in Central Otago.
- A cranefly (Tipulidae) species is in alpine wetland in the Dunstan Mountains. The cranefly has short wings and is flightless. This is likely to be a local species on block mountains of the region.

2.5.2 Herpetofauna

"Site locations of rare and endangered herpetofauna are recorded in the original report. Herpetofauna of this nature is at risk of illegal activities including damage and removal through unlawful interference and disturbance. Accordingly, information regarding the locations of any such herpetofauna has been deleted from this version of the report. The Department of Conservation has put in place mechanisms to ensure that such information can be released for genuine scientific and research purposes. Please contact the Department of Conservation directly to determine whether the information can be released."

Introduction

Lizard species that have been recorded on Cluden Pastoral Lease, or in similar habitat nearby, include green skink (*Oligosoma chloronoton*), common skink (*O. nigriplantare polychroma*) McCanns skink (*O. maccanni*), and geckos in the genus *Hoplodactylus* (Hitchmough, 1997, Amphibian and Reptile Distribution Survey Database, Whitaker *et al.*, 2002).

A survey for lizards was carried out on Dunstan Mountains and St Bathans Range during February – March 1989 (Whitaker and Loh, 1990). This included a small area of Cluden Pastoral Lease. Most search effort was put into bluffs and outcrops along Big Spur Creek (A. Whitaker, pers. comm.). Species found on the Dunstan Mountains include common skinks (*O. nigreplantare polychroma*), which were widespread, and common gecko (*H. maculatus*) which were found in outcrops or loose boulders and screes up to 1370m asl.

Scree skinks (*O. waimatense*) have been found in greywacke screes within 10km of Cluden Pastoral Lease, on Mt St Bathans (Whitaker and Loh, 1990).

The closest Otago (*O. otagense*) skink sites to Cluden Pastoral Lease are to the north (Morven Hills pastoral lease) and northwest (Deep Creek pastoral lease). The closest grand skink (*O. grande*) sites are to the northwest (Forest Range pastoral lease) (Whitaker *et al.*, 2002). No evidence of Otago or Grand skinks was found on the Dunstan Mountains during the 1989 survey, and no historic records exist for this area. However, there is suitable habitat present and the area is within the known range of the species. Absence of these lizards was thought most likely to be due to past high rabbit densities and agricultural modification of habitat (Whitaker and Loh, 1990). A 'large' lizard scat has previously been reported at one site (RAP A2) (S. Thorne, *pers. comm*.), so that Otago skinks may be present.

Green skinks (*Oligosoma chloronoton*) have been recorded less than 10 km away in Shepherds Creek, a tributary of Dunstan Creek, and 11km away in Dunstan Creek.

Alpine geckos could also be present at high altitude sites, given that some recent surveys of such sites in Otago have located previously unknown *H. granulatus* type geckos (Roys Peak gecko (*Hoplodactylus* aff. *granulatus)* at Roys Peak near Wanaka (Tocher and Marshall, 2001), and Moke gecko (*Hoplodactylus* sp. undet.) at Mt Creighton near Lake Wakatipu (Jewell, 2002).

Methodology

A survey for lizard fauna was conducted on 1 - 4h December 2003. The warm sunny weather conditions were suitable for lizard survey throughout the search period.

Searches were undertaken by day. Search methods included scanning rock outcrops with binoculars, and lifting loose rocks.

Parts of the property were either not adequately covered or not surveyed: north of Cluden Stream, some west facing blocks (Richmond Hut, Shaws, Dunstan and Greenos), and land above 1200m asl.

A variety of lizard habitats are present on this property, including grassland, shrubland, riparian margins, rock screes, and tors. On a wider scale most of the property has a north-westerly aspect, which is favourable for lizards.

Description of the Lizard Fauna

Six species of lizard were identified on the lease: the Cromwell gecko (*Hoplodactylus* sp. 'Cromwell'), Southern Alps gecko (*H.* sp. 'Southern Alps'), Roys Peak gecko (*H. aff. granulatus 'Roys Peak*'), cryptic skink *(Oligosoma inconspicuum),* McCann's skink (*O. maccanni),* and the common skink (*O. nigriplantare polychroma)*(Table 4). Map 4.2.4 shows the location of the single Roys Peak gecko.

Table 4: Lizards species found during current survey on Cluden Pastoral Lease (threat status according to Hitchmough, 2002).

Lizard species	Location	Habitat	Altitude (m asl)	Status
Cromwell gecko (*Hoplodactylus* sp. "*Cromwell*")	SW of Cluden Stream	Rock tors, bluffs	below 1100	Eastern limit of known range
Southern Alps gecko (*H.* sp. "*Southern Alps*")	East of Cluden Steam	Scree, rock outcrops	600 – 1400	Southern limit of known distribution
Possible Roys Peak gecko (*H.* aff. *granulatus* "*Roys Peak*") or new species	Chain Hills crest	Bluff	1402	Nationally Critical. Major extension of known range (over 50 kms).
Cryptic skink (*O. inconspicuum*)	East of Cluden Stream	Talus, rock outcrops	800 – 1400	Gradual Decline. North-eastern extension of known range in Otago
McCanns skink (*O. maccanni*)	Widespread	Among and near rocky sites		Common
Common skink (*O. n. polychroma*)	West & south of Cluden Stream	Damp gullies, dense grassland		Common

No evidence was found of Otago skinks in RAP2 where a large scat had previously been found. However, this species is cryptic and elusive and, if present, is likely to be in small and

isolated groups (Whitaker and Loh 1990). Thus it should not be concluded that Otago skinks are not present, even though they were not detected during this survey.

Significance of Herpetofauna

Two of the lizard species recorded at Cluden Pastoral Lease are threatened.

Roys Peak gecko *(Hoplodactylus* aff. *granulatus* "Roys Peak")
The discovery of a lizard assumed to be Roys Peak gecko on Cluden Pastoral Lease is of national significance. This species has a threat status of Nationally Critical (Hitchmough, 2002). The one specimen found is morphologically similar to those found at Mt Alpha and Roys Peak, Crown Range. However the Cluden specimen is larger than the Crown Range lizards (89mm SVL cf. up to 80mm SVL) and has a shorter tail and fewer subdigital lamellae. It is possible that the Cluden specimen is a distinct and new species. Whichever is the case, the habitat of this lizard on Cluden Pastoral Lease should be protected given its threat status and eastern limit of known range for Roys Peak gecko (Tocher and Marshall, 2001).

Cryptic skink (*Oligosoma inconspicuum*)
This species is ranked as being in Gradual Decline (Hitchmough, 2002). This implies that a species is chronically threatened and facing extinction, but buffered slightly by either a total large population or slow decline. Habitat destruction and modification through agricultural practices (especially burning of vegetation and grazing) and predation by introduced mammals (cats, mustelids, rodents) are likely to be the major causes of decline of these species.

The following lizard species are at distributional limits on Cluden Pastoral Lease:

Roys Peak gecko -	See above.
Southern Alps gecko -	at the southern limits of known distribution; coincides with habitat of Roys Peak gecko.
Cromwell gecko -	at the eastern limit of the known population distribution.
Cryptic skinks -	at the north-eastern extension of known distribution.

2.5.3 Avifauna

Native birds observed during the tenure review inspection include black backed gull, grey warbler, harrier hawk, South Island oyster catcher, welcome swallow, New Zealand pipit, paradise shelduck, and fantail.

Introduced bird species include chaffinch, Californian quail, yellowhammer, starling, magpie, sparrow, and blackbird.

Significance of Birds

The bird species recorded at Cluden Pastoral Lease are typical of the ecological district. No threatened bird species were found.

2.5.4 Aquatic Fauna

Introduction

There are six freshwater fish records on the New Zealand Freshwater Fish Database (NZFFD) for the Lindis River/Cluden Stream area. Brown trout, longfin eel and upland bully have all been recorded. The Department of Conservation has also conducted surveys in streams on adjacent properties where a threatened species of galaxiid (*Galaxias* sp. D.) has been recorded.

Methodology

Cluden Stream, a tributary of Lindis River within the Clutha River Catchment, and its tributaries, were sampled during 2 – 5 December 2003. Each site was sampled using a backpack electric fishing machine using defined criteria (Allibone, 1999). Where possible, each tributary was sampled at a lower, middle, and upper location. Given the dense and prickly nature of the riparian shrubland present along the tributaries, the middle sites were located where it was possible to access the stream.

The sites selected contained both riffle/run and pool habitat. All sites were sampled at a minimum of 50m in length or 100 m². Stream width, depth, water temperature and conductivity were recorded. Substrate and riparian composition were visually estimated according to the Freshwater Fish Database Form format. The location was recorded using a Global Positioning System (GPS). Where possible, barriers that prevent trout access further upstream were located and recorded.

In-stream invertebrates found during electric fishing surveys and sampled from under rocks, were noted and given a Macro-invertebrate Community Index (MCI) score (Stark, 1993), as an indicator of water quality in New Zealand stony streams.

Aquatic Fauna Description

A total of 55 sites were surveyed (Appendix 6). Sixteen sites were dry, although the topographical maps indicated that water should have been present. Four native species of fish were recorded: native upland bully (*Gobiomorphus breviceps)*, longfin eel (*Anguilla dieffenbachii*), koaro (*Galaxias brevipinnis*), and *Galaxias s*p.D. , and two introduced species - brown trout (*Salmo trutta*), and brook char (*Salvelinus fontinalis*).

The threatened galaxiid *Galaxias sp*. D. was recorded at 11 sites (see Map 4.2.4), generally in the upper sections of streams. At eight of these sites, *Galaxias sp. D.* was the only fish species recorded.

Upland Bully was recorded at one site only, in a tributary of Dunstan Creek, which forms part of the Manuherikia River catchment.

Longfin eel was found at one site only. Koaro was recorded at one site only, where *Galaxias sp. D.* and brown trout were also present.

Brown trout is widespread, generally located in the lower section of most the streams sampled. In some tributaries, brown trout were found above some very significant waterfalls, which elsewhere, would have prevented access. The presence of brown trout appears to be the greatest restriction to distribution of *Galaxias sp*. D.

Brook char was found only at one site within a tributary of Dunstan Creek which forms part of the Manuherikia River catchment.

Overall the water quality was very good throughout the property. The dense riparian shrubland which commonly grows alongside streams helps reduce stock access to the streams. Only one site showed signs of stock damage. Sixteen taxa (Appendix 7) of invertebrates were located within the property. Most sites have a high MCI value, indicating high water quality. This is despite the imprecise sampling method used.

Significance of Aquatic Fauna

Cluden Pastoral Lease has two freshwater fish of significance- *Galaxias sp.*D. and longfin eel.

Galaxias sp. D.

The upper sections of Cluden Stream tributaries (generally where barriers have prevented brown trout upstream) provide suitable habitat for five populations of a new non-migratory un-named galaxiid *Galaxias* sp. D. (extinction status: Nationally Vulnerable, Hitchmough 2002).

This fish species has yet to be taxonomically named, but it is included within the New Zealand non-migratory galaxiid recovery plan (Dept of Conservation 2002). An objective of this plan is to "identify, protect and manage a minimum of 30 habitats with key non-migratory fish populations, for each species". Given that nationally, less than 30 populations of *Galaxias sp.*D. are known, the populations found on Cluden Pastoral Lease are of significance.

Four clusters of populations of *Galaxias* sp. D. occur in the Clutha River catchment and areas of the Catlins District. A series of populations occur from Bannockburn upstream in tributaries of the Clutha and Lindis Rivers. Populations at Queensberry and in around the Chain Hills (Lindis) have gained some protection as part of the Crown Lands tenure review. A small number of populations are known from Rough Ridge, of which none are protected. Tributaries in the mid reaches of the Pomahaka River contain a series of *Galaxias* sp. D. populations, some of which are proposed for protection as part of other tenure review proposals. A final group of populations occur in the Catlins, Tahakopa and possibly the Mokareta Rivers. In the Catlins District, the only known populations are on farmland, although it is possible that some populations may be protected in the unsurveyed Catlins Forest Park.

The limited gene flow among populations within species, especially among catchments will mean there is a need to protect populations throughout their range to retain the genetic diversity present within each species. To protect this full range of galaxiid biodiversity considerable conservation effort is required. Protection of non–migratory and landlocked galaxiid populations over the full geographic range of the species is required. Populations in different river systems and even within river systems can be genetically isolated from other populations of their species and are free to adapt to local conditions or undergo genetic drift, leading to locally distinct gene pools and eventually new species. Protection of populations over a wide geographic and environmental range will protect the genetic diversity of each species and the process of speciation (Allibone, 1997).

Longfin eel (*Anguilla dieffenbachii*)

The upper main stem of Cluden Stream provides habitat for the longfin eel (threat of extinction status, Gradual Decline, Hitchmough 2002).This species was once abundant throughout New Zealand. Habitat modification, hydro dams preventing passage to and from the sea, and commercial fishing have contributed to making this a threatened species. Only one large individual (length 1.2 m) was located on the property. Its size would suggest that it was a mature female and is very unlikely to ever reach spawning grounds due to Clyde and Roxburgh dams.

2.5.5 Problem Animals

Animal pests present on the property include rabbit, hedgehog, wild pig, cats, ferrets, stoats, possum, hares, goats and rats.

Rabbits are common in the lower country. Very large areas of the lower country, reaching as high as 1000 m asl. in places, have been heavily browsed and kept almost bare by rabbits. The occasional shrubs are either chewed almost to ground level or have been ring barked and killed. Rabbits appear to be making a comeback at present with numerous animals seen even at midday in the lower country.

Cat, stoat, hedgehog, ferret and rat are present and are likely eat lizard fauna.

2.6 HISTORIC

2.6.1 Maori cultural values

The wider Lindis region was of significance to Maori. The Lindis Pass was an important route between the Waitaki and Clutha valleys. The usual route seems to have been up Longslip Creek from the Ahuriri, down the Pass Burn to the Lindis River and then over Mount Grandview to Lake Hawea. This is the route given in Stevenson (1947:49) and that which was taken by the surveyor Thompson in 1857 when following directions given by Reko of Tutarau (Duff 1978:pp19-20).

There is one Maori site recorded on Cluden Pastoral Lease - a rockshelter (New Zealand Archaeological Association site number G40/62 grid reference G40 339 915). This site is on the true left of the Lindis River, upstream of the southern boundary of the lease, and may possibly be within the Lindis River marginal strip. The site comprises a rock overhang with a sloping floor. The bulk of the useable part of the shelter was destroyed during the construction of an irrigation race, which runs along the base of the cliff. In 1959, a Ministry of Works employee found a fire stick or fire plough. This comprised a flat piece of wood with a groove worn in it and a pointed stick. Vigorous rubbing of the stick in groove generated considerable heat sufficient to ignite the powder produced by the rubbing. This artefact is now in the Otago Museum. The inspection of the remaining part of the rock shelter yielded no further signs of cultural material.

2.6.2 Heritage values

In 1858, John McLean, a Scotsman who had originally settled in Australia, guided by Huruhuru from the Waitaki, crossed the Lindis Pass searching for grazing land. Ultimately four grazing licences were leased to McLean, his two brothers and his sister (Runs 235, 236, 237, 238). These became the Morven Hills Station of 35,200 acres. It stretched from the Cromwell Gorge to the Lindis Pass and from Lake Hawea to the Dunstan Mountains and Dunstan Creek. In 1874 the McLeans sold the station and it eventually passed into the hands

of F. G. Dalgety of London who had created a business empire based upon sheep stations in Australia and New Zealand.

In the 1880s, parts of the original Morven Hills run were relinquished from the lease to provide for closer farming settlement in the Hawea Flat and Tarras areas. But it wasn't until 1910 that the bulk of Morven Hills was broken up into more than 20 smaller runs, Cluden being one of these (Duff 1978: 48-52).

There are two European sites recorded by the New Zealand Archaeological Association on Cluden Pastoral Lease.

Site G40/59 stone stock yards (grid reference G40 367 945). This site was located about 3 km up Cluden Stream. Since the site was first recorded in 1977, the stone walls have been bulldozed, leaving only a pile of rubble and the bottom course of a stone wall that extends for about 40 metres along the base of the hill.

Site G40/58 stone hut ruin (grid reference G40 365 945). This is the ruin of a two roomed stone dwelling approximately 12 metres long by 4 metres wide (see photo.) This is typical hut ruin which was almost certainly a shepherds hut dating from the Morven Hills period.

Significance of Historic Values

No further measures are required for the protection of the yards or rock shelter as they have been almost totally or partially destroyed. The hut ruin is a typical feature associated with 19th Century pastoralism. It is already protected by the archaeological provisions of the Historic Places Act as it pre-dates 1900. No further protection is required.

2.7 PUBLIC RECREATION

2.7.1 Physical Characteristics

Cluden Pastoral Lease comprises the semi-arid lower slopes of Lindis River and Cluden catchment, extending up to the alpine environment of the North Dunstan Mountains. Dunstan Creek Valley formed the easternmost property boundary.

There are important opportunities for public recreation on Cluden Pastoral Lease. This is due to the:

- Large and seemingly remote nature of the property.
- Great views of the St Bathans Range, Pisa Range and to the Main Divide further west.
- Presence of a good network of moderate gradient tracks on the property.
- Network of public access routes on adjoining properties in the Lindis area which provide outstanding mountain biking and walking opportunities.
- Interesting mix of rocky outcrops, woody gorges, open tussockland and alpine cushionfield vegetation.

In 1992 DOC compiled a Recreation Opportunity Spectrum (Harper, 1992) for the entire Conservancy whereby all areas regardless of land tenure were classified and mapped according to setting, activity and recreational experience characteristics. The majority of the

property is zoned *Backcountry 4WD Drive In* which "is characterised by a feeling of relative remoteness from populated areas". "The highly natural setting is a valued part of the experience and may be associated with motivations of 'escape from town', education and nature appreciation. Four wheel drive vehicles are desirable to give access to high country tussock grasslands and block mountains and more rugged remote areas" (Harper, 1992). The excellent network of tracks on Cluden Pastoral Lease provides well for this zone.

The Lindis River and Cluden Stream valleys are zoned *Rural* which is characterized by 'a feeling of being away from urban areas, but in a strongly human-modified setting. Common recreation activities include pleasure driving, horse riding, walking and picnicking' (Harper, 1992).

