Toitu te whenua
Land Information
New Zealand

Crown Pastoral Land Tenure Review

Lease name : DUNSTAN DOWNS

Lease number : PO 019

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.

December 05

DUNSTAN DOWNS PASTORAL LEASE

CONSERVATION RESOURCES REPORT

DOC CONSERVATION RESOURCES REPORT ON TENURE REVIEW OF DUNSTAN DOWNS PASTORAL LEASE

PART 1

INTRODUCTION

Dunstan Downs Pastoral Lease has an area of 12,351 hectares and is a long (nearly 30 km), relatively narrow (4-8 km) strip of mountain land lying to south and east of State Highway 8 (SH 8), about 16 km west of Omarama. Most of the northern part of the property is very stony, greywacke mountain slopes of the Dunstan and Wether Ranges, with steep sideslopes and broad, planar ridge tops. Flat land is confined to the small area around the homestead, along the Ahuriri River and a narrow strip along parts of SH 8.

The southern half of the lease includes the western scarp of the St Bathans Range. The steep, stony upper slopes of the Range fan out lower down to form broad, gently sloping terraces, which descend to the wide valley floor of the Dunstan Creek. Most of the pastoral lease is above 800m asl. The soils are shallow and stony, especially on the steeper slopes where screes are often prominent, but deeper on the valley floors and some lower slopes.

The property shares common boundaries with several other pastoral leases including Twinburn, Dunstan Peaks, Killermont, Birdwood, Longslip, Dalrachney, Morven Hills, Long Acre, Shirlmar, Timburn, Mt St Bathans, Michael Peak, Twin Peaks and Ahuriri Downs. The Lindis Pass Scenic Reserve adjoins Dunstan Peaks at the northwestern corner.

Most of the pastoral lease lies in the St Bathans Ecological District in the Waitaki Ecological Region. The northern catchments, from the top of the Dunstan and Wether Ranges, fall into the Ahuriri Ecological District in the McKenzie Ecological Region and most of Dunstan Creek lies in the Dunstan District in the Central Otago Region. The Ahuriri and Dunstan Ecological Districts have been surveyed by the PNA Programme and one part RAP has been identified on the property – Ahuriri RAP 14 (Lindis Pass).

PART 2

INHERENT VALUES: DESCRIPTION OF CONSERVATION RESOURCES AND ASSESSMENT OF SIGNIFICANCE

2.1 Landscape

2.1.1 Landscape context

The two main structural components of the property - the Dunstan Range and the Wether/St Bathans Ranges form a large part of a distinctive transitional landscape around the South Canterbury/North Central Otago regional boundary.

Three physical characteristics underlie the distinctiveness of the area. Firstly, the underlying geology changes from greywacke (typical of Canterbury) to schist (typical of Otago). The visible results of weathering and erosion differ between the rock types. Secondly, the St Bathans Range is an example of the fault-block mountains that gives this area its special character. Thirdly, high-altitude cirque glaciation and peri-glacial processes superimposed on the originally smooth planar dip-slopes of the uplifted peneplain have created a very special and distinctive upper range topography.

Within this broad physical context lie the two valleys that form the more immediate landscape context for Dunstan Downs - the Dunstan Creek and Longslip Creek/Lindis Pass valleys:

The Dunstan Creek valley is a large, well-defined, remote mountain valley with a remarkably homogenous grassland cover over the mid and upper valley sections. The valley appears very natural with few visible cultural elements especially on the St Bathans Range side and the upper part of the valley. The absence of fragmenting cultural elements enhances the sense of space. The high, steep scarp face of the St Bathans Range forming the long structurally even face on the east side of the valley is very impressive and is a major element giving the valley its special character. Cirque glaciation at the head of the valley, on the east side of the Dunstan Range is also distinctive.

Dunstan Downs comprises about one third of the total Dunstan Creek valley landscape and takes in most of the more dramatic and distinctive parts of the valley – the glaciated head of the valley; the St Bathans Range from Mt St Bathans northward; and the wide middle section of valley floor created by the more gently sloping to rolling lower slopes of the St Bathans Range, and the Dunstan Creek floodplain.