In 1989, Federated Mountain Clubs compiled an outdoor recreation plan for Central Otago's Block Mountains (Mason, 1988). The document notes that the majority of the Dunstan Mountains (including Cluden Pastoral Lease) is zoned *open space*. "This zoning recognises the highly modified landscapes resulting from extensive tussock depletion, pastoral development and vehicle tracking. Rights of public access through the zone need to be retained and extended". The only area zoned *natural experience* on the property is along the Dunstan Mountain summit, where RAP A1 is located. Recreational opportunities noted include cross country skiing on the Dunstan Mountain tops, and walking/botanizing in the vicinity of RAP A1.

2.7.2 Legal Access

Map 4.2.1 shows where marginal strips and legal roads exist on Cluden Pastoral Lease.

Marginal Strips
A s. 58 Land Act marginal strip is present along the Lindis River, while s. 24 Conservation Act marginal strips are present along Cluden Stream, Big Spur Creek and along an unnamed tributary of Cluden Stream, 2km upstream of Big Spur Creek.

Legal Roads
State Highway 8 passes through the westernmost part of the property and is located on a legal road line.

Cluden Hill Road, which comes off State Highway 8 near Cluden Hill, crosses the Lindis River, then goes up the Cluden Stream valley. The road is maintained by the Central Otago District Council as a track for about 4km, as far as the first yards. A formed gravel road continues up the valley for a further 4km to Richmond Valley Hut, frequently deviating from the legal road line.

An unnamed track follows the eastern bank of the Lindis River, and appears to coincide with either a legal road line or the marginal strip.

A paper road is located along the eastern property boundary in Dunstan Creek. A farm track here is, in places, aligned to the paper road or the marginal strip.

A paper road is present along the property's northern boundary (i.e. along much of McPhies Ridge to Dunstan Pass), where it drops down to meet the Dunstan Creek paper road. Public foot access has been formalized through tenure review negotiations on the adjacent property along the McPhies Ridge farm track and legal road alignment.

Several unformed legal roads are also present on the property (e.g. up Richmond Valley and up to Cluden Pass) and bear no relation to formed tracks (see Map 4.2.1a & b).

2.7.3 Activities

The Lindis River margins receive substantial public use for picnicking and fishing. Access to the Lindis River is gained via the legal Cluden Road (although the track formation deviates from the legal road line) and marginal strips.

The Cluden Valley receives some usage from local walking groups.

A relatively popular two day trip for mountain bikers is to bike up Dunstan Creek from near St Bathans township and to cross the Chain Hills to State Highway 8 via one of several routes including Cluden Stream (Cluden Pastoral Lease), and Coal Creek, Pleasant Valley, Tim Burn or Goodger Road (Short Spur Creek) on nearby properties. This route was also popular with 4WD vehicle owners until 1995, when the track up Dunstan Creek was badly washed out in many places during heavy flooding. Routes into Dunstan Creek are also well suited to horse trekkers.

The network of public foot and mountain bike access routes (a recent outcome of tenure review on adjoining Lindis properties) along McPhies Ridge, and across and along the Chain Hills immediately north of Cluden Pastoral Lease, link in with existing farm tracks on Cluden Pastoral Lease. With landholder permission, mountain bikers, walkers, horse riders and four wheel drivers can gain access to the North Dunstan Mountains (and adjacent Lauder Conservation Area), the Chain Hills and the remote Dunstan Creek catchment.

With landholder permission to drive part way up the North Dunstan Mountains, the summit ridge provides opportunities for cross country ski touring.

Recreational activity on Cluden Pastoral Lease is likely to significantly increase when public access is formalised.

Significance of Recreation

Significant recreational routes are shown on Map 4.2.3.

The location of Cluden Pastoral Lease at the northern end of Dunstan Mountains is of great significance to recreational use. While current visitor numbers are low because the recreational opportunities are little known, it is reasonable to expect the area to become of increasing popularity to recreationists. Central Otago is becoming recognised as a mecca for mountain biking and horse trekking. In addition, the increase in tourism and visitor numbers to National Parks and the Great Walks has seen New Zealand trampers looking for new and less popular areas for recreation.

The network of farm tracks present on the property provide access routes which connect State Highway 8 to Dunstan Creek to the east and Lauder Basin Conservation Area to the south. In addition, there is a recently formalised network (through tenure review of the Lindis Valley properties) of legal public access tracks for mountain bike/walking tracks in the Chain Hills to the north. The rapid growth in mountain biking in the Alexandra and Wanaka areas is likely to result in increased demand for such opportunities.

Cluden Pastoral Lease is also strategically placed to provide public access to the adjoining Lauder Basin Conservation Area, which currently has no legal public access route.

PART 3: OTHER RELEVANT MATTERS & PLANS

3.1 CONSULTATION

The property was discussed at an NGO early warning meeting held in Alexandra on 24th September 2003. The main points raised during the meeting were:

- Provide access to Dunstan Creek
- Provide access to Richmond Yards and then over Cluden Pass
- Where does access match up with legal access on adjoining properties?
- North Dunstan Mountains are inaccessible (Lauder Conservation Area has no legal access); Cluden may provide the best access to this area.
- Conservation land should be above the altitude of low alpine vegetation.
- There are problems with access to Cluden Stream at present.
- Possible access points highlighted:
  (i) From Lindis via Cluden Stream
  (ii) To Westside of Big Spur Creek? Airstrip (Entry and exit points)
- Property is very suitable for skiing, foot, horse and mountain bike access.
- Dunstan Creek is a key catchment; not necessary to have a reserve. It may be convenient to provide a continuation of wide open space.
- Dunstan Creek needs an option for through-access along its full length.

In terms of landscape:

- There are no significant landscape values near the highway.
- The tops are important.
- Rock tor areas often have high landscape value.
- Dunstan Creek has very high landscape values
- Shady faces of Cluden Stream may have botanical values, but briar may dominate.

Other matters:

- The stretch of Cluden Stream as viewed from the road is interesting and possibly an opportunity for riverside swimming/picnicking and summer recreation.
- Approx. 6 squatter baches present- on Crown Land or Pastoral Lease?
- Does the architectural stone quarry have a license?

The key points raised by Federated Mountain Clubs (FMC) at the early warning meeting 24 September 2003 are outlined below:

- Current recreation usage: Very little except local walking groups in the Cluden valley. significant potential for trips (especially mountain bike trips along the Dunstans and crossings from Upper Clutha- Lindis area to Dunstan Creek and St. Bathans.
- Access Requirements:
  (i) Marginal strips on all qualifying waterways.
  (ii) Access for foot, mountain bike and horse use, and 4WD with landholder consent, up the Cluden Road (part legal road) to the Richmond Yards and thence via the track close to a legal road leading to Cluden Pass. The track should be recognized as the legal road which was obviously intended as a route to Cluden Pass.

(iii) The track from Cluden Pass to Dunstan Creek is mainly on the adjoining property, but the lower part is on Cluden Pastoral Lease and public access over this section to make provision for public use in due course (when other tenure reviews are completed).

(iv) Public foot, mountain bike and horse access is also required along the crest of the Dunstan Mountains with a link to Cluden Valley Road either via the airstrip track, or down to Apple Tree Yards, to enable round trips to be made over the northern section of the Dunstan Mountains.

- Conservation Land:

  (i) Most of Dunstan Steepland country above 1000m, which probably can't be managed in a way that is ecologically sustainable. There is a real problem with the dry N facing slopes (LUC Class VII Arrow and Alexandra Steepland soils which are badly infested with *Hieracium* and should be destocked. This might allow for slow recovery of native species with shrubland to come back, but conservation values are very low at present.

The full written submission by FMC is included in Appendix 8.

3.2 REGIONAL POLICY STATEMENTS & PLANS

(a) Regional Policy Statement. The Regional Policy Statement for Otago provides a policy framework for all of Otago's significant regional resource management issues. It does not contain rules. District Plans shall not be inconsistent with the Regional Policy Statement.

In respect of natural values the Regional Policy Statement includes the following policy and method:

Policy: "To maintain and where practicable enhance the diversity of Otago's significant vegetation and significant habitats of Indigenous fauna, trout and salmon…"

Method: "Identify and protect Otago's significant indigenous vegetation and significant indigenous habitat of indigenous fauna, trout and salmon, in consultation with relevant agencies and with Otago's communities."

In respect of landscapes and natural features it includes the following policy and method:

Policy: "To recognise and provide for the protection of Otago's outstanding natural features and landscapes..."

Method: "Prepare in conjunction with relevant agencies and in consultation with the community and affected landowners, and inventory of outstanding features and landscapes that are regionally significant."

(b) Water Plan. Those parts of the property which are in the Cluden Stream and Dunstan Creek catchments are subject to the Otago Regional Plan: Water rule which requires resource consent for suction dredge mining.

3.3 DISTRICT PLANS

The property is located within the Rural Resource zone of the Central Otago District Plan. The proposed Central Otago District Plan (amended to incorporate Council decisions) does not act as a trigger for the protection of tussock grasslands and smaller wetlands and forest areas. However, the Central Otago District Council is in the middle of a Court Hearing regarding vegetation clearance of indigenous vegetation. The Court decision and resulting Plan change will be issued at an unspecified time in the future.

Resource consent is required for excavations or tree planting within specified distances of a water race or irrigation pipeline, and for development work within 10m of any water body.

A transmission line crosses the property in the vicinity of State Highway 8. Resource consent is required for additions, buildings or structures occupied by people or animals within 20m of the lines.

3.4 CONSERVATION MANAGEMENT STRATEGIES & PLANS

The Otago Conservancy of DOC has prepared a Conservation Management Strategy (CMS) which was approved by the Minister of Conservation in August 1998.

The CMS identifies 41 special places of conservation interest in Otago Conservancy. Cluden Pastoral Lease lies within the North Dunstan Mountains Special Place.
The CMS objective for the North Dunstan Mountains Special Place relevant to Cluden Pastoral Lease is:

> *To extend protection in the area to cover the remaining higher altitude areas of nature conservation importance and to secure appropriate public access.*

The key implementation methods relevant to Cluden Pastoral Lease are:

- Pastoral lease tenure review on properties in the area may provide opportunities to negotiate to protect the areas of interest. Overall management of these new areas with the existing conservation areas will confer conservation and management benefits.
- The Lauder Basin Conservation Area will be signposted from the nearest gravel road once access is secured by negotiation.
- Recreation or tourist concession use of areas administered by the department may be allowed where such uses can be shown to have no adverse effects on the vegetation, landscape or specific biological values, or where conditions can be attached to a concession to adequately or reasonably avoid, remedy or mitigate any potential adverse effects.
- Opportunities to legalise public access points and develop appropriate public facilities will be explored. Once access is improved, public awareness of the area can be increased.
- Attempts will be made to negotiate as of right public foot and mountain bike access to high altitude protected areas.
- A freshwater fisheries survey will be carried out.

Priorities for the North Dunstan Mountains Special Place are:

"The negotiation of protection arrangements for areas of biodiversity importance and recreational opportunities and access are the priority activities in this Special Place."

3.5 NEW ZEALAND BIODIVERSITY STRATEGY

The New Zealand Government is a signatory to the Convention on Biological Diversity. In February 2000, Government released the New Zealand Biodiversity Strategy which is a blueprint for managing the country's diversity of species and habitats and sets a number of goals to achieve this aim. Of particular relevance to tenure review, is goal three which states:

-Maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state, enhance critically scarce habitats, and sustain the more modified ecosystems in production and urban environments, and do what is necessary to:-

-Maintain and restore viable populations of all indigenous species across their natural range and maintain their genetic diversity.

The strategy outlines action plans to achieve this goal covering terrestrial and freshwater habitat and ecosystem protection, sympathetic management, pest management, terrestrial and freshwater habitat restoration, threatened terrestrial and freshwater species management.

PART 4: MAPS ETC.

4.1 ADDITIONAL INFORMATION

4.1.1 References

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4.1.2 Appendices

APPENDIX 1: Recommended Areas for Protection. Excerpts from Ward, C.M., Bruce, D.L., Rance, B.D. and Roozen, D.A. (Grove, P. Ed.) 1994: Lindis, Pisa and Dunstan Ecological Districts- a survey report for the Protected Natural Areas Programme. New Zealand Protected Natural Areas Programme Series No.36. Dept of Conservation.

APPENDIX 2: Landscape Unit Photos

APPENDIX 3: Land Environments of New Zealand – Cluden Pastoral Lease

APPENDIX 4: Native Plant Species List - Cluden Pastoral Lease

APPENDIX 5: Invertebrate List- Cluden Pastoral Lease

APPENDIX 6: Freshwater Fisheries Survey Sites - Cluden Pastoral Lease

APPENDIX 7: Aquatic Invertebrate Species List – Cluden Pastoral Lease

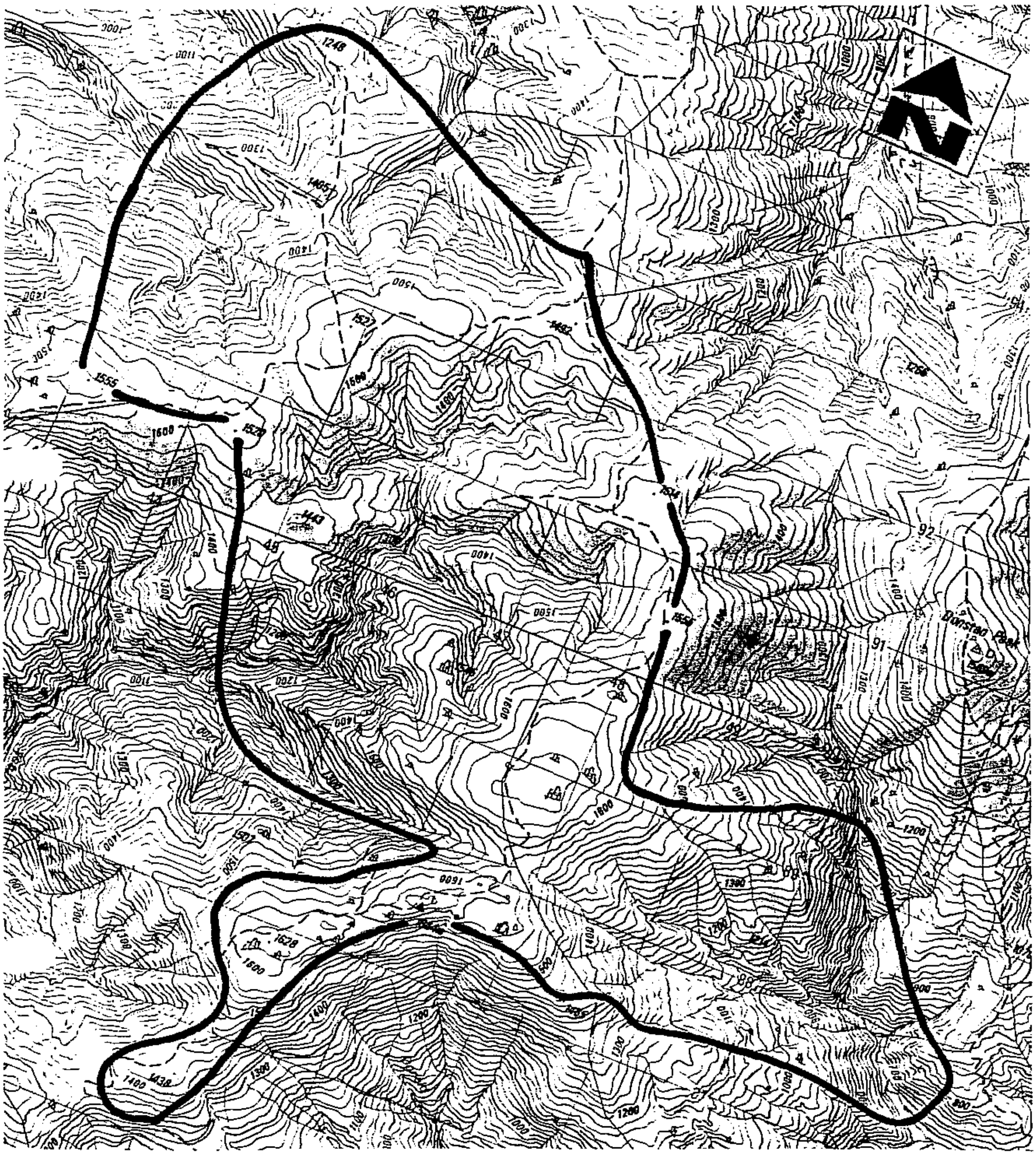
APPENDIX 8: FMC Report on Recreational Values

APPENDIX 9: Photos – Cluden Pastoral Lease

APPENDIX 1: Recommended Areas for Protection. Excerpts from Ward, C.M., Bruce, D.L., Rance, B.D. and Roozen, D.A. (Grove, P. Ed.) 1994: Lindis, Pisa and Dunstan Ecological Districts- a survey report for the Protected Natural Areas Programme. New Zealand Protected Natural Areas Programme Series No.36. Dept of Conservation.

APPENDIX I: Recommended Areas for Protection. Excerpts from Ward, C.M., Bruce, D.L., Rance, RD. and Roozen, D.A. (Grove, P. Ed.) 1994: Lindis, Pisa and Dunstan Ecological Districts- a survey report for the Protected Natural Areas Programme. New Zealand Protected Natural Areas Programme Series No.36. Dept of Conservation.

DUNSTAN - RAP A1



GRID REFERENCE - INFO MAP 260 G40 465 900

AREA 2760 hectares

ALTITUDE 640m -1695m

0 1 2 3 4

kilometres

LINDIS RAP A1 - NORTH DUNSTAN

Bioclimatic Zones: Montane to high alpine

Ecological Units	Vegetation types	Landforms
	Pod halon	outcrop/rubblefield
	Gri lit-Cop pro	on derivative slope
	Gri lit-Cop pro	on riparian slope
	Sop mic-Cop pro-Dis tou	on derivative slope
	Dis tou-Cop pro	on colluvial slope
	Dis tou-Cop pro	on riparian slope
	Mixed shrubland	on outcrop/rubblefield
	Mixed shrubland	on riparian slope
	Fes nov	on colluvial slope
	Fes nov	on derivative slope
	Fes nov	on alluvial surface
	Chi rig-Fes nov	on colluvial slope
	Chi rig-Fes nov	on ripply colluvial slope
	Mixed outcrop vegetation	
	Ora Ion	on colluvial slope
	Pod niv	on colluvial slope
	Chi rig-Fes mat-Poa col	on colluvial slope
	Chi rig-Fes mat-Poa col	on ripply colluvial slope
	Chi rig-Fes mat-Poa col	on derivative slope
	Fes mat-Poa col	on colluvial slope
	Chi mac-Fes mat-Poa col	on colluvial slope
	Chi mac-Fes mat-Poa col	on rlpply colluvial slope
	Chi mac	on summit peneplain
	Chi mac	on colluvial slope
	Chi mac	on rlpply colluvial slope
	Chi mac-Poa col	on summit peneplain
	Chi mac-Poa col	on rlpply colluvial slope
	Poa col	on colluvial slope
	Poa col	on rlpply colluvial slope
	Dra mus-Rao hec	on soil hummocks
	Ora mus-Rao hec	on solifluction lobes/terraces
	Ora mus-Rao hec	on ridge crest lag surfaces
	Ora mus-Poa col-Cel vis	on soil hummocks
	Sparse cushion vegetation	on ridge crest lag surface
	Leu Era-Chi den	on ridge crest lag surface
	Snowbank vegetation	
	Car gau-Dre pec-Moss	on flush
	Sch pau	on flush

Landform: A partial transect across the northern Dunstan Mountains, extending from Iowan the southeastern flank across the broad summit area to the upper northwestern flank.