The mid to upper slopes of the St Bathans Range, from the Wether Range to well south of Mt St Bathans is also part of the basin landscape of the upper Clutha River area, an area roughly bounded by the Pisa Range, the Dunstan Mountains and the ranges to the north of Tarras. It is an enclosing range seen to the northeast, and, although distant, forms an impressive long mountain range backdrop from many viewpoints especially in winter when covered in snow.

The large and very impressive valley of Dunstan Creek dominated by the St Bathans Range is an extremely natural looking area with high coherence, intactness and legibility which together confer high inherent visual quality. It is a very distinctive discrete landscape with special visual character. Its main value lies in its "wholeness" – rarely are such large valleys with substantial lower altitude areas of easy terrain entirely free of development as this valley is. This characteristic also imparts a strong sense of "back-country" remoteness.

The Longslip Creek valley is an equally large but somewhat shorter and less well-defined valley. This valley, headed by the famed Lindis Pass, is the main inland route between Canterbury and Otago. The Lindis Pass has long been renowned for its scenic beauty. The whole valley has been identified as an Outstanding Natural Landscape in the Canterbury Regional Landscape Study (BMP and LA 1993). "The Lindis Pass area ... [is] among the best examples of tussock landscapes in the region and is probably the best known landscape of its kind in the country. Its landform and land cover are exceptional....". Dunstan Downs comprises virtually all of the east side of this valley and highway corridor, from its entry/exit point with the Mackenzie Basin to the Lindis Pass. Its importance lies in the fact that it is readily visible from a major highway and tourist route. Whilst not the most significant part of the valley landscape, the high, steep, planar slopes of the Dunstan Range with their mosaic of scree, talus and tussockland is visually fascinating and it is an ever-present and distinctive natural element of the landscape. The lower hills forming the immediate Pass landscape are also important as they are part of the iconic views of the Pass landscape.

The west side of the Dunstan Range is a highly visible landscape and a significant part of the SH8 visual corridor between the Birchwood Road turnoff and the Lindis Pass, particularly the mid to upper slopes which are considered to be of significant natural landscape value. The lower slopes and most of Killermont Hill although easily seen are not remarkable in any way and are strongly modified by AOSTD, burning and heavier grazing. The rectilinear lower slopes just north of McClays Creek are notable for their distinctive form and for the way they

allow full views of the range. The relict totara forest is a significant natural feature just north of McClays Creek.

The Lindis Face and much of the Lindis Hills landscape unit is an important part of the Lindis Pass landscape. This is a highly significant landscape of natural character, of national reputation and value. The Lindis Hills form the immediate landscape corridor to the east of the highway in this area. The Lindis Face forms the slightly more distant but very impressive mountain range backdrop and skyline. The very smooth planar form of the face with its mottled grey-brown surface is visually fascinating and contrasts with the scenery of the Lindis Pass itself, thus accentuating its character.

2.1.2 Landscape Description

2.1.2.1 Property Level Landscape Description

At the property level, seven landscape units can be recognised and are briefly described below.

1 Killermont Hill

This hill is a large, high, pyramid-shaped hill at the north end of the Dunstan Range. It straddles the transition zone between greywacke (north side) and semi-schist (south side). It is deeply, but coarsely dissected in radial fashion with steep-sided V-shaped gullies. Slopes are generally planar to broadly convex, rising to a broadly rolling smooth plateau summit reaching 1464m asl. A thick mantle of scree and talus covers the hill giving it a smooth surface. Visible patches of talus exist on the schistose southwest aspect.

The hill is mostly well-covered with vegetation. Depleted induced short tussock and "grey" shrubland with a significant exotic component including hieracium, Vipers bugloss, pasture grasses and sweet briar covers the mid to lower slopes. AOSTD is evident through the unnaturally extensive matagouri and sweet briar growth in some areas. Tall tussock covers the upper slopes and summit.

The hill is extensively grazed as one block. Small areas have been fenced off around the base of the hill to form deer paddocks. A water race has been constructed also around the base of the hill above the homestead. A TV transmitter is located at 950m on the northern boundary spur, with an inconspicuous 4WD (four wheel drive) track leading up to it. A 4WD track also winds up the valley on the south side of the hill to a prominent saddle in the range then traverses the range summit for a short distance.

2 Homestead Area

This is a small area less than 1 square km. This area has been completely modified, developed into the homestead area with paddocks of exotic pasture, stock yards and buildings. SH8 bisects the area.

3 Dunstan Range

The Dunstan Range runs southwest-northeast and rises to 1755m asl. The low to mid altitude area comprises a variety of landforms. The southern "upstream" end comprises a broadly convex planar surface merging smoothly with the steep slopes above. Small angular steep-sided gullies incise the surface. Longslip Creek has formed a short scarp at the lower end of the surface. The northern "downstream" end is more deeply dissected. The ridges are truncated at their lower ends, forming steep planar and often rocky slopes facing SH8.

The upper range slopes are steep and of planar form overall. The southern end of the range is moderately dissected with several shallow gullies. Gullies are much smaller and shallower over the north end of the range. An extensive mantle of scree and talus gives a smooth surface, typical of semi-schist areas. Rock outcrop is a minor element. The summit is typical of the range summits in the area, being mostly a broadly rolling to undulating plateau of irregular shape. Rock pavement is extensive and rock outcrop occasionally punctuates the smooth surface often forming pronounced knobs.

Snow tussock is the dominant vegetation cover on the summit and upper slopes. Dracophyllum and snow totara also form olive to rusty-brown mosaic patterns with dark grey stable scree and talus on the steep side slopes. Cushionfield and fellfield communities occupy the rock-paved summit areas. Mid-slope, the tall tussock grades into induced short tussock/hieracium, and grey scrub is a common element, in gullies. The lower country has also been AOSTD, resulting in a dark grey haze of dense matagouri growth in places and widespread presence of sweet briar as well as the seasonally green bands of exotic grasses and clover. A notable feature is a relict totara forest surviving on a large area of old scree and talus just north of McClays Creek.

The roadside alluvial surfaces at the base of the range have recently been ploughed out of short tussock. A small pine plantation has also been established on a low rolling spur in the valley between the northernmost high ridge and Killermont Hill. Willows line Longslip Creek.

The range is extensively grazed. The mid to lower slopes have been subdivided into several moderate-sized grazing blocks and AOSTD. A fence also runs along the crest of the range separating grazing from the Dunstan Creek valley. There is a grass airstrip north of McClays Creek. A power pylon line and associated access tracking traverses the base of the range, parallel to and just above SH8.

4 McClays Creek and Lindis Face

This unit comprises the discrete valley of McClays Creek and the side of the Dunstan Range below and west of Old Man Peak. McClays Creek is a large, deep, V-shaped stream valley with Old Man Peak (1826m asl) at its head. Its side-slopes are smooth and planar to broadly rounded. A thick mantle of colluvium covers the slopes, mostly dark grey stable scree and talus, and the slopes appear very smooth with only occasional small rock outcrops.

The Lindis Face, below Old Man Peak, is lumpy in places due to slumping in the thick mantle of colluvium that covers the slope.

Vegetation cover is predominantly rather open tall tussock with minor subalpine shrublands. Several brighter green to reddish seeps and bogs are a notable feature. The northern end of the Lindis Face has been AOSTD.

This unit is extensively grazed. A fence and 4WD track lead up to a telecommunications structure on Old Man Peak. A stock fence and 4WD track also run along the top of the Dunstan Range. The north end of the Lindis Face and the lower true left of McClays Creek are fenced off as part of a smaller grazing block that has been AOSTD. A power pylon line and associated access tracking follows the base of the Lindis Face.

5 Lindis Pass Hills

This unit comprises a complex area of dissected semi-schist hill terrain lying between McClays Creek/Lindis Face and the Lindis Pass and SH8. Topography in this unit is rolling to angular and more finely detailed than that of the Dunstan Range, with secondary dissection of primary slopes, typical of the Lindis Pass area. Vegetation cover is continuous over the ridge crests, also typical of the Lindis area. There are a few pale scars where slips have occurred.

A heavily modified mixed short and tall tussock grassland and grey shrubland are the main vegetation communities. Most of the area has been AOSTD and sweet briar is widespread. There is a marked fenceline effect, where healthy robust tall tussock lies west of a fence that runs north-south along the pylon route. Denser tall tussock covers the southern area.

The unit is divided into at least three semi-extensive grazing blocks. The road boundary is also fenced. The power pylon line and associated tracking provide conspicuous manmade intrusions.