In the east, Shepherds Creek flows in a gorge more deeply entrenched than other streams in the Cambrians land system. It exploits a line of faulting and dislocation in semischist on the edge of the transition zone from the Haast Schist characteristic of the Dunstan Mountains to the greywacke of the St Bathans Range. Coarse talus is present in some sections of the gorge. The western branch of Shepherds Creek, the main focus of the transect, is perched above the main stream and enters it via watetfalls. Its broad upper basin is dominated by slumped ripply colluvial slopes.

The summit plateau remnant around the head of Lauder Creek features very broad gently undulating ridges culminating in the unnamed highest point of the Dunstan Mountains (1690 m). The ridge crest southwest of this point is mainly a deflated stony pavement, but soil hummocks are characteristic elsewhere on the summit ridges. Other relict periglacial phenomena are localised solifluction lobes and scattered tors. The generally stable colluvial slopes steepen towards the streams and Lauder Creek becomes deeply gorged towards the end southwestern edge of the RAP.

The main ridges of the Cluden land system in the west generally slope 5 - 10 degrees NW, but tributaries of Cluden Stream are strongly incised. These valleys are asymmetric because of the moderate northerly dip of the Haast Schist here. Sunny aspects tend to be slumped while shady aspects are more commonly stable though steeper.

Soils of the priority area are predominantly hygrous yellow-brown earths-Carrick soils on the gentle summit slopes, Dunstan Steepland soils elsewhere, grading into yellow-grey (Arrow) earths in the lower reaches of Shepherds Creek.

Vegetation

Slim· snow tussockland of moderate to high density dominates the broad summit ridges and upper slopes. Common associated species are false spaniard (in local concentrations), blue tussock, *Raoulfa grandiflora, R. suhsericea, Rytfdosperma pumflum* and *Pfmelea oreophila.* Alpine fescue becomes prominent below 1500 m.

Several minor communities are closely assodated with slim snow tussockland. Alpine flushes are numerous and relatively extensive, commonly up to several hectares. They are dominated by *Carex gaudfchaudiana, Oreobolus peetfnatus* and mosses, with frequent *Epilobium komarovianum, Caltha obtusa, Cenrrolepis pallida, Agrostis pallescens, Abrotanella caespftosa* and *Gnaphalfum mackayf.* Snowbank communities, with *Celmfsfa haastif, Raoulfa subulata* and *Pbyllachne rubra* are weakly developed and generally **not characteristic of the area.**

Cushionfields dominated by *DracopbyUum muscoides* with *Raoulia heetori,* blue tussock and *Luzula rufa* are commonly associated with tors on exposed sites, especially in the east. Other small areas of deflated stony soils are dominated by *Chionohebe densifolia* and blue tussock with other tussockJand herbs and grasses. An extensIve area of heavily deflated ridge Crest southwest of the main summit features sparse cushionfield with *Chionohebe thomsonii, Colobanthus buchananii, Luzula pumila, Leptinella pectinata* and occasional edelweiss.

Slim snow tussockland extends downslope to a generally abrupt boundary with narrow-leaved snow tussockland at an altitude between 1350-I400 m on sunny faces and about 1200 m on shady faces in the west but as low as 1100 m in the east. Only a narrow zone of narrow-leaved snow tussockland is present in the west, it gives way downslope to fescue tussockland generally of low naturalness. Fire·induced blue tussockland has replaced snow tussockland on the slopes northeast of Trig, G. A discontinuous line of flushes acted as a partial fire-break, and a sharp, irregular fire boundary against slim **snow tussock remains clearly visible.**

In Shepherds Creek narrow-leaved snow tussockland is more extensive, with abundant alpine fescue, blue tussock and the several sub-shruh species; *Pentaebondra pumila, Gaultheria depressa,* G. *macrostigma, Leueopogon fraseri* and some *Leueopogon eolensoi.* Fescue abundance increases downslope, generally to become dominant at low altitude especially on sunny faces.

The lower gorge slopes of Shepherds Creek feature a wide range of woody vegetation types. Hall's totara treeland occupies outcrops and ruhblefie1d near the eastern extremity of the area, with *Corokia cotoneaster,* broadleaf and occasional celery pine. Streamside vegetation is predominantly mixed shruhland, with *Coprosma propinqua,* malagouri, koromiko *andAristotelia jrutieosa* dominant in the lower portion; broadleaf (trees) and C. *propinqua* in the mid section near the forks; and *Hebe subalpina,* matagouri and many associated species including scattered Hali's totara in the upper section. Snow totara as isolated plants and scattered clumps is present near the upper limits of shrubland and locally within snow tussockland.

Dense matagouri shrubland, of generally low diversity but locally with seedling broadleaf and three finger, is present in the lower section of Shepherds Creek, hut has ben reduced by fire. Manuka shrubland has been almost destroyed except for a clump a few metres across and scattered young plants within fescue tussockland. *DenseDraeopbyUum long/folium* shruhland (patches of several hectares) on shady slopes at 800-900 m appear to he young communities invading tussockland.

Flora

A newly discovered tiny *Gentiana* species is common in many alpine flushes, and has since been described and named *Gentiana Iilliputiana* (Webb, 1990). Small populations of rare *Myosotis oreopbila* and *M. ebeesemanti* occur locally on exposed sites on the ridge southwest of the high summit. These populations have been documented Oohnson & Rohertson 1986) and further research is currently underway to learn more of their population dynamics. Edelweiss, found here, is uncommon in the District. Also found were *Microseris scapigera* and *Carpba alpina,* and a trifid leaved form of *Cbio.nobebe densifolia* which is seemingly characteristic of the northern Dunstan Mountains.

Along Shepherds Creek are three *fmger,Braebyglottis cassinioides, Olearia nummularifolia, Coprosma erassifolia,* C. *linariifolia,* mountain flax, *Hieroebloe reeurvata, Sebizeilema trifiolatum, Bleebnum flUViatile, Asplenium flaccidum, Lycopodium seariosum, L australianum* and celety pine - all uncommon in the District.

Discussion

The northern Dunstan Mountains have been little studied by biologists, as emphasised by the discovery of a locally common new gentian species. The priority area is of outstanding sigoificance for the extensive intact snow tussocklands on the summit area, and the altitudinal sequence in Shepherds Creek with continuity between snow tussockland and diverse woody vegetation types.

Slim snow tussockland on the broad upper slopes and plateau surface is **the most extensive in the lindis, Pisa and Dunstan Districts. It is in** conspicuous contrast with the southern Dunstans, Pisa and Old Man Ranges where cnshionfle1d dominates under conditions of generally similar altitude, terrain and annual precipitation. Most cushlonfleld in these areas is probably fire-induced. Fire modification to the alpine tussockJand of this priority **area is evident, especially in the northwest, but most has escaped** destruction. The variety of cushionfield and flush communities, although covering much smaller areas, add considerably to the overall diversity of the alpine zone.

Clearcut altitudinal and aspect relations between slim snow tussockland and narrow-leaved snow tussockland, with sharp boundaries and minimal hybridism apparent, are distinctive and probably indicative of the relative lack of disturbance in these alpine ecosystems. The alpine zone of the North Dunstan priority area is of major importance for an understanding of the alpine ecological histoty of the Central Otago Region.

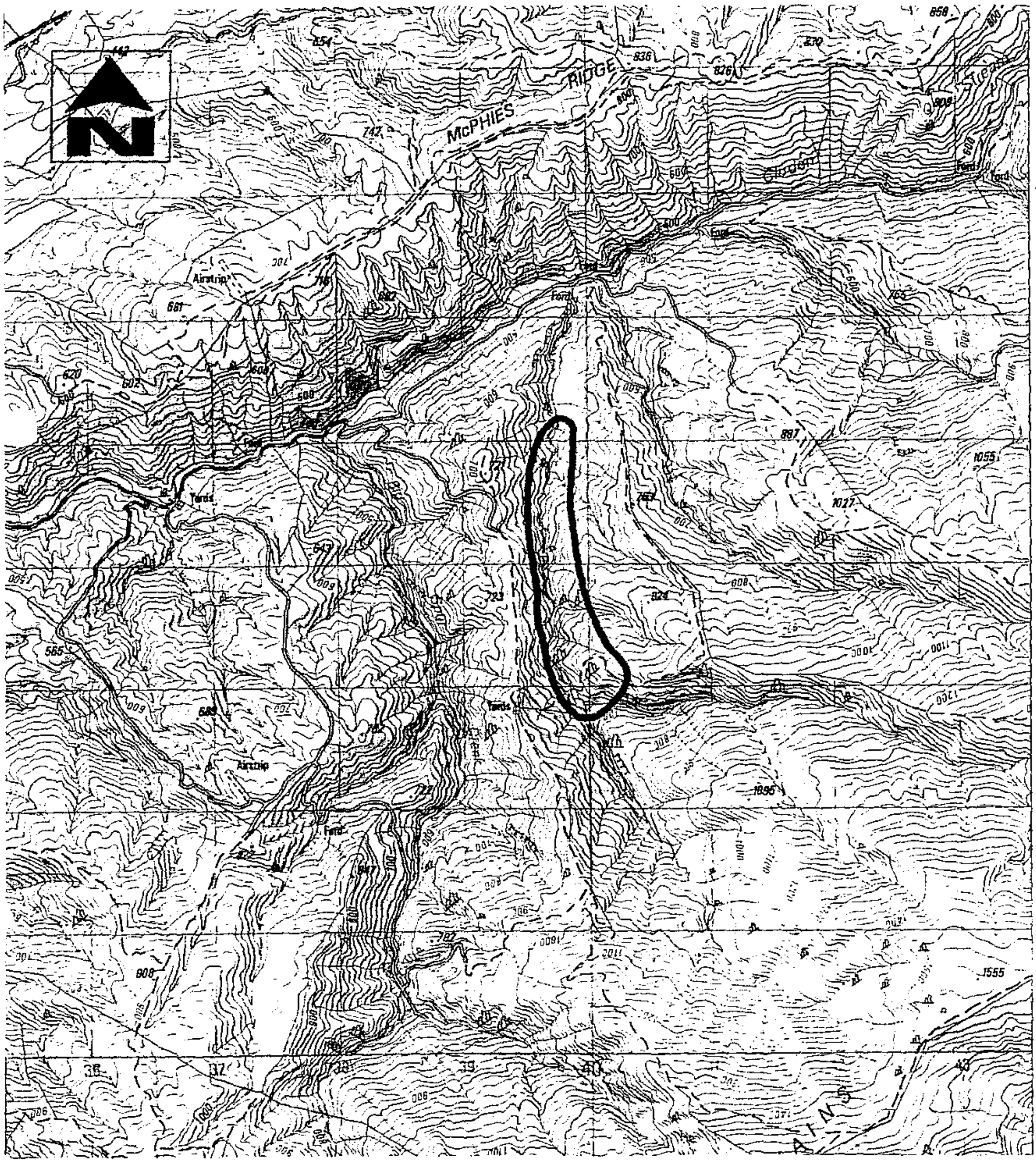
The dty northwest slope of the Dunstan Mountains (auden and Bendigo land systems) is generally strongly modified and almost devoid of snow tussockland. The area of narrow-leaved snow tussockland in the northwest of the North Dunstan priority area, although limited, is the largest surviving.

The altitudinal sequence from Shepherd Creek and its western tributary to the high point of the Dunstan Mountains is the best in the District. It ranges continuously from small areas of cushionfield, through slim and narrow-leaved snow tussockland with very few exotic species present, to the gorge of Shepherds Creek which shelters the greatest diversity of woody vegetation in the District. This includes the only substantial area of broadleaf treeland in the three districts, and one of the larger Hall's totara treelands, with numerous species generally characteristic of forest.

The significance of Shepherds Creek as a forest refuge is emphasised by the siting of a brown creeper, a forest bird not previously recorded in Central Otago (nearest record in Bull *et aL* 1985 is 45 km away near Lake Hawea). The combination of abundant rock outcrops and talus with the vegetation diversity probably indicated good habitat for lizards and diverse invertebrates.

CRITERIA SUMMARY :L1NDIS RAP A1 - NORTH DUNSTAN

Representativeness	H	Excellent representation of original alpine communities, and **altitudinal sequence to montane zone in east.**
Diversity	H	Wide range of tussocklands and associated alpine communities, also of subalpine - montane woody communities.
Naturalness	H	Unusually high naturalness overall, especially in alpine zone, generally few exotics.
Special Features	H	**Nwnerous rare or uncommon species.**
Viability	H	Communities intact and functioning in natural interrelationships.
Buffering	H	Summit plateau surface well buffered by isolation. West slope only moderately buffered by depleted or oversown fescue tussockland. Shepherds Creek shrubland with some buffering but subject to fire.
Threat	M	Fire (shrubland and tussockland), stock impact in alpine flushes, potential oversowing in montane subalpine zones in **east.**
Landform	H	Good representation of northern Dunstan land systems with emphasis on the plateau surface and deeply incised Shepherds Creek.



GRID **REFERENCE** INFO MAP 260 G40 398 940

AREA 65 hectares

ALTITIJDE 530m -820m

0 1 2 3 4

kilometres

DUNSTAN RAP A2 • LOWER CLUDEN TRIBUTARY

Bioclimatic Zone: Montane

Ecological Units

Vegetation types	Landform
Dis tou-Cop pro	on colluvial slope
Dis tou-Cop pro	on derivative slope
Mixed dryland vegetation	on colluvial slope
Mixed shrubland	on riparian slope
Fes nov	on derivative slope

Landform

The lower-mid reaches of a tributary valley of Cluden Stream, Incised Into the gentle northwest slope of the western flank of the northern Dunstan Mountains (Cluden Land System). The schistosity plane of the bedrock here closely parallels the plateau surface. Bands of outcrops and bluffs show on **the steep valley sides.**

Soils are dry-subhygrous, yellow-grey earths (predominantly Arrow steepland soils).

Vegetation

Dense mixed scrub along the streamside is dominated by Coprosma *propinqua,* with abundant *Olearla odorata, Aristotelia jrutfcosa* and matagouri. Less diverse matagouri shrubland with some briar and *Coprosma propinqua* generally occurs away from the stream, especially on sunny aspects, and partially buffers the mixed shrubland. *OIearla odorata* is prominent **on some moist shady faces.**

The shrublands are enclosed by sparse fescue tussockland, most of it oversown, with small area of distinctive dryland vegetation on spurs with thin soils.

Flora

Carmicbaelia kirkii, a vulnerable native cllmbing broom which has suffered **much restriction of its range, is scattered through much of the dense mixed** scrub.

Discussion

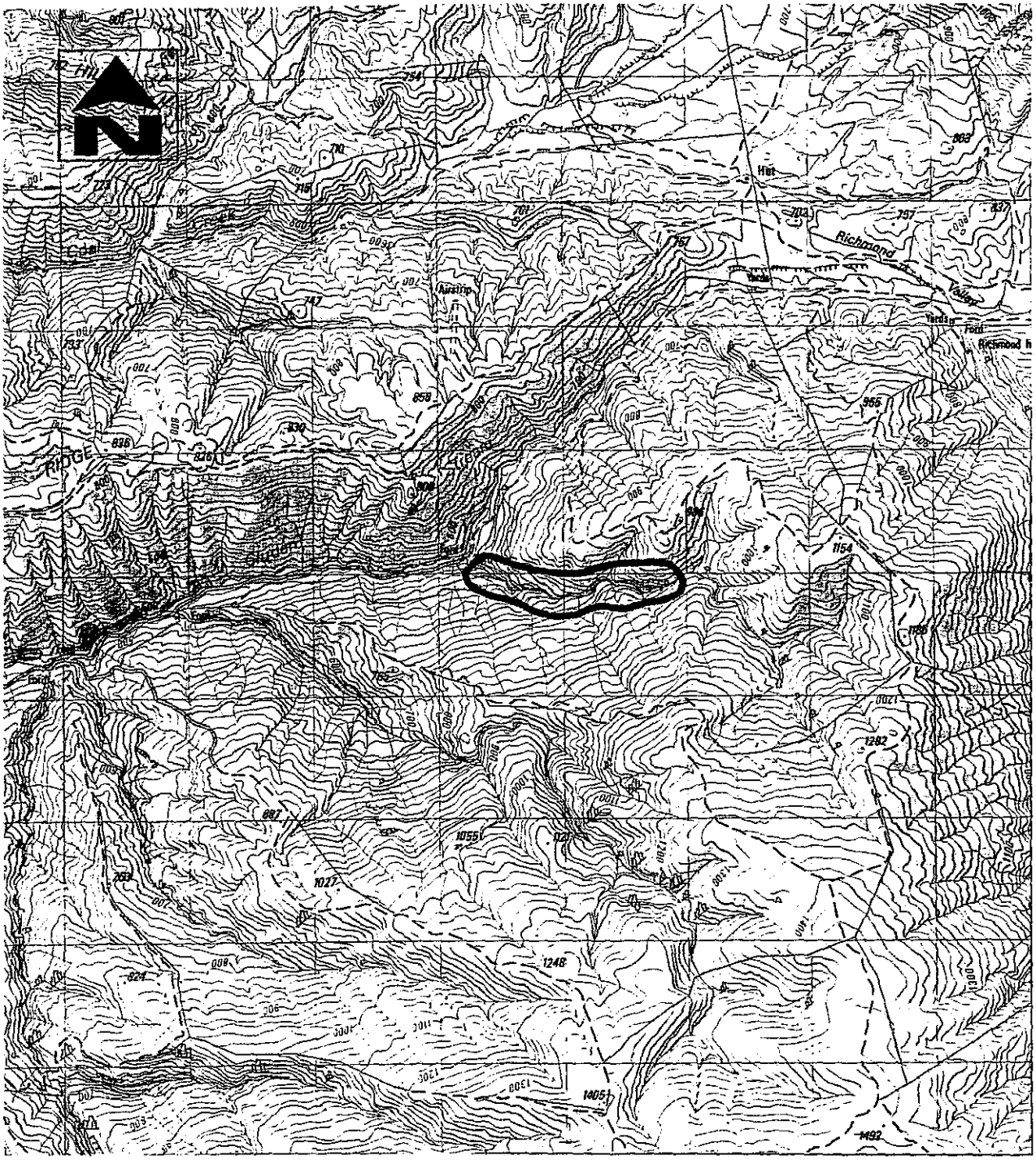
An excellent example of the diverse Coprosma·matagouri dominated scrub in riparian zones of steep-sided valleys characteristic of the dry (550-650 mm annual rainfall) northwest Dunstan Mountains (Cluden Land System) and adjacent areas of the Llndis District (Georges land system).

This newly found site of C *kirkii* includes possibly the largest remaining population, and is of viable size for long term survival, provided burning and browsing of this palatable species can be prevented.

Boundaries do not extend to the ridge crests. A llmited area of modified **tussockland has been included for its representativeness and to improve** the potential buffering of the shrublands. Most of the diverse shrubland, containing the majority of the C. *kirkii* plants is Included. Shrublands downstream towards Cluden Stream, with much briar and generally low **species diversity, are excluded.**

CRITERIA SUMMARY: DUNSTAN RAP A2 - LOWER CLUDEN TRIBUTARY

Representativeness	H	Typical of important communities in montane zone of northwest Dunstan District.
Diversity	M	Variety of shrublands, minor tussockland.
Naturalness	M	Generally low naturalness in tussockland and ground tier of shrubland, otherwise high.
Special Features	H	*Carmicbaelia kirkii*, relatively large population present.
Viability	H	Shrublands in good condition.
Buffering	M	Diverse shrublands partially buffered by matagouri, but narrowness of shrubland leaves streamsides vulnerable.
Threat	M	Shrubland clearancelbuming, browsing.
Landfonn	M	Part of a typical incised valley in the Cluden land system though the adjacent ridge crests are not represented.



GRID REFERENCE INFO MAP 260 G40 440 968

AREA 40 hectares

ALTITUDE 580m-910m

0 1 2 3 4

kilometres

JNSTAN RAP 81 - MID-CLUDEN TRIBUTARY

Bioclimatic Zones: Montane to subalpine

Ecological Units	vegetation types	Landforms
	Dis tou-Cop pro	on colluvial slope
	Dis tou-Cop pro	on ripply colluvial slope
	Mixed shrubland	on riparian slope
	Fes nov	on ripply colluvial slope
	Poa cit	on colluvial slope
	Paa cit	on ripply colluvial slope

Landform

The lower reaches of a tributary of mid-Cluden Stream comprising mainly a narrow steep-sIded inner valley incised into a more open valley on the western flank of the northern Dunstan Mountains. Slump topography is predominant on north-facing aspects. The oppOSite slope is mainly stable with prominent buttress outcrops. Large boulders rest in the streambed below.

Soils are dry-subhygrous yellow-grey earths, predominantly Arrow steepland soils.

Vegetation

Dense, mixed scrub along the streamside is dominated by Coprasma *proptnqua* with much *Artstotelia frurrcosa,* koromiko, matagouri and *Olearia odorata.* Matagouri (including scattered large plants up to 4 m) dominates shrublands on the lower slopes and side gullies. Briar is frequent below 700 m, especially on sunny aspects.

Surrounding tllssocklands are strongly modified; silver-fescue tussock.land on the lower altitude slumped sunny slopes with patches of mixed dryland vegetation dominated by exotic herbs and grasses, elsewhere generally **fescue tussockland.**

Flora

A few plants of the vulnerable climbing broom *Cannichaelia kirkii* were noted near the lower boundary. Large (3 m tall) *Olearia nummularifolia* **occur near the upper boundary. Coral broom is scattered in the upper portion of the area.**

Discussion

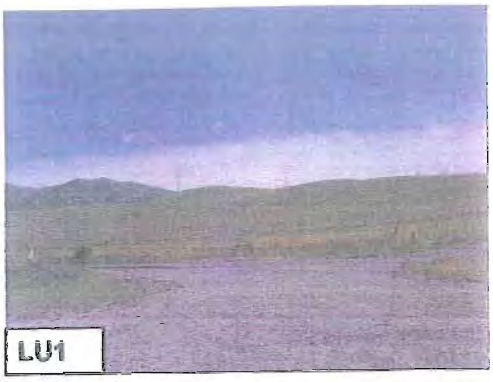
The area is a narrow strip extending almost 2 kID up a tributary of Cluden Stream to include the shrublands, together with sufficient modified tussockland for buffering purposes and minlmal representation in its own right.

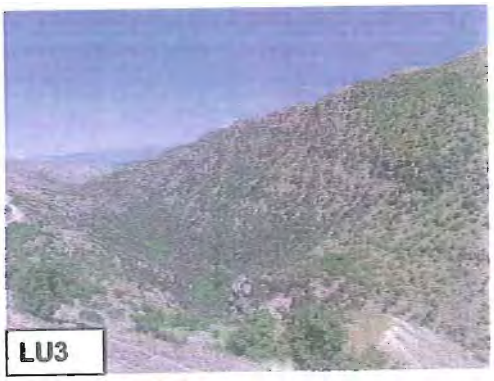
This RAP is analogous to Dunstan A2 (Lower Cluden Tributary). Mixed riparian shrubland is the main feature of both, here of some what greater diversity and stature than in Dunstan A2, but with much less *Cannichaelia kirkii.* This **area contains more extensive matagouri-dominated shrublands,** but also considerably more briar. Tussocklands are equally modified by oversowing and topdressing, though the presence of silver tussockland **here is a positive feature.**

CRITERIA SUMMARY: DUNSTAN RAP B1 - MID-CLUDEN TRIBUTARY

Representativeness	M	Typical of imponant montane-zone communities.
Diversity	M	Variety of shrublands, minor tnssockland.
Naturalness	M	Generally low in tussockland and ground tier of shrubland, otherwise high.
Special Features	M	Some *Carmichaelia kirkii,* other uncommon species.
Viability	H	Shrublands in good condition.
Buffering	M	Steep riparian sites give partial buffer.
Threat	M	Burning and/or clearing of shrublands, browsing.
Landform	M	Typical valley of Cluden land system, but only inner valley without upper slopes and ridges.

APPENDIX 2: Landscape Unit Photos





Drawn by Blakely Wallace Associates

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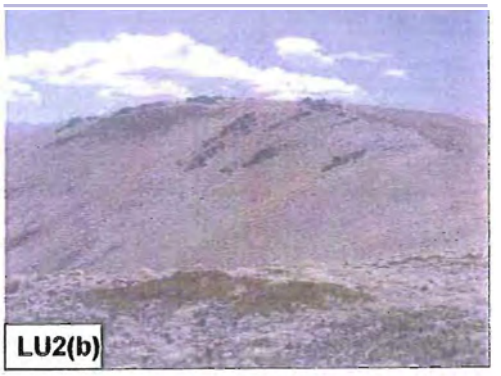
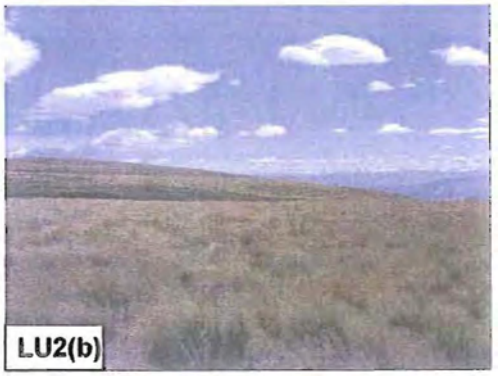
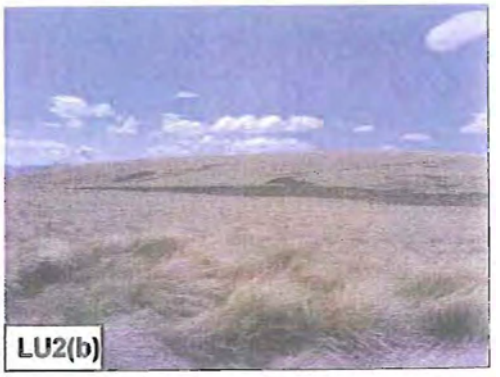
	Topo sheets







Dr w by Blakely Wallace Associates

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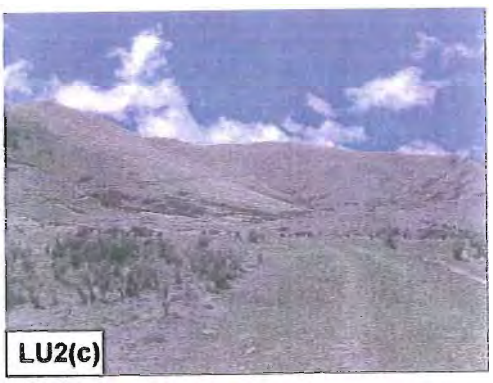

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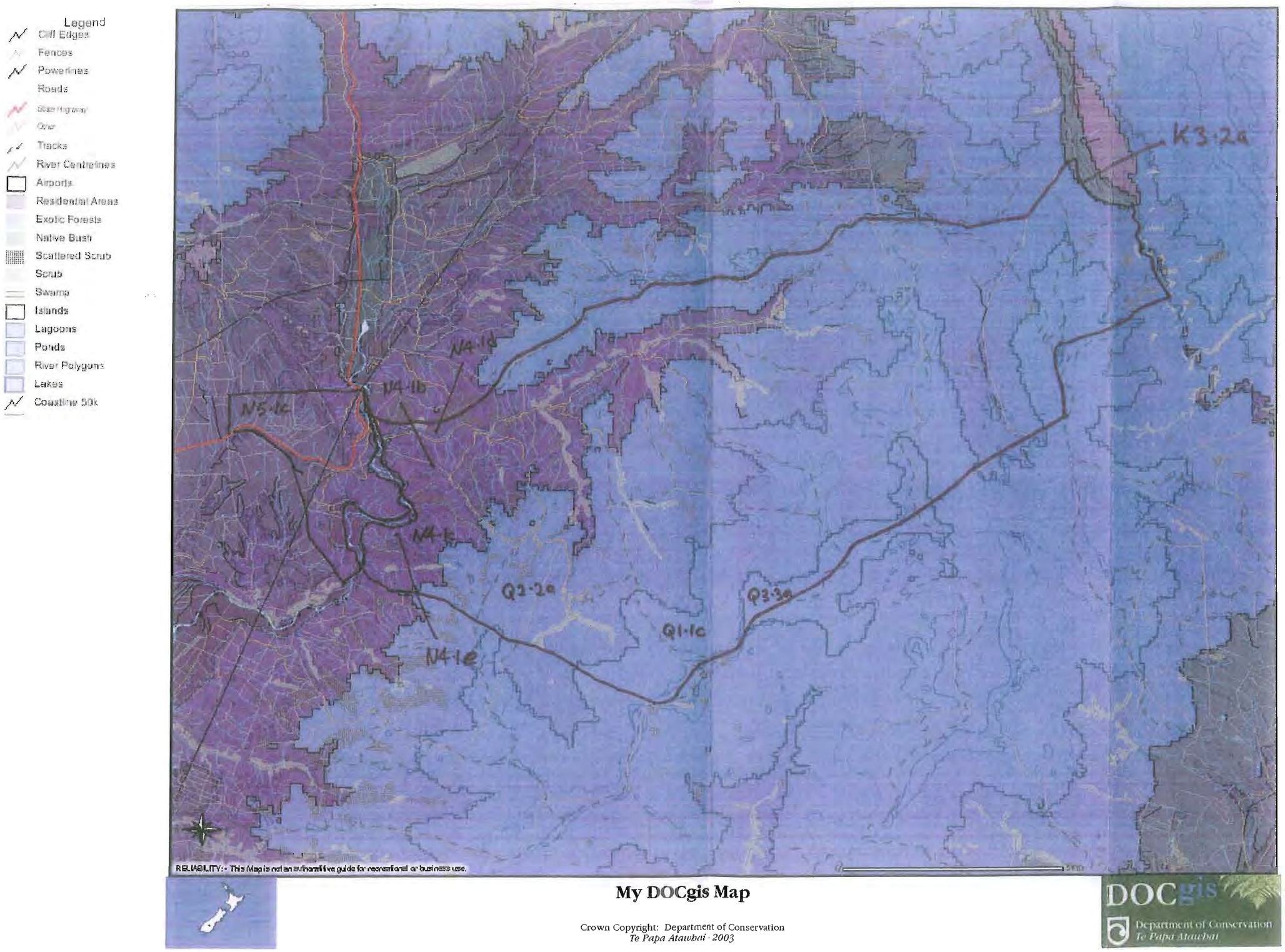
APPENDIX 3: Land Environments of New Zealand – Cluden Pastoral Lease



APPENDIX 4: Native Plant Species List - Cluden Pastoral Lease

Scientific Name	Common Name
Abrotenella caespitosa	
Abrotenella inconspicua	
Acaena buchananii	Bidibid
Acaena caesiiglauca	Bidibid
Acaena dumicola	Bidibid
Acaena saccaticupula	Bidibid
Aciphylla aurea	Golden speargrass
Aciphylla hectorii	Speargrass
Anaphalioides bellidioides	Everlasting daisy
Anisotome flexuosa	
Anisotome imbricata	
Aristotelia fruticosa	Mountain wineberry
Asplenium flabellifolium	Spleenwort
Asplenium richardii	
Blechnum penna-marina	
Brachyglottis haastii	
Brachyscome sinclairii	
Bulbinella angustifolia	Maori onion
Cardamine sp.	
Carex breviglumis	Sedge
Carex buchananii	Sedge
Carex colensoi	sedge
Carex coriacea	Sedge
Carex gaudichaudiana	Sedge
Carex kaloides	Sedge
Carex muelleri	Sedge
Carex pterocarpa	Sedge
Carex secta	Sedge, Purei
Carmichaelia crassicaule	Coral broom
Carmichaelia kirkii	Scrambling broom
Carmichaelia petriei	Native broom
Carmichaelia vexillata	Dwarf Broom
Celmisia densiflora	Mountain daisy
Celmisia gracilenta	Mountain daisy
Celmisia lyallii	False Spaniard
Celmisia sessiliflora	Mountain daisy
Cheilanthes sieberi	Fern
Chionochloa macra	Slim snow tussock
Chionochloa rigida	Narrow-leaved snow tussock
Chionohebe densifolia	
Clematis marata	Clematis
Colobanthus apetalus	
Colobanthus buchananii	
Colobanthus strictus	
Convolvulus verecundus	Convulvulus
Coprosma atropurpurea	coprosma
Coprosma ciliata	coprosma
Coprosma intertexta	coprosma
Coprosma propinqua	coprosma
Cordateria richardii	Toe toe
Corokia cotoneaster	

Craspedia sp.	
Dichelachne crinita	Plume grass
Discaria toumatou	Matagouri
Dracophyllum muscoides	
Dracophyllum pronum	
Dracophyllum longifolium	Turpentine shrub
Drosera arcturi	Sundew
Epilobium brunescens	Willowherb
Epilobium komarovianum	Willowherb
Epilobium minutiflorum	Willowherb
Festuca novae-zelandiae	Hard tussock
Galium sp. aff. perpusilla (tarn)	
Gaultheria novae-zelandiae	
Gaultheria parvula	
Gentiana amabilis	Gentian
Gentiana sp (divisa?)	Gentian
Geranium microphyllum	Geranium
Geranium sessiliflorum	
Geum leiospermum	
Euchiton laterale	
Hebe buchananii	
Hebe lycopodioides	
Hebe pauciramosa	
Hebe rakaiensis	
Hebe salicifolia	
Helichrysum filicaule	
Pachycladon cheesemanii	Native cress
Isolepis aucklandicus	
Juncus novae-zelandiae	Rush
Kelleria dieffenbachii	
Koelaria novo-zelandica	
Koelaria youngii	
Leptinella pectinata var. villosa	
Leptinella serrulata	
Leucogenes grandiceps	South Island edelweiss
Leucopogon fraseri	Dwarf heath
Leucopogon muscoides	
Leucopogon suaveolens	
Luzula leptophylla	
Luzula pumila	
Luzula rhadina	
Luzula rufa	
Lycopodium fastigiatum	Mountain clubmoss
Melicytus alpinus	Porcupine shrub
Melicytus sp. cliff	
Melicytus sp. tall	
Montia fontana	
Muehlenbeckia australis	
Muehlenbeckia axillaris	
Muehlenbeckia complexa	
Myosotis cheesemanii	Forget-me-not
Myrsine nummularia	Creeping mapou
Mysine divaricata	Weeping mapou
Nertera balfouriana	
Olearia bullata	Tree daisy

Olearia cymbifolia	
Olearia lineata	Tree daisy
Olearia nummularifolia	
Olearia odorata	Tree daisy
Oreobolus pectinatus	Comb sedge
Oreobolus strictus	
Oreomyrrhis ramosa	Mountain myrrh
Oreomyrrhis sp. bog	
Parsonsia heterophylla	Vine
Phyllachne colensoi	
Pimelea oreophila	Native daphne
Plantago obconica	Plantain
Plantago uniflorum	Plantain
Poa cita	Silver tussock
Poa colensoi	Blue tussock
Poa maniatoto	Desert poa
Poa sp.	
Psychrophila obtusa	
Pteridium esculentum	Bracken fern
Ranunculus gracillipes	Buttercup
Ranunculus cheesemanii	Buttercup
Ranunculus glabrifolius	Buttercup
Ranunculus maculatus	Buttercup
Ranunculus royi	Buttercup
Raoulia subulata	
Raoulia apicenigra	
Raoulia australis	Scabweed
Raoulia hectorii	
Raoulia parkii	
Raoulia subsericea	
Rubus schmidelioides	Bush lawyer
Rytidosperma maculatum	
Rytidosperma pumilum	
Rytidosperma setifolia	Bristle grass
Schizeilema cockaynei	
Schizeilema nitens	
Schoenus pauciflorus	
Scleranthus uniflora	
Sophora microphylla	South Island kowhai
Stellaria gracilenta	
Thelymitra longifolia	White sun orchid
Uncinia divaricata	
Viola cunninghamii	Viola
Vitadinia australis	Native fuzzweed
Wahlenbergia albomarginata	Native harebell