6 St Bathans Range

This very long, north-south trending high mountain range forms the east side of the Dunstan Creek valley. Mt St Bathans (2088m asl) is the highest point along the range and forms the southeast corner of the property. The range is mostly a high, steep, west-facing scarp face of a large fault-block mountain, hence its impressively long and even overall form.

Tall tussock grassland provides the dominant vegetation cover on the mid to upper slopes. It typically forms streaky to patchy mosaics with scree and talus. Cushionfields dot the summit ridge along with sweeps of alpine tussock grasses. Dracophyllum is widespread and snow totara is present to a lesser degree.

On the lower slopes, tall tussock tends to grade into induced short tussock grassland.

Dry floodplains of the valley floor have a thin layer of mat and cushion species in amongst sparse stunted short tussock. Grey scrub is a common but minor component but generally the country has a very "clean" appearance.

7 Dunstan Range and Wether Range

This unit comprises the east aspect of the Dunstan Range and the west side of the Wether Range, ie, the head of the Dunstan Creek valley. The Dunstan Range is a high steep mountain range some 7.5km long. The crest is generally over 1700m asl with Old Man Peak at1826m asl. It converges with the Wether Range at its north end to form the head of the Dunstan creek valley. The Wether Range is a lower northward extension of the St Bathans Range. Both ranges are composed of low grade schist.

Both ranges are different in appearance to the St Bathans Range and the whole form of the valley they create is much narrower. The mid to lower slopes are steep and planar and the upper part of the range a broadly rolling plateau area.

The west side of the Wether Range is steep and planar with no cirque glaciation. Scree and talus is extensive, especially dark grey stable material, intermixed with vegetation.

Vegetation cover over this area is similar to that of the St Bathans Range, with a notably lesser presence of exotic species and grey shrubland. Bog communities and alpine

grasslands occupy the lumpy to rolling floors of the cirque basins. *Dracophyllum* is more extensive on the south and west aspects. There is also a greater proportion of mostly healthy alpine tussock on the Dunstan Range summit as well. The Wether Range crest mostly consists of rock and scree.

The Dunstan Creek valley is seasonally extensively grazed. The only cultural elements are two musterer's huts, a small set of stockyards, some fences (visually inconspicuous) and a 4WD track along the valley floor and up to Old Man Peak.

Exotic species particularly hieracium and browntop/sweet vernal are more widespread but overall the valley has a very natural appearance with the brown/gold/grey/red-brown colours of tussock grassland and subalpine shrubland visually dominant. A few scattered willows are the only trees in Dunstan Creek.

2.1.3 Visual Values

Visual values are a major component of overall landscape values and are closely to tied to the presence of other values (eg, ecological, geological/scientific). They are assessed in terms of inherent visual values and visibility.

2.1.3.1 Inherent visual values

These relate to what the landscape actually looks like, regardless of whether it is publicly visible. Attributes that contribute to high visual quality are:

- A high degree of perceived naturalness and intactness.
- Visual coherence (the degree to which the elements fit together including cultural ones).
- Legibility (the ability to clearly see the different elements and how they were formed).
- Visual distinctiveness/vividness and how memorable it is (unusual things or contrasting elements).

These attributes also underlie the special character or "sense of place" of an area. Whilst cultural patterns are often very important, the greater presence of indigenous (and especially endemic) flora and fauna and landforms in their natural state is particularly important in creating the special character of a place.
The whole of the Dunstan Creek valley and the mainly mid to high altitude areas of the Dunstan Range in the Longslip Creek/Lindis valley are the areas considered to have high inherent value.

The Dunstan Creek valley

Impressive visual simplicity is reflected the sheer scale and openness of this large discrete valley. The highly natural appearance significantly contributes to the high visual quality. There is high legibility and coherence to the landscape which allows landforms to occur in aesthetically pleasing uninterrupted rhythms and patterns. Tussock grassland has special inherent visual qualities to do with texture, uniformity, movement, the interplay of light and shadow across the land, and colour, especially when it exists over large areas.

The long and remarkably consistently structured, high steep scarp face of the St Bathans Range is visually very impressive, dramatic and distinctive, exemplary of the power of the geological forces that have formed this valley. The cirque basins and simple sweeping plateau summits have a distinctive and impressive visual character with many vivid visual

images. The texture of the shattered rock with its intricate pattern of lichens and mosses is visually interesting as are the patterns created by frost action in the rock pavement.