APPENDIX 5: Invertebrate List- Cluden Pastoral Lease

E. Edwards and T. Jewel

(Determinations assisted by B. Patrick, B. Barratt, J. Ward, J. Nunn & S. Morris)

Taxon	Locality	Elevation	Comment
Spiders Araneae			
Tetragnathidae -long jawed spiders			
Tetragnatha sp.	Richmond Hut	720 m	Widespread, inhabiting wetland vegetation
Beetles Coleoptera			
Byrrhidae -moss beetles			
Genus & species indet.	Dunstan Mts.	1500 m	An alpine moss beetle
Carabidae -predatory ground beetles			
Bembidion parviceps	Cluden Stream	520 m	Inhabiting river terrace mat vegetation, a widespread species
Demetrida sinuata	nr. Cluden Pass	1480 m	
Holcaspis [sternalis?]	ridge Big Spur Ck.	1100 m	widespread lower eastern South Island mountains
Holcaspis ovatella	Dunstan Mts.	1200 m	Inhabits southeast South Island Mountains
Holcaspis ovatella	Dunstan Mts.	1150 m	
Mecodema [fulgidum?]	nr. Cluden Pass	1480 m	widespread lower eastern South Island mountains
Megadromus memes/fultoni	Dunstan Mts.	1500 m	Inhabits north and west Otago mountains
Megadromus sandageri	Dunstan Mts.	1150 m	
Notagonum sp.	wetland Dunstan Mts.	1500 m	Inhabiting wet marginal vegetation
Notagonum sp.	trib. Cluden Stream	580 m	
Scopodes [edwardsi?]	wetland Dunstan Mts.	1500 m	inhabiting wet cushion areas
Scopodes sp. 1	wetland Dunstan Mts.	1500 m	inhabiting wet cushion areas
Cerambycidae -longhorned beetles			
Zorion sp.	Richmond Valley	700 m	steel blue species
Zorion sp.	trib. Cluden Stream	700 m	
Chrysomelidae -leaf beetles			
?*Adoxia* sp.	spur to Cluden Stream	800 m	an interesting small species
Adoxia sp.	Richmond Valley	700 m	Flower visiter, commonly inhabiting *Olearia odorata* flowers
Coccinellidae -ladybird beetles			
Coccinella leonina	Dunstan Mts.	1500 m	A native ladybird beetle
Coccinella undecimpunctata	nr. Cluden Pass	1480 m	Exotic ladybird beetle

Curculionidae -weevils			
Anagotus lewisi	nr. Cluden Pass	1480 m	Common on Central Otago block mountains and east Otago
Catoptes sp.	spur to Cluden Stream	800 m	
Inophloeus sp. cf. *sulcifer*	wetland Dunstan Mts.	1500 m	Common on Central Otago block mountains
Inophloeus sp. cf. *sulcifer*	ridge Big Spur Ck.	1100 m	
Irenimus sp. cf. *egens*	spur to Cluden Stream	800 m	female, common in grassland
Lyparogetus sp.	nr. Cluden Pass	1480 m	Common on Central Otago block mountains
Nicaeana sp.	wetland Dunstan Mts.	1500 m	Similar to species from Central Otago range tops
Peristoreus sp. 1	spur to Cluden Stream	800 m	Common in shrubland
Peristoreus sp. 1	ridge Big Spur Ck.	1100 m	
Peristoreus sp. 2	Cluden Stream	520 m	Not seen before
Rhinocyllus conicus	Cluden Stream	520 m	Biological control agent for introduced weed
Rhinocyllus conicus	Big Spur Ck./Cluden Stream	380 m	
Rhinocyllus conicus	Cluden Stream	500 m	
Sitonia discoideus	spur to Cluden Stream	800 m	Introduced pest of Lucerne
Dytiscidae -diving beetles			
Liodessus plicatus	wetland Dunstan Mts.	1500 m	Diving beetle, widespread in ponded waters
Rhantus pulverosus	wetland Dunstan Mts.	1500 m	Diving beetle, widespread in ponded waters
Elateridae -click beetles			
Elatichrosis species	Richmond Hut	720 m	Common tussock species
Elatichrosis species	Dunstan Mts.	1200 m	
Melyridae -soldier beetles			
?Dasytes sp.	Cluden Stream	520 m	widespread, inhabiting flowering vegetation
Scarabaeidae -chafers			
Costelytra zealandica	Big Spur Ck./Cluden Stream	380 m	common native pest of grassland
Odontria rufescens	Big Spur Ck./Cluden Stream	380 m	Common in intermontane grassland/shrub in Central Otago
Odontria striata	Richmond Valley	700 m	Common Otago and Southland
Pyronota sp. cf. *festiva*	spur to Cluden Stream	800 m	seasonally very abundant
Pyronota sp. cf. *festiva*	trib. Cluden Stream	980 m	

Taxon	Locality	Elevation	Comment
Tenebrionidae -darkling beetles			
Artystona obscura	nr. Cluden Pass	1480 m	Inhabits eastern South Island mountains
Mimopeus sp.	Dunstan Mts.	1100 m	record is part of a group of species with limited distributions within Otago. Not widespread.
Trogossitidae			
Gynoma sp.	Richmond Valley	700 m	Found under stones
Flies -Diptera			
Bibionidae			
Bibionid sp.	trib. Cluden Stream	580 m	Larvae inhabit litter in grassland
Blephariceridae -netwinged midges			
Blephericerid sp.	Dunstan Mts.	1200 m	Larvae inhabit natural swift stony streams
Blephericerid sp.	Cluden Stream	500 m	
Therividae -stilleto flies			
Anabarhynchus sp.	Richmond Valley wetland	660 m	Stilleto fly, larvae predatory in loamy or sandy soils
Tipulidae -craneflies			
Tipulid sp.	wetland Dunstan Mts.	1500 m	A short winged flightless cranefly
Bugs, cicada -Hemiptera			
Cicadidae			
Amphipsalta strepitans	trib. Cluden Stream	960 m	Clapping cicada, inhabits shrubland
Corixidae -backswimmers			
Sigara sp.	wetland Dunstan Mts.	1500 m	Backswimmer, inhabits ponded waters
Cydnidae -bugs			
Philapodemus australis	trib. Cluden Stream	580 m	Inhabits dry open areas with sparse vegetation
Lygaeidae -bugs			
Nysius huttoni	Cluden Stream	520 m	Widespread, inhabiting mat and cushion vegetation
Nysius huttoni	nr. Cluden Pass	1480 m	
Nysius huttoni	spur to Cluden Stream	800 m	
Nysius huttoni	wetland Dunstan Mts.	1500 m	
Nysius huttoni	Cluden Stream	500 m	
Nysius huttoni	spur to Cluden Stream	1100 m	
Rhopalimorpha lineolaris	Big Spur Ck./Cluden Stream	380 m	Widespread & common in damp vegetation
Rhopalimorpha lineolaris	Dunstan Mts.	1200 m	
Rhopalimorpha lineolaris	Richmond Hut	720 m	

Taxon	Locality	Elevation	Comment
Pentatomidae -shield bugs			
Dictyotus caenosus	Cluden Stream	500 m	Widespread, inhabiting grasses and herbs in open areas
Dictyotus caenosus	Cluden Stream	480 m	
Bees, ants wasps -Hymenoptera			
?Leioproctidae/Colletidae -bees			
native bee sp. 1	trib. Cluden Stream	580 m	Nesting in roadcuts and open areas, adults in flowering vegetation
native bee sp. 1	Chain Hills	850 m	
native bee sp. 1	Dunstan Mts.	1200 m	
native bee sp. 1	spur to Cluden Stream	1100 m	
native bee sp. 2	Cluden Stream	480 m	found common on flowering native broom
Moths and butterflies -Lepidoptera			
Arctiidae			
Metacrias huttoni	trib. Cluden Stream	960 m	Locally common as females are flightless and wooly bear caterpillars disperse.
Metacrias huttoni	Richmond Valley	700 m	
Coleophoridae			
Coleophora trifolii	Big Spur Ck./Cluden Stream	380 m	Clover case bearer
Coleophora trifolii	Richmond Valley	700 m	
Crambidae -mostly day active moths			
Eudonia aspidota	Big Spur Ck./Cluden Stream	380 m	
Eudonia aspidota	trib. Cluden Stream	580 m	
Eudonia cataxesta	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Raoulia* spp. mat daisies
Eudonia chalara	Richmond Valley	700 m	Inhabits grasslands
Eudonia chalara	nr. Cluden Pass	1480 m	
Eudonia chalara	Big Spur Ck./Cluden Stream	380 m	
Eudonia chalara	ridge Big Spur Ck.	1100 m	
Eudonia chalara	trib. Cluden Stream	580 m	
Eudonia ergatis	Dunstan Mts.	1200 m	Inhabits grassland, diurnal
Eudonia legnota	trib. Cluden Stream	650 m	Local and uncommon - better known in Canterbury basin areas
Eudonia legnota	Richmond Valley	700 m	
Eudonia legnota	Big Spur Ck./Cluden Stream	380 m	
Eudonia leptalea	Dunstan Mts.	1200 m	Inhabits open areas
Eudonia leptalea	Richmond Valley	700 m	
Eudonia leptalea	Cluden Stream	520 m	

Taxon	Locality	Elevation	Comment
Eudonia leptalea	Big Spur Ck./Cluden Stream	380 m	
Eudonia philerga	Big Spur Ck./Cluden Stream	380 m	Larvae eat mosses on rock faces
Eudonia sabulosella	trib. Cluden Stream	580 m	
Eudonia sabulosella	Chain Hills	850 m	
Eudonia sabulosella	Cluden Stream	520 m	
Eudonia sabulosella	Richmond Valley	700 m	
Eudonia sabulosella	spur to Cluden Stream	800 m	
Eudonia sabulosella	Big Spur Ck./Cluden Stream	380 m	
Eudonia trivirgata	Dunstan Mts.	1100 m	Inhabits open areas
Eudonia trivirgata	Dunstan Mts.	1150 m	
Orocrambus aethonellus	Richmond Valley wetland	660 m	Inhabits wetlands
Orocrambus aethonellus	Richmond Valley	700 m	
Orocrambus aethonellus	Dunstan Mts.	1150 m	
Orocrambus aethonellus	Dunstan Mts.	1200 m	
Orocrambus aethonellus	trib. Cluden Stream	580 m	
Orocrambus corruptus	Dunstan Mts.	1200 m	Inhabits dry areas
Orocrambus corruptus	spur to Cluden Stream	800 m	
Orocrambus corruptus	Chain Hills	850 m	
Orocrambus corruptus	Dunstan Mts.	1150 m	
Orocrambus corruptus	nr. Cluden Pass	1480 m	
Orocrambus corruptus	Richmond Valley wetland	660 m	
Orocrambus flexuosellus	Big Spur Ck./Cluden Stream	380 m	
Orocrambus lectus	Richmond Valley	700 m	Inhabits wetlands
Orocrambus lectus	Richmond Valley wetland	660 m	
Orocrambus lectus	trib. Cluden Stream	580 m	
Elachistidae -miners			
Cosmiotes ombrodoca	Big Spur Ck./Cluden Stream	380 m	Larvae mine sweet vernal and festuca leaves
Cosmiotes ombrodoca	Richmond Valley	700 m	

Taxon	Locality	Elevation	Comment
Elachista n.sp.	Richmond Valley	700 m	
Gelechiidae			
Isochasta paradesma	Big Spur Ck./Cluden Stream	380 m	Larvae cause gall swellings in *Coprosma* spp. shrubs
Kiwaia cheradias	Richmond Valley	700 m	Inhabits damp areas. Female flightless
Kiwaia cheradias	Big Spur Ck./Cluden Stream	380 m	
Megacraspedus calamogonus	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Chionocloa* spp. tall tussock seeds
Megacraspedus calamogonus	Dunstan Mts.	1100 m	
Symmetrischema plaesiosema	Big Spur Ck./Cluden Stream	380 m	
Geometridae			
Arctesthes catapyrrha	Dunstan Mts.	1200 m	Larvae inhabit open mat vegetation
Asaphodes aegrota	Big Spur Ck./Cluden Stream	380 m	Larvae on herbs
Asaphodes aegrota	Richmond Valley	700 m	
Asaphodes chlamydota	Richmond Valley	700 m	Larvae eat *Clematis* spp. lianes
Asaphodes chlamydota	Big Spur Ck./Cluden Stream	380 m	
Asaphodes stinaria	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Rannunculus reflexus* or *R. foliosus* in damp areas. Threat of extinction status ####
Austrocidaria gobiata	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Coprosma* spp.
Austrocidaria similata	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Coprosma* spp.
Chloroclystis inductata	Richmond Valley	700 m	Larvae polyphageous on flowers
Chloroclystis sphragitis	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Muehlenbeckia* spp.
Dasyuris n.sp.	nr. Cluden Pass	1480 m	Larvae eat *Anisotome imbricata*
Declana junctilinea	Big Spur Ck./Cluden Stream	380 m	Larvae polyphageous on shrubs
Declana junctilinea	Richmond Valley	700 m	x6
Epyaxa lucidata	Big Spur Ck./Cluden Stream	380 m	
Epyaxa lucidata	trib. Cluden Stream	580 m	

Taxon	Locality	Elevation	Comment
Epyaxa rosearia	Big Spur Ck./Cluden Stream	700 m	Larvae on herbs
Epyaxa rosearia	Richmond Valley	700 m	
Helastia christinae	Big Spur Ck./Cluden Stream	380 m	Larvae eat lichens
Helastia cinerearia	Big Spur Ck./Cluden Stream	380 m	Larvae eat rockface mosses
Helastia corcularia	trib. Cluden Stream	580 m	Larvae eat mosses in open areas
Helastia corcularia	Richmond Valley	700 m	
Helastia corcularia	Big Spur Ck./Cluden Stream	380 m	
Helastia cryptica	Big Spur Ck./Cluden Stream	380 m	Larvae eat perched dead leaves
Homodotis megaspilata	Big Spur Ck./Cluden Stream	380 m	Larvae arboreal on perched *Muehlenbeckia complexa* litter
Homodotis megaspilata	Richmond Valley	700 m	
Notoreas hexaleuca	Dunstan Mts.	1150 m	Larvae eat ?*Pimelea* spp.
Notoreas n.sp.	Dunstan Mts.	1100 m	Larvae eat *Kellaria* spp.
Notoreas n.sp.	ridge Big Spur Ck.	1100 m	
Notoreas paradelpha	nr. Cluden Pass	1480 m	Larvae eat ?*Pimelea* spp.
Notoreas paradelpha	spur to Cluden Stream	1100 m	
Notoreas paradelpha	ridge Big Spur Ck.	1100 m	
Pasiphila n.sp. 1	Big Spur Ck./Cluden Stream	380 m	Larvae eat small leaved *Olearia*
Pasiphila n.sp. 2	Richmond Valley	700 m	Larvae eat *Charmichalia* spp.
Pasiphila n.sp. 2	Big Spur Ck./Cluden Stream	380 m	
Pasiphila n.sp. 3	trib. Cluden Stream	580 m	inhabits shrubland
Pseudocoremia cineracia	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Olearia odorata.* Threat of extinction status - Gradual decline
Xanthorhoe semifissata	Big Spur Ck./Cluden Stream	380 m	Larvae on herbs
Glyphipterigidae -stem and leaf miners			
Glyphipterix achlyoessa	Richmond Valley	700 m	A leaf miner
Glyphipterix sp. 1	spur to Cluden Stream	800 m	A leaf miner
Glyphipterix sp. 2	Cluden Stream	480 m	A leaf miner

Taxon	Locality	Elevation	Comment
Hepialidae -ghost moths or porina			
Wiseana copularis	Big Spur Ck./Cluden Stream	380 m	Native grassland porina pest
Wiseana copularis	Richmond Valley	700 m	
Wiseana mimica	Big Spur Ck./Cluden Stream	380 m	Larvae inhabit damp areas
Wiseana mimica	Richmond Valley	700 m	
Wiseana umbraculata	Big Spur Ck./Cluden Stream	380 m	Native damper grassland porina pest
Wiseana umbraculata	Richmond Valley	700 m	
Lycaenidae -butterflies			
Antipodolycaena n.sp.	trib. Cluden Stream	650 m	A glade copper species. Larvae eat *Muehlenbeckia complexa/australis*
Antipodolycaena sp.aff. *salustius*	trib. Cluden Stream	650 m	An undescribed copper species. Larvae eat *Muehlenbeckia complexa*
Boldenaria n.sp.	Cluden Stream	520 m	Larvae eat *Muehlenbeckia axillaris* in open areas
Zizina oxleyi	Cluden Stream	520 m	Larvae eat native prostrate brooms and exotic clovers
Zizina oxleyi	Dunstan Mts.	1200 m	
Zizina oxleyi	Chain Hills	850 m	
Zizina oxleyi	Richmond Valley wetland	660 m	
Zizina oxleyi	nr. Cluden Pass	1480 m	
Zizina oxleyi	spur to Cluden Stream	800 m	
Momphidae -miners			
Zapyrastra stellata	Richmond Valley	700 m	Larvae eat *Meuhlenbeckia complexa*
Noctuidae -owlet moths, cutworms etc.			
Aletia moderata	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Raoulia* spp. mat daisies
Aletia moderata	Richmond Valley	700 m	
Aletia temenaula	Big Spur Ck./Cluden Stream	380 m	
Euxoa admirationis	Big Spur Ck./Cluden Stream	380 m	
Euxoa admirationis	Richmond Valley	700 m	
Graphania disjungens	Big Spur Ck./Cluden Stream	380 m	
Graphania infensa	Richmond Valley	700 m	Larvae eat grasses and sedges
Graphania lithias	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Melycytis alpinus* porcupine shrub

Taxon	Locality	Elevation	Comment
Graphania lithias	Richmond Valley	700 m	
Graphania mutans	Big Spur Ck./Cluden Stream	380 m	Widespread in grasses
Graphania mutans	Richmond Valley	700 m	
Graphania nullifera	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Aciphylla* spp. speargrasses
Graphania nullifera	Richmond Valley	700 m	
Graphania omoplaca	Big Spur Ck./Cluden Stream	380 m	Larvae eat grasses
Graphania paracausta	Big Spur Ck./Cluden Stream	380 m	Larvae eat grasses
Graphania phricias	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Discaria taumatau* Matagouri
Graphania phricias	Richmond Valley	700 m	
Graphania plena	Big Spur Ck./Cluden Stream	380 m	Larvae on herbs
Graphania plena	Richmond Valley	700 m	
Meterana coeleno	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Muehlenbeckia* spp.
Meterana coeleno	Richmond Valley	700 m	
Meterana exquisita	Big Spur Ck./Cluden Stream	380 m	Larvae eat divaricate *Olearia* species shrubs including *O. odorata* & *O. bullata* on the Pastoral Lease.
Persectania aversa	Big Spur Ck./Cluden Stream	380 m	Larvae on grasses including *poa cita*
Persectania aversa	Richmond Valley	700 m	
Rhapsa scotoscialis	Big Spur Ck./Cluden Stream	380 m	Larvae eat understory litter
Rictonis comma	Big Spur Ck./Cluden Stream	380 m	
Rictonis comma	Richmond Valley	700 m	
Tmetolophota acontistis	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Poa, Festuca, Elymus*
Tmetolophota acontistis	Richmond Valley	700 m	
Tmetolophota atristriga	Richmond Valley	700 m	Larvae eat grasses
Tmetolophota semivittata	Richmond Valley	700 m	Larvae eat *Carex* spp. sedges in wetland
Tmetolophota toroneura	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Poa cita*

Taxon	Locality	Elevation	Comment
Tmetolophota toroneura	Richmond Valley	700 m	
Nymphalidae -butterflies			
Bassaris gonerilla	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Urtica* spp. nettles
Oecophoridae			
Gymnobathra parca	Big Spur Ck./Cluden Stream	380 m	Larvae eat litter
Gymnobathra parca	trib. Cluden Stream	580 m	
Leptocroca asphaltis	Big Spur Ck./Cluden Stream	380 m	Inhabits dry banks. Larvae eat litter and roots. Female flightless
Leptocroca asphaltis	trib. Cluden Stream	580 m	
Leptocroca asphaltis	Richmond Valley	700 m	
Leptocroca asphaltis	spur to Cluden Stream	800 m	
Prepalla austrina	Dunstan Mts.	1100 m	Larvae eat *Leucopogon fraseri* mat heath
Prepalla austrina	wetland Dunstan Mts.	1500 m	
Prepalla austrina	Chain Hills	850 m	
Prepalla austrina	ridge Big Spur Ck.	1100 m	
Prepalla austrina	Big Spur Ck./Cluden Stream	380 m	
Prepalla austrina	Richmond Valley	700 m	
Prepalla austrina	Dunstan Mts.	1150 m	
Tingena maranta	Richmond Valley	700 m	Larvae on litter under Poa cita and Elymus spp.
Tingena melinella	Big Spur Ck./Cluden Stream	380 m	Larvae eat shrubland litter
Tingena sp.	Big Spur Ck./Cluden Stream	380 m	
Trachypepla euryleucota	Big Spur Ck./Cluden Stream	380 m	
Psychidae -casemoths			
Orophora unicolor	Richmond Valley	700 m	Montane to alpine case moth
Orophora unicolor	ridge Big Spur Ck.	1100 m	
Pterophoridae -plume moths			
Aciptilia innotatalis	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Dichondra ?repens*
Aciptilia innotatalis	Richmond Valley	700 m	
Aciptilia innotatalis	Cluden Stream	480 m	

Taxon	Locality	Elevation	Comment
Stenoptilia orites	nr. Cluden Pass	1480 m	Larvae eat *Brachyglottis* spp. flowers
Pyralidae			
Diasemia grammalis	Dunstan Mts.	1200 m	common in open dry areas
Diasemia grammalis	ridge Big Spur Ck.	1100 m	
Diasemia grammalis	Dunstan Mts.	1200 m	
Gadira acerella	Big Spur Ck./Cluden Stream	380 m	Larvae eat rockface mosses
Glaucocharis elaina	Big Spur Ck./Cluden Stream	380 m	Larvae eat rockface mosses
Glaucocharis helioctypa	Big Spur Ck./Cluden Stream	380 m	Inhabits wetlands
Glaucocharis lepidella	Big Spur Ck./Cluden Stream	380 m	
Homoeosoma anaspila	Richmond Valley	700 m	Larvae eat *Vittadinia australis*
Homoeosoma anaspila	Big Spur Ck./Cluden Stream	380 m	
Udea flavidalis	Richmond Valley	700 m	Inhabits damp and flush swards
Udea flavidalis	Big Spur Ck./Cluden Stream	380 m	
Satyridae –ringlet butterflies			
Argyrophenga n.sp. 'western'	Trib. Cluden Stream	1100 m	A tussock ringlet butterfly inhabiting *Chionocloa* grasslands
Udea flavidalis	trib. Cluden Stream	580 m	
Tineidae -detritus feeding moths			
Erechthias fulguritella	Big Spur Ck./Cluden Stream	380 m	Larvae eat dead wood
Erechthias fulguritella	trib. Cluden Stream	580 m	
Monopis ethelella	Big Spur Ck./Cluden Stream	380 m	Sheeps wool moth
Tortricidae -leafroller moths			
Carpua semiferana	Big Spur Ck./Cluden Stream	380 m	Larvae eat litter
Carpua semiferana	Richmond Valley	700 m	
Carpua semiferana	Chain Hills	850 m	
Carpua semiferana	trib. Cluden Stream	580 m	
Harmaloga amplexana	Big Spur Ck./Cluden Stream	380 m	Inhabits shrubland

Taxon	Locality	Elevation	Comment
Harmaloga amplexana	Richmond Valley	700 m	
Harmaloga n.sp.	Big Spur Ck./Cluden Stream	380 m	Larvae eat *Melycytis alpinus* porcupine shrub
Harmaloga n.sp.	Richmond Valley	700 m	
Harmaloga oblongana	Big Spur Ck./Cluden Stream	380 m	Inhabits shrubland
Parienia mochlophorana	Chain Hills	850 m	Inhabits damp areas. Local and uncommon
Yponomeutidae			
Plutella xylostella	Richmond Valley	700 m	Larvae eat Brassicaceae
Protosynaema questuosa	trib. Cluden Stream	580 m	Larvae eat *Carex* spp. sedges
Hemlock moth	Richmond Valley	700 m	Larvae eat *Conium maculatum* Hemlock
Scorpionflies -Mecoptera			
Nannochoristidae			
Nannochorista philpotti	Dunstan Mts.	1150 m	Scorpionfly, larvae inhabit small natural streams
Aquatic toebiters -Megaloptera			
Coryalidae			
Archicaulioides diversus	Big Spur Ck./Cluden Stream	380 m	Larvae widespread in stony streams
Dragonflies and damselflies -Odonata			
Anisoptera -Dragonflies			
Procordula sp.	trib. Cluden Stream	580 m	A ranger dragonfly species
Zygoptera -Damselflies			
Xanthicnemis zealandicus	Cluden Stream	500 m	Redcoat damselfly
Grasshoppers and weta -Orthoptera			
Acrididae -shorthorned grasshoppers			
Phaulacridium otagoense	trib. Cluden Stream	580 m	Found inhabiting dry open areas
Phaulacridium otagoense	Richmond Valley	700 m	
Phaulacridium otagoense	ridge Big Spur Ck.	900 m	
Phaulacridium otagoense	Cluden Stream	520 m	
Phaulacridium marginale	?		
Sigaus australis	Dunstan Mts.	1500 m	
Sigaus australis	nr. Cluden Pass	1480 m	
Anostostomatidae -weta			
Hemideina maori	nr. Cluden Pass	1480 m	Mountain stone weta
Tettigoniidae -longhorned grasshoppers			
Conocephalus semivittatus	Richmond Valley wetland	660 m	Found inhabiting wetlands

Taxon	Locality	Elevation	Comment
Stoneflies -Plecoptera			
Antarctoperlinae			
Taraperla ancilis	trib. Cluden Stream	980 m	Widespread along stony streams
Taraperla ancilis	Richmond Hut	720 m	
Zealandobius truncus	Richmond Valley	700 m	Distributed lower north Island and Central Otago only. Adults common in intermontane riparian shrub.
Zealandobius truncus	trib. Cluden Stream	580 m	
Zealandobius truncus	Richmond Hut	720 m	
Austroperlinae			
Austroperla cyrene	trib. Cluden Stream	580 m	Widespread along stony streams
Austroperla cyrene	Richmond Hut	720 m	
Gripopterygidae -predatory stoneflies			
Zealandoperla fenestrata	trib. Cluden Stream	580 m	Flightless short winged form. Adults inhabit plunging water margins along streams
Pseudoscorpions			
Pseudoscorpion sp.	spur to Cluden Stream	800 m	inhabits undersurface of dry rocks
Caddis -Trichoptera			
Conoesucidae -sand cased caddis			
Pycnocentria evecta	Big Spur Ck./Cluden Stream	380 m	A sand cased caddis
Pycnocentrodes aureolus	Big Spur Ck./Cluden Stream	380 m	A sand cased caddis
Hydrobiosidae -predatory free living and stony retreat caddis			
Costachorema xanthopterum	Big Spur Ck./Cluden Stream	380 m	Widespread
Hydrobiosis chalcodes	Richmond Valley	700 m	
Hydrobiosis clavigera	Big Spur Ck./Cluden Stream	380 m	
Hydrobiosis clavigera	Richmond Valley	700 m	
Hydrobiosis parumbripennis	Big Spur Ck./Cluden Stream	380 m	Predatory stony cased caddis inhabiting stony streams
Hydrobiosis parumbripennis	Richmond Valley	700 m	
Hydrobiosis sara	Big Spur Ck./Cluden Stream	380 m	
Hydrobiosis umbripenis	Big Spur Ck./Cluden Stream	380 m	

Taxon	Locality	Elevation	Comment
Hydrobiosis umbripenis	Richmond Valley	700 m	
Neurochorema confusum	Big Spur Ck./Cluden Stream	380 m	
Psilochorema bidens	Big Spur Ck./Cluden Stream	380 m	
Psilochorema bidens	Richmond Valley	700 m	
Psilochorema leptoharpax	Big Spur Ck./Cluden Stream	380 m	
Psilochorema mataura	Big Spur Ck./Cluden Stream	380 m	
Hydropsychidae -net caddis			
Aoteapsyche colonica	Big Spur Ck./Cluden Stream	380 m	Common net caddis from swift rocky reaches of streams and rivers
Aoteapsyche colonica	Cluden Stream	520 m	
Aoteapsyche colonica	Richmond Valley	700 m	
Aoteapsyche tepoka	Big Spur Ck./Cluden Stream	380 m	Common net caddis from swift rocky reaches of streams and rivers
Hydroptilidae -purse cased caddis			
Oxyethira albiceps	Richmond Valley	700 m	Purse cased caddis
Oxyethira albiceps	Big Spur Ck./Cluden Stream	380 m	
Leptoceridae -stick cased caddis			
Hudsonema alienum	Cluden Stream	500 m	Leaf cased caddis -often in wetland
Hudsonema alienum	Cluden Stream	520 m	
Hudsonema alienum	wetland Dunstan Mts.	1500 m	
Oecetis unicolor	Big Spur Ck./Cluden Stream	380 m	Stick cased caddis
Oeconesidae			
Oeconesis maori	Richmond Valley	700 m	Leaf cased caddis inhabiting seepage areas
Oeconesis maori	Big Spur Ck./Cluden Stream	380 m	
Philopotamidae			
Hydrobiosella stenocerca	trib. Cluden Stream	580 m	

APPENDIX 6: Freshwater Fisheries Survey Sites - Cluden Pastoral Lease

Location (Galaxias site no.)	Water Present	Fish species	Invertebrates
224661/ 5599318 **(1)**	Yes	*Galaxias* sp.D.	**Stoneflies**;*Stenoperla, Zeandoperla, Zealandobius,* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus* **Caddisflies;** *Aoteapsyche,Psilchorema, Pycnocentria*
2248234/5595066	Yes	Brown trout	**Stoneflies**;*Stenoperla* **Mayflies**;*Deleatidium*
2248659/5594910 **(2)**	Yes	*Galaxias* sp.D.	**Mayflies**;D*eleatidium, Nesameletus, Coloburiscus* **Caddisflies;** *Pycnocentria* **Miscellaneous**; *Potamopyrgus, Oligchaete*
2247309/5598790	Yes	Brown trout	**Stoneflies**; *Zeandoperla* **Mayflies**;*Deleatidium, Coloburiscus* **Caddisflies;** *Aoteapsyche, Pycnocentridae,Olinga feredayi, Helicopsyche,Hydrobiosidae,* **Miscellaneous**; *Austrosimulidae, Elmidae*
2250744/559909	Yes	Brook Char	**Stoneflies**; *Zeandoperla, Zealandobius,* **Mayflies**;D*eleatidium*
2237811/5595054	Yes	Brown trout, Upland bully	**Caddisflies;** *Aoteapsyche, Pycnocentridae,Olinga feredayi, Helicopsyche,Hydrobiosidae,* **Mayflies**;D*eleatidium* **Miscellaneous**; *Austrosimulidae,*
224009/5592713 **(3)**	Yes	Brown trout, *Galaxias* sp.D.	**Caddisflies;** *Aoteapsyche, Pycnocentridae,Olinga feredayi, Helicopsyche,* **Mayflies**;D*eleatidium* **Miscellaneous**; *Austrosimulidae,*
2240007/5592869	Yes	No fish	**Stoneflies;** *Megaletoperla* **Mayflies**;*Deleatidium, Coloburiscus* **Caddisflies;** *Aoteapsyche, Pycnocentridae,Olinga feredayi, Helicopsyche, Beraeoptera*
2240992/5590914	Yes	No fish	**Stoneflies**;*Stenoperla, Zealandobius,* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus,Oniscigaster* **Caddisflies;** *Olinga feredayi*
2239300/5590900	No		
2238504/5590547 **(4)**	Yes	*Galaxias* sp. D.	**Stoneflies**; *Zeandoperla* **Mayflies**;D*eleatidium* **Caddisflies;** *Aoteapsyche, Pycnocentridae,Olinga feredayi, Helicopsyche* **Miscellaneous**; *Austrosimulidae*
2237800/5591900	No		
2235000/5592510	No		
2235000/5592800	No		
2236800/5592500	No		
2233900/5591500	No		
2238605/5593574	Yes	*Galaxias* sp. D.	**Stoneflies;** *Megaletoperla*

(5)			**Mayflies**;D*eleatidium, Coloburiscus* **Caddisflies;** *Aoteapsyche, Pycnocentridae,Olinga feredayi, Helicopsyche* **Miscellaneous**; *Austrosimulidae, Potamopyrgus,*
2236578/5594508	No		
2243849/5596846	Yes	No fish	**Stoneflies**;*Stenoperla, Zeandoperla,* **Mayflies**;D*eleatidium* **Caddisflies;** *Aoteapsyche, Pycnocentridae, Helicopsyche*
2248351/5597985	No		
2248270/5597530	No		
2248160/559672	No		
2248249/5595613	Yes	Brown trout	**Mayflies**;D*eleatidium, Coloburiscus* **Caddisflies;** *Aoteapsyche,*
2248420/5594929 **(6)**	Yes	Brown trout, *Galaxias* sp. D.	**Mayflies**;D*eleatidium, Coloburiscus, Oniscigaster* **Miscellaneous**; *Potamopyrgus,*
2248429/559485 **(7)**	Yes	*Galaxias* sp. D.	**Mayflies**;D*eleatidium, Coloburiscus, Oniscigaster* **Caddisflies;** *Aoteapsyche*
2248079/5596060	Yes	Brown trout	**Mayflies**;D*eleatidium*
2246300/5595300	No		
2246400/5596300	No		
2246469/5597276	No		
2246194/5599270	No		
2245215/5599314	Yes	Longfin eel	**Mayflies**;D*eleatidium* **Caddisflies;** *Aoteapsyche* **Miscellaneous**; *Potamopyrgus*
2244500/5598751	Yes (Seepage)	Not fished	
2244392/5598252	No		
2238529/5595194	No		
2239891/5596249	Yes	Brown trout	**Mayflies**;D*eleatidium, Coloburiscus*
2240041/5596322	Yes	Brown trout	**Mayflies**;D*eleatidium, Coloburiscus* **Miscellaneous**; *Potamopyrgus*
2240400/5595600	Yes	Brown trout	Not recorded
2240876/5596716	Yes	Brown trout	**Mayflies**;D*eleatidium, Coloburiscus* **Caddisflies;** *Aoteapsyche*
2243195/5597149	Yes	Brown trout	**Mayflies**;D*eleatidium*
2243500/5596900	Yes	No fish	**Mayflies**;D*eleatidium Nesameletus,*
2242566/5595625 **(8)**	Yes	*Galaxias* sp. D.	**Mayflies**;D*eleatidium, Coloburiscus, Oniscigaster* **Miscellaneous**; *Potamopyrgus,*
2242300/5595700	No		
2245900/5593600	No		
2245142/5593702	Yes	No fish	**Stoneflies**;*Stenoperla* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus,Oniscigaster*
2245273/5593578	Yes	No fish	**Stoneflies**;*Stenoperla* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus,Oniscigaster* **Caddisflies;** *Aoteapsyche*
2245133/5593428	Yes	No fish	**Stoneflies**;*Stenoperla* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus,Oniscigaster* **Caddisflies;** *Aoteapsyche*

2241774/5594808	No		
2242273/5596020	Yes	Brown trout	**Mayflies**;D*eleatidium, Nesameletus*
2242453/5595843 **(9)**	Yes	Brown trout, koaro, *Galaxias* sp. D.	**Stoneflies;** *Megaletoperla* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus*
2242536/5595773 **(10)** **Trout passage barrier 2242518/5595781**	Yes	*Galaxias* sp. D.	**Stoneflies;** *Megaletoperla* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus*
2243793/5595732	Yes	No fish	**Stoneflies;** *Megaletoperla, Stenoperla* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus,Oniscigaster*
2243590/5595730	Yes	No fish	**Stoneflies;** *Stenoperla* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus*
2240338/5595666	Yes	No fish	**Mayflies**;D*eleatidium, Nesameletus ,Coloburiscus* **Caddisflies;** *Aoteapsyche*
2247999/5597900	Yes	Brown trout	**Stoneflies;** *Megaletoperla, Stenoperla* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus,Oniscigaster* **Miscellaneous**; *Potamopyrgus,*
2248040/5597901 **(11)**	Yes	*Galaxias* sp. D.	**Stoneflies;** *Megaletoperla, Stenoperla* **Mayflies**;D*eleatidium, Nesameletus, Coloburiscus,Oniscigaster* **Caddisflies;** *Aoteapsyche*

APPENDIX 7: Aquatic Invertebrate Species List and MCI values (1010) – Cluden Pastoral Lease

Stoneflies	**MCI value**
Stenoperla,	10
Zeandoperla,	10
Zealandobius	5
Megaletoperla	9
Mayflies	
D*eleatidium*	8
Coloburiscus	9
Oniscigaster	10
Nesameletus	9
Caddisflies	
Aoteapsyche	4
Pycnocentridae	7
Olinga feredayi	9
Hydrobiosella	9
Helicopsyche	10
Beraeoptera	8
Diptera	
Austrosimulium	3
Mullusca	
Potamopyrgus	4

APPENDIX 8: FMC Report on Recreational Values

FEDERATED MOUNTAIN CLUBS OF NEW ZEALAND (Inc.)
P.O. Box 1604, Wellington.