Excellent views are gained from the summit and main ridges not only of the valley itself but of the wider landscape of north central Otago, the Lindis/Ahuriri area and into the Mackenzie Basin.

The Longslip valley

Distinctive features include the large-scale simple planar form of much of range and the extensive mosaics of scree/talus, dracophyllum and snow tussock especially on the face below Old Man Peak (the Lindis Face). This is very characteristic of semi-schist. The sweeping concave profile of the range just north of McClays Creek with its smooth rectilinear lower slopes is visually impressive and memorable, compared to the more complex topography elsewhere and despite the pylon line and the effects of AOSTD. The remnant of totara forest situated on a large steep scree slope is another unusual and eye-catching feature, a visual highlight.

Various bogs and some of the larger wet seeps over the range are also features of interest, due to their contrasting vegetation forms and colours and the visual patterns they create.

Within Longslip Valley, the Lindis Pass area has long been recognised as an area of outstanding scenic value and is a Scenic Reserve in part. The Lindis Hills landscape unit of Dunstan Downs forms a large part of this Pass landscape and as such is generally of visual significance. Within this unit however there are certain parts that are considered to have high inherent visual value notwithstanding their situation within the Pass landscape.

The shady sides of the Lindis Hills have a high visual quality despite AOSTD. It is a discrete well-defined entity with a continuous mainly tall tussock cover which accentuates the finely-detailed gully-and-spur modelled surface. It is typical of the landforms that characterise the Lindis Pass area. It also appears very natural apart from the seasonal green hue as there are no tracks or fences to mar the surface.

The plateau area on the south boundary of this unit also has high visual quality due to its unusual and well-defined shape, enhanced by the uniform tussock cover. It is contiguous with the Lindis Face of the Dunstan Range. Whilst parts of this area have been recently burnt with associated degradation of visual quality, other parts retain a dense tall cover of tussock whose high inherent visual qualities add to the overall visual value of the plateau area. The presence of the pylon line and especially the associated tracking is visually intrusive, although by following a natural break in the topography it fits in reasonably well.

2.1.3.2 Visibility from Public Places

The visibility of a landscape or feature from public viewpoints especially major highways, scenic routes and recreational areas determines visual significance. Visual values exist regardless of whether the area is viewed by the general public, but those landscapes that are more regularly seen from public areas will have more values for more people and be significant in forming the more widely held view of the landscape.

The most significant views of the property are those from SH8 and SH6. Very few parts of the Lindis Landscape Compartment are hidden from view from SH8. In contrast large parts of Dunstan Creek Valley are not publicly visible. The mid to upper slopes and crest of the St Bathans Range are distantly visible from SH8 and SH6 in the vicinity of Tarras.

Views from SH8 in the Lindis Landscape Compartment

SH8 forms the western margin of the property between the homestead and the Lindis Pass, a distance of around 16km. Travelling north, the first views of the Dunstan Range are gained from the highway at a point about 2km west of the Lindis Pass, on the Otago side. On rising to the Pass, the range forms an impressive large mountain backdrop to the lower ridges in the foreground. It is an appropriate climax to an increasing sense of subalpineness and naturalness gained on travelling up the Lindis River valley to the Pass. Its large scale smooth faces, extensive scree and talus and rounded plateau summit contrast with the finely detailed, sharp-crested, tussock-covered Lindis Pass hills each enhancing the other. The visual mosaic pattern of vegetation and scree is fascinating.

At the Pass itself, where there is a well-used formal pull-over area, the views of Dunstan Downs country are more restricted, owing to the long northeast trending ridge of Double Peak in the near ground. The large hill in in the Lindis Hills landscape unit is a prominent element is this view because of its large bulk forming a skyline, it is central in the view, and the long spur off Double Peak leads the eye straight to it. It remains visually prominent in views from the highway as one travels north.

North of the Pass, the Lindis Hills landscape unit forms the immediate visual corridor on the east side. Brief views of the Dunstan Range are gained up the small valleys between the hills. Lower down, extensive views of the Dunstan Range are gained from the highway. The eye is drawn naturally to the gently undulating crisp skyline and to the upper slopes with their mosaic of grey rock and brown vegetation. Several full views of the range from top to bottom are gained between McClays Creek and a point about 2km to the north where the lower slopes flatten out. The lower coarsely ribbed slopes along the west side of McClays Creek are visible along with a portion of broad rounded slope at the head of the valley. The relict totara forest is clearly visible from the highway and is an unusual feature of visual interest.

Much of Killermont Hill is visible as the highway passes around close to its base, with the pylon line lying between the viewer and the hill. Most of the hill lacks any significant visual quality in respect of views from the road, the only areas of visual interest being the skyline and the higher snow tussock/scree-covered slopes. It is perceived as a discrete natural entity however free from tracking and fencing scars. This is best appreciated from the last kilometre or so of the Birchwood Road, from which one looks directly up at the hill.

Lindis Pass Landscape

The landscape to either side of the Lindis Pass has long been regarded as very special and even unique for its scenic qualities level. The Lindis Pass area was identified as an Outstanding Natural Landscape in the Canterbury Regional Landscape Study (BMP and LA 1993) and in the Central Otago District Plan. The outstanding visual qualities of the area include the complex, finely-detailed spur and valley topography superimposed over an older, larger scale ridge and valley landscape and the uniform cover of tussock grassland. It is also highly valued because it is a rare visual experience. There are few tall tussock areas next to and so easily accessible from a state highway within the South Island. The Lindis Face is also important to the Pass landscape because of the way it visually contrasts with it (thus accentuating its qualities) and because of its high inherent value.

Views from Other Roads

The St Bathans Range forms an impressive backdrop to views across valley floor farmland and the lower Chain Hills from SH8 between Georges Flat/Long Spur Creek and Tarras; from the Luggate-Tarras Road; and from part of the Luggate-Cromwell Road (SH6).

The range is visually distinctive - its long even aspect with a very gentle convex skyline form culminating almost imperceptibly in Mt St Bathans is quite different to any other range. It is also distinctive for its homogeneity in landform and vegetation cover and for its highly natural appearance over such a length of range (more than 20km). Although distant relative to views from highways, the St Bathans Range is a significant high mountain range giving enclosure to the upper Clutha basin especially in winter when covered in snow.

Similar views are gained from certain viewpoints along SH8 between Tarras and Georges Flat. The range can be seen over low points and through gaps in the hills lying east of the highway including the Chain Hills. These are still distant views (around 20 km away) with narrow vistas because of the intervening hills. The range loses little of its visual impressiveness and imparts a sense of mystery and intrigue as to what may lie beyond the nearer hills.

2.2 Landforms & Geology

Dunstan Downs comprises two mountain ranges - the Dunstan Range and the Wether/St Bathans Range. It also includes a smaller area of hill country in the vicinity of Lindis Pass. The ranges are part of the distinctive fault-block mountain range landscape that forms the transition from Canterbury greywacke to Otago schist. They are also distinctive for their cirque glaciation and peri-glacial features. Fluvial and slope processes have shaped the land at mid to lower altitudes.

Landforms

The landforms on the property can be grouped into six geomorphic units: *St Bathans Range, Dunstan Range (East Side), Dunstan Range (West Side), Killermont Hill, Ahuriri Terraces, Lindis Hills.*

St Bathans Range

The St Bathans Range and its northern extension, the Wether Range, is a large and long (about 30km in total) fault-block mountain range running north/northwest to south/southeast forming the east side of the Dunstan Creek valley. It is comprised of non-foliated, quartzo-feldspathic semi-schist of the Haast Schist Group, Chlorite Subzone 2, with phyllite and marble. The range has a broadly convex summit profile, rising in the middle to its highest peak, Mt St Bathans at 2088m asl. North of Mt St Bathans, the range crest is mostly over 1700m asl.

The summit of the Wether/St Bathans Range is distinctive. It is a remnant of the ancient uplifted peneplain, explaining its flat to broadly rolling plateau form of variable width. It is broadest over the northern half, and narrows over the higher southern half, where cirque glaciation on the east side has eaten back into the crest. Along the undulating crest, especially in the southern section are regularly spaced rocky knobs. Peri-glacial processes have been active in the past on the summit, reducing rock tors and outcrop that would have featured on the peneplain to a deep mantle of angular fragments of shattered rock. Most fragments have been worked by subterranean ice to lie flat, forming a remarkably even rock pavement. Occasionally the rocks stand on end or edge in lines or little groups. Stone patterning is an distinctive feature of the surface, where the rock fragments are formed into lines ("drains") and polygons ("nets").