PASTORAL LEASE TENURE REVIEW

Preliminary Report on Recreational and Related Significant Inherent Values

CLUDEN STATION

March 2004

Compiled for Federated Mountain Clubs (FMC) ofNZ anc.)
by Dr Michael J S Floate. High Country Consultancy.

RECREATIONAL AND RELATED SIGNIFICANT INHERENT VALUES of CLUDEN STATION

A Report for FMC based on field inspection and other research to assist in the Pastoral Lease Tenure Review Process

March 2004

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A map showing the preferred allocation of conservation and freehold land (green and red pink outlines respectively), a proposed 'Sustainable Management Covenant' (orange outline) and important recreational access routes (in yellow)

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LIST OF FIGURES

Fig. 1 Cluden Station spreads over some 12,000ha and occupies a commanding position at the northern end of the Dunstan Mountains. The view here is from one of several spurs leading down to the Cluden Stream. These spurs command expansive views of the Upper Clutha area which makes a very scenic backdrop to the many potential recreational opportunities on the Dunstan Mountains.

Fig. 2 This view shows the junction of the Cluden Stream and the Lindis River near the western boundary of Cluden Station. The Cluden Valley forms a natural east-west communication roote between the Lindis and Dunstan Creek valleys and could provide recreational access to St Bathans. Topography rises from about 300m at the Lindis to more than 1,500m on the crest of the range.

Fig. 3 Cavalcaders take a break on the northern slopes of the Dunstan Mountains and look back to the Richmond Valley and Dunstan Pass (0). A legal road leads over the Pass to Dunstan Creek in the valley below the dominant escarpment of the St Bathans Range. Although no vehicle track crosses Dunstan Pass, there is a track over Cluden to the right of this picture. It is important that public access is secured through tenure review.

Fig. 4 Cluden Station contains a wide range of land types including the downland in the foreground, very small areas of alluvial flats, semi-arid north facing slopes in the middle distance and rolling, tor-studded tussock tops extending up to 1,500m and more the skyline. Much of this land has been classified LUC Class VIIe with severe limitations for pastoral use.

Fig. 5 Cluden Station homestead is situated near the Lindis Pass Highway where it passes through Tarras. There are irrigated flats in the foreground which support an intensive deer farming enterprise on freehold land. The homestead is on a low alluvial terrace in the middle distance, while the pastoral leasehold land begins some 6km closer to Lindis Pass, on Cluden Hill.

Fig. 6 The fresh spring growth of the willows contrasts sharply with the almost barren, semi-arid, Hieracium-infested north-facing slopes to the east of the Lindis River. It is hard to imagine how these slopes could be managed in a way that would promote ecologically sustainable land use. Conservation values, other than recovery potential in the absence of all grazing (including rabbits), are also low with the land in its present state.

Fig. 7 Here, one of the Otago Goldfields Cavalcade Trails makes its way along the Dunstan tops between Cluden Pass and Cloudy Peak. This roote is likely to become increasingly popular in future as traditional NZ trampers and outdoor people look for alternatives because they are being displaced from places like National .'arks and the increasingly well known 'Great Walks' which are becoming dominated by overseas visitors.

Fig. 8 From the Dunstan tops there are expansive views to the Manuherikia and Central Otago, to the Upper Clutha and, on a fme day, as far away as Mt Aspiring and even Mt Cook. Such scenic experiences add greatly to recreational values of these great upland landscapes. Some small areas of stony, deflated soils can be seen in the middle distance before the tor-studded skyline is reached.

Fig. 9 There is a smaller area of Arrow Steepland soils on the shady faces, as seen here on the true right of Cluden Stream below McPhies Ridge, which is more productive, mainly because it is less arid than so much of the other north-facing depleted land. This land has been classified LUC Class VI with moderate limitations for pastoral use. With appropriate maintenance to replenish nutrients removed in animal products, it should be possible to manage such areas in a sustainable manner so that they are suitable for freeholding.

Fig. 10 The best soils on Cluden Station are confined to very limited areas on alluvial flats on the floors of the Lindis and Cluden Stream Valleys. These have been classified LUC Class III with only minor limitations for pastoral use and are therefore eminently suitable to become freehold. The flats here are squeezed between the downlands and the semi-arid, degraded slopes to the east of the Lindis River.

Fig.11 Public access up the Cluden Valley over a legal road and beyond, to the Dunstan Pass is important for through trips to St Bathans, but it is also valuable for shorter, day trips by locals from the Upper Clutha. Here a group from Wanaka is enjoying a day trip in the mid-reaches of the Cluden Stream, with the kind permission of the runholder to make the return trip via McPhies Ridge.

Fig. 12 The Cluden Bridge over the Lindis River not only gives access to the Cluden Stream and its valley, but is also a convenient starting point for gentle walks along the banks of the Lindis River. Although marginal strips have been laid off, in places these are not wide enough to negotiate bluffs and wetlands adjaceut to the river. Appropriate widening should be included in the tenure review provisions.

Fig.]3 There has been a traditional camping spot beside the Lindis River, near Cluden Hut, for many years. This is thought to be only partly on the marginal strip and it would be beneficial to recognise this recreational use by establishing a small Recreational Reserve through tenure review.

Fig. 14 Several significant inherent values are illustrated in this view on the crest of the Dunstan Mountains, along the back boundary of Cluden Station. These include the healthy tussock grasslands, the wide-sweeping tussock and tor landscapes, and commanding views over the Otago block mountains to the main divide.

RECREATIONAL AND RELATED SIGNIFICANT INHERENT VALUES of CLUDEN STATION

INTRODUCTION

This report has been prepared following the Early Warning Meeting in September 2003 at which the properties entering the tenure review process in 2003 were introduced. Brief notes on behalf of Federated MOlUltain Clubs (FMC) were provided at that time, and this report now provides more detail. An inspection of the property was planned for February or March 2004, but permission for access was not granted by the runholder. This report is therefore written without the benefit of detailed knowledge of the property but instead is based on prior knowledge of The Dunstans and on information gathered from other sources (see Methods of Survey and Assessment section below). This report is offered as a contribution to the statutory consultation process undertaken by the Department of Conservation.

The report focuses on those features of Cluden Station which are important for public recreational interests. It should be noted that while much of this interest focuses on access, the natural values and landscapes of the areas concerned have a fundamental impact on the recreational value of the property and greatly influence the quality of recreational experience enjoyed. It is for this reason that reference is also made to both natural .Id landscape values in this report.

This pastoral lease is situated in a dominant position on the northern end of the Dunstan Mountains. It straddles the range from the Lindis River in the west to Dunstan Creek (at the foot of the St Bathans Range) in the east. It occupies most of the catchment of the Cluden Stream and rises to more than 1,500m on the crest of the range and covers more than 12,000ha. The homestead and about 150ha of associated freehold land is situated close to the Lindis Pass highway (SH 8) in Tarras.

There are other pastoral leases in this area which are, or have been, involved in the tenure review process. These include Ardgour and Cloudy Peak to the South, and Mt St Bathans (including Dunstan Peak) and the Lindis Group of leases to the north of Dunstan Pass. These latter properties provide access to the Chain Hills and the natural landscapes of Dunstan Creek and the St Bathans Range from the Lindis Pass highway (SH 8), and recreational use of this whole area is likely to increase in the future. It is important that a broad view is taken of the overall outcomes of the provisions for public use and access as each lease is reviewed. Particular attention needs to be given to the emerging network of recreation opportunities, and how each lease under review can contribute to that overall network of opportunities.

The PNA survey which inspected then area in the mid 1980s described the Dunstan Mountains as follows:-

The Dunstan Mountains are the driest of the alpine Central Otago ranges because their location is the most central. The Pisa Range and Lindis Mountains provide extra shelter from the north-west; the Old Man Range from the south-south-west, particularly the snow-bearing wtnds of Winter; while 120 kilometres of basin, range and plateau country lie to the south-east and east.

The Dunstan Mountains typify the Central Otago pattern of fault-block mountain ranges uplifted along faults on their south-eastern edges and tilted to the north-west. The mid-Tertiary peneplain sUlface is expressed as long gently sloping ridges on the north-west slope and the smooth crest of the range.

There is 110 evidence of the Dunstan Mountains ever having generated glaciers - an indication of the low precipitation in comparison with the adjacent Old Man Range of similar height which has several notable Cirques and small glacial valleys. &hist tors and periglacial phenomena (in particular soil hummocks) are very well developed on the higher parts of the upland surface.

Apart from these minor eJ1ects, the absence of glaciation results in a simple topographic pattern, with steep slumped slopes characteristic of the dissected fault scarp on the southeast face, contrasting with the long north-west slope. "

Mason (I988) has described the general area as follows:- *"The Dunstans are tilted block mountains of schist, situated between the upper Clutha and Manuherikta valleys. The eastern escarpment rises moderately steeply from the Manuherikia basin. The western slopes have a rough, craggy appearance at their base (the Northburn and Bendigo localities are notable for these landforms), with a pattern of low, shallow valleys and ridges. With increasing altitude the landscape becomes progressively subdued and indistinct as the broad summit crests are reached.*

The Dunstan Mountains are connected to the Lindis country by the relatively low Chain Hills divide between the Lindis and Dunstan Creek catchments."

The PNA Report described the Cluden Land System as follows:- *"This is the more northerly part of the north-west slope of the Dunstan Mountains. It is characterised by a regular pattern of long rounded ridges derived from the tilted peneplain surface, with sizeable valleys entrenched 200-3OOm deep between them. The valley sides are predominantly slumped, although some stable buttress rock outcrops and colluvial slopes do occur. Some incised stream margins have provided suffiCient rejUge from fire for the survival of diverse matagouri - Coprosma scrub. The vegetation for the most part is highly modified except at higher altitudes where the valley heads and ridges merge into the summit dome."*

Understanding the underlying geology and the effects of geomorphological processes assists recreational sitors to the Dunstan Mountains to get a deeper understanding of the landscape and scenery, and of those factors 'Uld processes affecting the ecological distribution of native species.

The most important recreational issues in this tenure review are related to access. Some legal roads exist and over these, secure public access needs to be confirmed. It will also be important to secure public access from Cluden Bridge to the Richmond Yards via the Cluden Stream valley, over Dunstan and Ouden Passes to Dunstan Creek and St Bathans, and along the crest of the Dunstan Mountains with acceSs from Richmond Yards and Cluden Stream.

METHODS OF SURVEY AND ASSESSMENT

A site visit and field inspection was planned for February or March 2004, but the runholder refused pennission for access. This report is therefore written without the benefit of an inspection specifically for the purposes of tenure review. The author is however, familiar with the property as a result of other legitimate trips over the Dunstan Mountains and up the valley of the Cluden Stream. This report is based in part on that knowledge and in part on information gathered from other sources. The other sources include studies "ftopographical and Land Use Capability (LUC) maps, consultation with recreational user groups and a general knowledge of the landscapes seen from the Lindis PasslUpper Clutha area. A study of Jutdoor Recreation in Otago" was undertaken by Mason (I988) and published by FMC. Reference is made to this Recreation Plan for Otago in the recreation section below. The Survey Report of the Protected Natural Area (PNA) Programme for Liildis, Pisa and Dunstan Ecological Districts (1994) and the Conservation Management Strategy for Otago have also been used as a sources of reference.

GENERAL DESCRIPTION OF CLUDEN STATION

Cluden 3tation is a relatively large pastoral lease (l2,400ha), which is much larger than most of the neighbcuring properties. It occupies a dominating position at the northern end of the Dunstan Mountains (Fig. 1), reaching 1,565m at its highest point and dropping to 300m on Archies Flat in the Lindis in the west, and 700m at the ford over Dunstan Creek in the east. The valley of Cluden Stream forms a na:tural communication route from east to west (Fig. 2) rising gradually from 300m to almost 700m before dropping to the Richmond Valley. From here a crossing to Dunstan Creek can be made via the Dunstan or Cluden passes (Fig. 3), although there is no vehicle track over the Dunstan Pass.

The northern boundary of Cluden Station runs parallel to Cluden Stream, along the crest of the prominent McPhies Ridge which drops gradually in altitude westwards to the Lindis valley. The pastoral lease includes Cluden Hill and some terrace land west of SH 8, and some alluvial flats by the Lindis River (Fig. 4). The homestead and some associated freehold land is situated on terrace country close to SH 8 in Tarras (Fig. 5).

Most of the pastoral lease occupies a series of north-west trending spurs running off the north western end of the Dunstan Mountains. It occupies most of the catchment of the Cluden Stream. The property is well served by internal tracking as each of these spurs carries a track leading down to the Cluden valley.

Three areas were recognised by the PNA survey team as Recommended Areas for Protection (RAPs). One of these (RAP A1) covers almost 3,000ha on the crest of the range, about 800ha of which lies on the highest part of Cluden Station. The other two (RAP A2 and RAP B1) include native shrublands in steep sided gullies which are unnamed tributaries of Cluden Stream.

Much of the property lies to the sun and there is a large area of semi-arid land heavily infested with scabweed and Hieracium on north-facing slopes below about 1,000m. This can be clearly seen from the Lindis Pass highway at Cluden Hill (Figs 4 and 6).

The recreational significance of Cluden Station is related to its strategic position at the northern end of the Dunstan Mountains which provide opportunities for both range crossings and a long distance traverse of the Dunstan Mountains (Fig. 7). Crossings of the range can be made between the Lindis Country and St Bathans (Fig. 3), and Cluden Station could provide access to the start of an extended traverse along the length of Dunstan Mountains southwards to Cloudy Peak, Bendigo, Leaning Rock and the Cromwell Gorge (Figs 7 and 8). These opportunities will be discussed in the recreation section below.

Conservation interests (associated with enhancing the recreational experience) are primarily focused on the landscape values of the higher country, including the crest of the Dunstan Mountains, and the passes leading to Dunstan Creek and St Bathans, but also include the RAPs referred to above, and described in detail below.

LAND RESOURCES OF CLUDEN STATION

There is a very large area (8,500 to 9,000ha) of land on Cluden Station which has been classified Land Use Capability (LUC) Class VIIe (Fig. 4). This is all erosion-prone land with severe limitations for pastoral use. It is not confined to the high country and extends down the sunny north-facing slopes to the valley of the Cluden Stream and Lindis River (Fig. 4). This land is mainly composed of Dunstan Steepland High Country Yellow Brown Earth soils on the high country above about 1,000m where the dominant vegetation is tussock grassland. At lower altitudes the soils are Arrow Steepland Yellow Grey Earths between about 500 and 1,000m, while on the lowest north-facing slopes (between about 300 and 600m) there is a significaot area of Alexandra Steepland and Conroy Hill semi-arid Brown Grey Earth soils which carry abundant scabweed, and are heavily infested with the mouse-eared hawkweed or Hieracium. About half the property is still in semi-natural vegetation which has been modified by pastoral use, while the other half has been improved by oversowir,g and topdressing.

There is a smaller area (about 3,000ha) of LUC Class VI Arrow Steepland and Blackstone Hill Yellow Grey Earth soils on shady slopes between about 500m and 1,000m which have generally been improved by oversowing and topdressing (Fig. 9) and are more productive. This area has 'moderate limitations for pastoral use but with appropriate treatment to ensure that the removal of essential nutrients in animal products (meat and wool) is balanced by fertiliser application to maintain nutrient reserves, it should be capable of ecologically sustainable pastoral production. So long as the nutrient balance is maintained and pests are kept under control, this land should be suitable for freeholding.

About 500ha of Clyde semi-arid Brown Grey Earth soils occur on the high terraces and downland at about 500m west of the highway at Cluden Hill (Fig. 4). This has been classified LUC Class IV with high suitability for pastoral production. There is also a very small area (perhaps 100ha) of LUC Class III alluvial soils on Archies Flat and along the Lindis River (Fig. 10). With appropriate maintenance this LUC Class III and Class *VI* area will be suitable for freeholding.

There are serious problems with land use and appropriate allocation to conservation or freehold on land classified LUC Class VIIe. On the high country, above about 1,000m, natural soil fertility is low and grazing and burning remove essential nutrients from soil reserves. Unless removals through burning and in animal products (meat and wool) are balanced by replenishment in the form of fertiliser, soil depletion will be inevitable and the system will be unsustainable. Nutrient balance might be maintained by fertiliser use but at

these higher altitudes plant growth response is small and it is usually not economically justifiable to apply the necessary fertiliser. Furthermore the term 'ecologically sustainable' is not defined in the CPL Act, 1998. It has been suggested that 'ecological sustainability' will involve maintenance of not only nutrient status, but also biological diversity. Pastoral use, especially if that included fertiliser use and burning would not favour or promote biodiversity. For all these reasons, freeholding would not promote 'ecologically sustainable' land use: Under these circumstances conservation values need to be assessed and considered as an alternative to unsustainable pastoral use.

At lower altitudes, and especially on sunny north-facing slopes characterised by Arrow Steepland Yellow Grey soils, or on the lowest slopes, Alexandra Steepland semi-arid Brown Grey soils, the land has already been depleted by a history of overgrazing by rabbits (and sheep) and Hieracium invasion (Figs. 4 and 6). Very little semi-natural, or indeed any useful pasture vegetation remains, and such land has severe problems for both farming and conservation (see section below on Significant Inherent Values).

RECREATIONAL USE AND POTENTIAL NEW OPPORTUNITIES

The recreational significance of this pastoral lease lies in its strategic location at the northern end of the Dunstan Mountains. Access is available at the western end via the Cluden Road (Fig. 11) which is a legal road to a point part way up the Cluden Stream, or from the east from St Bathans and the Dunstan Creek then over the Dunstan or Cluden Passes (Fig. 3). From either the eastern or western access it is then possible to ascend the northern end of the Dunstan Mountains and traverse south (Figs. 7 and 8) over Cloudy Peak, Ardgour and Bendigo to Leaning Rock above the Cromwell Gorge. All these properties have been through, or are still in the tenure review process.

The fact that all these properties along the Dunstan Mountains, and a group of six other properties in the Lindis area, to the north of Dunstan Pass, are all involved in tenure review, highlights the need to consider the emerging network of recreational opportunities as each individual property is reviewed.

In the FMC Report on the tenure review of Cloudy Peak it was stated that: *"The linkage between the North Dunstan area* [including Dunstan Pass and the upper reaches of the Dunstan creek catchment] *and Thomsons Saddle (and the Thomson Gorge Road)* is *likely to become increasingly important as a recreational resource in future."*

Thus, increasing usage is anticipated but currently recreational use of Cluden Station is relatively light because the opportunities are largely unknown. The crossings of the range from Cluden Stream to Dunstan Creek and St Bathans, and the traverse along the tops would be suitable for tramping, mountain bike and horse travel. As a result of the Goldfields Cavalcades (Figs 3 and 7), the route over the Dunstan Pass and the traverse along the tops has become more widely known but is still little used. Local walkers enjoy gentle trips along the Lindis River and the water race (Fig. 12), while there has been a traditional camping spot at the Cluden Hut for many years (Fig. 13). Because it is not clear if this camping area is within the marginal strip, it would be useful if the traditional recreational use was recognised and a small Recreation Reserve created out of tenure review.

Traditional NZ trampers and other outdoor enthusiasts are increasingly seeking new recreational opportunities as the more popular National Parks and 'Great Walks' are more and more becomming dominated by overseas tourist visitors. The traditional NZ users are being displaced and these people are now looking to new areas for recreation such as those likely to become available through the tenure review process. It is thus important that this need is recognised and new provisions are made through the tenure review process.

Another reason for increasing demand has been provided by Mason (1988) who stated: *"The Northern Dunstan PNA* [protected Natural Area at the head of Lauder Creek] is *an unknown as far as the recreational public* is *concerned, although no doubt this situation will change with greater awareness of its natural values and its potential for cross country skiing."* Mason also observed that with greater awareness of the same features, it could be anticipated that summer visitation will also increase.

Mason (1988) has observed that there may be some potential for cross country skiing on parts of the Dunstan Mountains but that the amount of snowfall is frequently limited by the orientation of the range to the

southerlies which bring most of the snow. In some years however, snow does lie long enough for recreational use.

The recreational significance of pastoral leases like Cluden Station should be assessed not only on their present usage but also on potential. This is because current usage is much less than its potential for a number of reasons. Partly because of lack of awareness and partly because of the current land tenure under pastoral lease, access to the ridge system has not been easy in the past and the recreational use of the Dunstan Mountains is less than it might have been if access was freely available. There is significant potential for greater use and it is the full range of possibilities which should be considered during this tenure review.

An increasing problem for people wishing to do trips involving overnight stays in the backcountry is security of car parking at road ends. Consideration should be given during the tenure review process to making provision where possible for car parking off highways, and in the most secure places possible near the start of new easements over land which becomes freehold through tenure review. In the case of Cluden Station, consideration should be given to future opportunities for off-road parking at some convenient place in the valley of the Cluden Stream.

In summary, this assessment indicates that there is considerable scope in crossings of and a traverse along the Dunstan Mountains for mountain bike trips, tramping, and possibly horse riding. It is recommended that ublic access for all these activities should be secured as an outcome of tenure review. The riverside also offers opportunities for camping and more gentle day walks, and if it does not already exist, a marginal strip or easement along the true left of the Lindis River should be included.

SIGNIFICANT INHERENT VALUES AND mEIR IMPORTANCE FOR RECREATION

This report focuses on those features of Cluden Station which are known to be important fur public recreational interests. It should be noted that while much of this interest focuses on access, the natural values and landscapes of the areas concerned and views to be had from the key vantage points have a fimdamental impact on the recreational value of the property and greatly influence the quality of recreational experience enjoyed. It is for this reason that reference is also made to both natural and landscape values of this property Fig. 14).

Mason (1988) has commented on the vegetation of the Dunstan Mountains as follows: *"Tall tussock grassland has a more complete presence north of Thomsons Saddle although this* is *moderately to severely depleted Only a relatively small area of alpine herbjield occurs on the northern crest. Short fescue and Silver tussock grassland cover lower slopes. Pockets of shrubland occur throughout this half of the range, being mainly conjined to deeply incised gullies. "*

The scenic and natural values of the tussock grassland and tor landscapes on the range crest (Fig. 14) were recognised by the PNA survey team who identified and recommended a large area for protection (Dunstan RAP AI). This covers about 800ha on Cluden Station and a much larger area 011 the neighbouring property. The public and natural value of this area is made more important by the fact that it is adjaceut to the already existing Lauder Basin Conservation Area. This RAP (AI) and two other RAPs are described in more detail below.

As discussed in the Land Resources section above, there is a real problem with land use and land allocation relating to the remaining LUC Class Vile land on lower sunny north facing slopes with Arrow Steepland and semi-arid Alexandra Steepland soils. Much of this land is severely depleted and infested with scabweed and Hieracium (Figs. 4 and 6). It is now of very low value for pastoral fanning and it is difficult to imagine what could be done to promote its management in a way that is ecologically sustainable as required by the CPL Act 1998 (S. 24). On the other hand, the land currently has very little in the way of conservation value, other than its potential for recovery in the complete absence of grazing and burning. Even this would be difficult to achieve as much of the damaging grazing has been and is increasingly again being done (after a respite due to RHO) by rabbits. Special arrangements will need to be made for some kind of stewardship in this particular case. The best ecological solution would be total rest from grazing and productive use, but this would also require pest management and control by the land owner/manager. Because of high costs and nil returns it seems that possible solutions are (a) for return of the land to full Crown ownership and control

or (b) stewardship protection under a Snstainable Management Covenant in favour of the Commissioner as provided for by CPL Act (S97). This arrangement would provide the long-term stewardship required to encourage slow progressive vegetative recovery with minimal competition from pests and weeds. Special funding may need to be provided to allow this to happen.

RECOMMENDED AREAS FOR PROTECTION (RAPs)

PNA survey teams inspected the Lindis and Dunstan Ecological Districts in the mid 1980s and their report was published in 1994. Three areas on Cluden Station were identified as Recommended Areas for Protection (RAP AI, RAP A2 and RAP 81). These are described below.

Dunstan RAP Al (North Dunstan)

The first and highest of these areas is the Dunstan RAP Al (North Dunstan) which covers some 2,760ha on the crest of the range. About 800ha of this RAP occurs on Cluden Station (Fig. 7). The landform was described as follows:- *"The summit plateau remnant around the head of Lauder Creek features very broad gently undulating ridges culminating in the unnamed highest point of the Dunstan Mountains (J690 m). The ridge crest southwest of this point* is *mainly a deflated stony pavement, but soil hummocks arc characteristic elsewhere on the summit ridges. Other relict periglacial phenomena are localised solifluction lobes and attered tors. The generally stable colluvial slopes steepen towards the streams and Lauder Creek becomes deeply gorged towards the end southwestern edge of the RAP. The main ridges of the Cluden land system in the west generally slope 5-10 degrees NW, but tributaries of Cluden Stream are strongly incised. These valleys are asymmetric because of the moderate northerly dip of the Haast Schist here. Sunny aspects tend to be slumped while shady aspects are more commonly stable though steeper."*

Vegetation communities within the RAP were described:- *"Slim snow tussockland of moderate to high density dominates the broad summit ridges and upper slopes. Several minor communities are closely associated with slim snow tussockland. Alpine flushes are numerous and relatively extensive, commonly up to several hectares. Cushionjields dominated by Dracophyllum muscoides with Raoulia hectori, blue tussock and Luzula rufa are commonly associated with tors on exposed sites, especially in the east. Other small areas of deflated stony soils are dominated by Chionohebe densifolia and blue tussock with other tussockland herbs and grasses. Slim snow tussockland extends downslope to a generally abrupt boundary with narrow-leaved snow tussockland at an altitude between 1350-1400 m on sunny faces. Only a narrow zone of narrow-leaved snow tussockland* is *present in the west, it gives way downslope to fescue tussockland generally of low naturalness."*

Some important discoveries were made by the survey team in respect of new, rare and endangered species. bey reported as foliows:- *"A newly discovered tiny Gentiana species* is *common in many alpine flushes, and has since been described and named Gentiana lillipuntiana (Webb, 1990). Small populations of rare Myosotis oreophila and M. cheesemanii occur locally on exposed sites on the ridge southwest of the high summit. These populations have been documented and further research* is *currently underway to learn more of their population dynamics. Edelweiss, found here,* is *uncommon in the District. Also found were Microseris scapigera and Carpha alpina, and a trifid leaved form of Chionobebe densifolia which* is *seemingly characteristic of the northern Dunstan Mountains."*

The PNA team concluded that: *"The northern Dunstan Mountains have been little studied by biologists, as emphasised by the discovery of a locally common new gentian species. The priority area* is *of outstanding Significance for the extensive intact snow tussocklands on the summit area. Slim snow tussockland on the broad upper slopes and plateau surface* is *the most extensive in the Lindis, Pisa and Dunstan Districts. 1t* is *in conspicuous contrast with the southern Dunstans, Pisa and Old Man Ranges where cushionfield dominates under conditions of generally similar altitude, terrain and annual precipitation. The alpine zone of the North Dunstan priority area* is *of major importance for an understanding the alpine ecological history of the Central Otago Region."*

The significance of their findings is summarised by the following assessment criteria which were ranked High (H), Medium (M) or Low (L):

Representativeness (H) Excellent representation of original alpine communities
Diversity (8) Wide range of tussocklands and associated alpine communities, also of subalpine-montane woody communities.
Naturalness (H) Unusually high naturalness overall, especially in alpine zone.
Special Features (H) Numerous rare or uncommon species.
Viability (H) Communities intact and fimctioning in natural relationships..
Buffering (H) Summit plateau surface well buffered by isolation.
Threat (M) Fire (shrubland and tussockland), stock impact in alpine flushes.
Landform (H) Good representation of northern Dunstan land system.

Dunstan RAP A2 (Lower Cluden Tributary)

The PNA Report stated that this RAP occupied *"The lower-mid reaches of a tributary valley of Cluden Stream, incised into the gentle northwest slope of the western flank of the northern Dunstan Mountains (eluden Land System)."*

Its vegetation was described as:- *"Dense mixed scrub along the streamside is dominated by Coprosma propinqua, with abundant Olearia odorata, Aristotelia fruticosa and matagouri. Less diverse matagouri shrubland with some briar and Coprosma propinqua generally occurs away from the stream, especially on :nnyaspects, andpartially buffirs the mixed shrubland Olearia odorata is prominent on some moist shady faces."*

A special feature of the RAP was: *"Carmichaelia kirkii, a vulnerable native climbing broom which has suffired much restriction of its range, is scattered through much of the dense mixed scrub."*

The PNA survey concluded that DWlstan RAP A2 (Lower Cluden Tributary) was:- *"An excellent example of the diverse Coprosma/matagouri dominated scrub in riparian zones of steep-sided valleys characteristic of the dry (550-650 mm annual rainfall) northwest Dunstan Mountains (Cluden Land System) and adjacent areas of the Lindis District."* It was also obselVed that: *"This newly found stte ofe. kirkii includes possibly the largest remaining population, and is of viable size for long term survival, provided burning and browsing of this palatable species can be prevented."*

The significance of their findings is summarised by the following assessment criteria which were ranked High (H), Medium (M) or Low (L):

Representativeness (H) Typical of important communities.
lliversity (M) Variety of shrublands.
aturalness (M) Generally low in tussocklands, otherwise high.
Special Features (H) *Carmichaelia kirkii*, relatively large proportion present.
Buffering (M) Partially buffered by matagouri.
Viability (H) Shrublands in good condition.
Threat (M) Shrubland clearancelburning, browsing.
Landform (M) Part of a typical incised valley in the Cluden land system.

Dunstan RAP Bl (Mid Cluden Tributary)

The vegetation in the Mid Cluden Tributary RAP was described as follows:- *"Dense, mixed scrub along the streamside is dominated by Coprosma propinqua with much Aristotelia fruticosa, koromiko, matagouri and Olearia odorata. Matagouri (including scattered large plants up to 4 m) dominates shrublantis on the lower slopes and side gullies. Briar is frequent below 700 m, especially on sunny aspects."*

Some notable features were obselVed: *"A few plants of the vulnerable climbing broom Canntchaelia kirkii were noted near the lower boundary. Large (3 m tall) Olearia nummularifolia occur near the upper boundary. Coral broom is scattered in the upper portion of the area."*

The significance of their findings is summarised by the following assessment criteria which were ranked High (H), Medium (M) or Low (L):

Representativeness (M) Typical of important montane communities.
Diversity (M) Variety of shrublands.
Naturalness (M) Generally low in tnssocklands, otherwise high.
Special Features (H) Some *Carrnichaelia kirkii*, other uncommon species..
Viability (H) Shrublands in good condition.
Buffering (M) Steep riparian sites give partial buffering.
Threat (M) Shrubland clearancelburning, browsing.
Landform (M) Typical inner valley of the C1uden land system.

On the basis of the PNA Reports and these assessment criteria it is believed that all three RAPs have very significant inherent values which are worth of protection. Protection by return to full Crown ownership, or under a secure binding covenant would ensure that the threats identified above are minimised through tenure review.

AREAS TO BE PROTECTED

There is a real problem with the dry north-fucing slopes (LUC Class VIle Arrow and Alexandra Steepland soils) which are badly infested with scabweed and Hieracium and should be destocked. This should allow very slow recovery of native species and shrubland to come back but the conservation values are very low at present. Stewardship is required. Because weed and pest control costs would need to be met but there would be no income from production, it seems that the possible solutions are (a) for return of the land to full Crown ownership and control or (b) stewardship protection under a Sustainable Management Covenant in favour of the Commissioner as provided for by S.97 CPL Act 1998. This arrangement would provide the long-term stewardship required to encourage slow progressive vegetative recovery with minimal competition from pests and weeds. In the event that the land is not returned to full Crown ownership and control, it is recommended that this area should be treated as a long-term stewardship area under a Sustainable Management Covenant as provided for by 8.97 CPL Act 1998.

The large area of RAP A1 on the tops should be included within an area of high country to be returned to full Crown ownership and control and become conservation land. As well as Dunstan RAP A1 (North Dunstan) this conservation area should include all the LUC Class VIIe land on Dunstan Steepland soils above about I,OOOm on C1uden Station. It was explained above that it is unlikely that such land can be managed in a way that is ecologically sustainable. This land does however have very significant landscape value which should be recognised. The value of this entire area is enhanced by the fact it adjoins the already existing Lauder Basin Conservation Area. It is recommended that this entire area (indicated with a green outline on the ttached map) should be returned to full Crown ownership to be managed for conservation and recreation urposes.

The other RAPs recognised by the PNA survey team should also be protected because of their significant inherent values which are described above. In this case, the two RAPs are situated in separate unnamed tributaries of the C1uden Stream, within an area which may become freehold. If freehold tenure is the outcome of tenure review, the most appropriate form of protection for Dunstan RAPs A2 and BI, will be Wlder a binding covenant registered on the freehold title.

The traditional camping spot beside the Lindis River near the Cluden Hut should be formally recognised. Because it is not clear if this camping area is entirely within the marginal strip, it is recommended that a small Recreation Reserve covering the entire camping area should be one of the provisions of this tenure review.

ACCESS REOUIREMENTS

The following access provisions will be required:-

Marginal strips should be laid off on all qualifying waterways.

Walking access is required along the banks of the Lindis River and the associated water race. There should already be marginal strips along the banks of the Lindis River which could be used by locals and others for a gentle riverside walk. Part of this area, in the vicinity of Cluden Hut, has been traditionally used for camping, and the legality of this usage should be confirmed. Similarly, the legal existence of the marginal strips along the river should also be confirmed as part of this tenure review.

Public access for foot, mountain bike and possibly also horse riding will be required over a number of routes on the Dunstan Mountains. Some of these routes are on, or close to legal roads as follows:-

I. There appears to be a legal road up the Cluden Valley for about 9km which may or may not coincide with the road formation on the ground. As an outcome of tenure review, there needs to be secure foot, non-motorised vehicle and horse access to the Richmond Valley. This would preferably be achieved by confirming the legal road. Failing that, an alternative might be the establishment of an easement for public access as defined above. Vehicle access with land owner permission should be considered.

2. From the Richmond Valley, a legal road appears to lead over Dunstan Pass to Dunstan Creek. There is no vehicle track to Dunstan Pass so the actual alignment of the legal access (perhaps as a poled route) should be made clear as an outcome of this tenure review.

   There is also a legal road leading from Richmond Valley to Cluden Pass, but its relationship with tracks on the ground is not clear. In this case, the track on the ground should be recognised as the legal alignment as it was clearly intended that the legal road should provide public access to Cluden Pass.

4. From Cluden Pass the access to Dunstan Creek is mainly over the neighbouring property, but there is a section of track on Cluden Station pastoral lease leading to the ford (at Map Reference H40 523.982) which should be formally recognised as public access (probably as an easement) during this tenure **reVIew.**

5. An Easement for public foot, non-motorised vehicle and horse access is also required from Cluden Pass to any new conservation land created on the crest of the Dunstan Mountains. This would provide a link for a future traverse southwards to Bendigo and Leaning Rock as well as to the Lauder Basin Conservation Area which abuts the Cluden Station boundary along the ridgeline.

6. From the crest of the Dunstan Mountains there is a need for at least one accessway to the Cluden Stream to provide opportunities for round trips, and an emergency route in the event of bad weather. This route might be by way of points 1,527m, 1,405m, 1,248m, 1,027m and 887m, or by way of points 1272m, 782m and the airstrip road down to the Apple Tree Yards. The latter route is preferred as it would make a much better round trip.

7. If the two RAPs in unnamed tributaries of Cluden Stream are protected as a result of this tenure review, public access will also be required to these new conservation areas.

All the recreationally important access routes are indicated in yellow on the attached map.

CONSERVATION MANAGEMENT STRATEGY FOR OTAGO

There are important statements in the Conservation Management Strategy (CMS) for Otago, in which the North Dunstan Mountains are recognised as a Special Place. It is noted in the CMS that the Lauder Basin Conservation Area is landlocked and that public access to the area is required. The objective for this Special Place is:- *"To extend protection in the area to cover the remaining higher altitude areas of nature conservation importance, and to secure appropriate public access. "*

Implementation includes:- *"Pasio rallease tenure review on properties in the area may provide opportunities to negotiate to protect the areas of interest Overall management of these new areas with the existing conservation areas will confer net conservation and management benefits. "*