The west side of the range is a long, high and very steep scarp face of a large uplifted block of ancient peneplain which slopes away gently to the east from the flattish summit. The active fault controlling the fault-block runs in a slight southeast-northwest alignment through

the Dunstan Creek valley, lying between 500 and 1500m east of the creek. It passes under the creek and runs up Old Man Peak.

The western face of the range has a broadly concave profile. The upper slopes are very steep and planar, and thickly mantled in colluvium which gives a smooth surface. Talus and scree are extensive and typical of semi-schist terrain. Bedrock exposure and rock outcrop is common especially along the summit. Mid-altitude terrain is of more moderate slope and consists of planar to rolling to lumpy landforms. The range face has been subjected to mostly shallow to moderate fluvial dissection along it length, with generally straight to simply branched gullies regularly spaced along the range separated by angular to rounded spurs and planar triangular faces.

The valley floor comprises gently angled lower colluvial slopes and fans, and the flat floodplain of Dunstan Creek which varies from less than 100m wide to nearly 700m at the widest part. Two parallel and off-set bands of gravels laid down in the last glacial periods underlie the gentler lower valley floor. In the widest part of the valley a band "Ranfurly" gravels from the last glacial period run parallel and close to the creek. A similarly sized band of weathered rusty-brown gravels from the older "Drybread" glacial advance (penultimate or older advance) lie above the Ranfurly gravels. Dunstan Creek itself is a clear boulder and gravel-bottomed creek several metres wide, flowing within a well-defined meandering channel incised in former floodplain. Previous courses and minor streams form sinuous channels in the floodplain surfaces, and on some surfaces, the braided wind-generated mound-and-hollow micro-topography typical of outwash surfaces is evident.

Dunstan Range (East Side)

The east side of the Dunstan Range forming the upper west side of the Dunstan Creek valley, is also a high steep mountain range comprised of semi-schist. It runs southwest-northeast for around 13km, the northern 7.5km being within *Dunstan Downs*. Its summit is slightly lower overall than the St Bathans Range, falling as low as 1400m asl at saddles. Its highest point is Old Man Peak at 1826m asl. The range continues south to become the Chain Hills, and to the north it converges with the Wether Range to form the head of the Dunstan Creek valley. It is distinguished by cirque glaciation that has shaped its upper slopes. Four large cirque basins lie side by side north of Old Man Peak and several shallower, less well-developed basins form the upper slopes at the northern end and the head of the valley. The cirque basins drop away into large deep V-shaped valleys separated by large rounded spurs. The lower slopes of the range and the valley side-slopes are large, steep and planar to broadly rounded. Glacial erosion is possibly the cause of the planar main valley slopes and the truncated spurs. The general profile of the Dunstan Range is opposite to that of the St Bathans Range, being broadly convex. The original peneplain surface forms the generally flatter upper slope form, and steeper erosional slopes form the lower part of the range.

Dunstan Range (West Side)

The west side of the Dunstan Range is similar to the St Bathans Range overall, being high, steep and generally planar in form with a west-facing concave profile and extensive scree and talus over the higher slopes and summit. Rock outcrop and exposure is less common. The deep colluvium mantle produces generally smooth surfaces on the slopes.

The Lindis Face, below Old Man Peak, shows slumping of the thick mantle of colluvium giving a hummocky micro-topography. Four Late Quaternary fault traces exist on this face. One lies just below Old Man Peak and is possibly manifested in it's two prominent knobs. Two others lie at the base of the range, one marked by a bench with "sag ponds" to the

south of the boundary at Dip Creek. The fourth angles up across the face for about 1200m towards the north end, visible as a thin line of distortion.

McClays Creek is a large, deep north-flowing stream valley formed in the range face to the north of Old Man Peak. Its side slopes with a coarse scale of secondary dissection are of similar appearance to the rest of the range.

Killermont Hill

This is a large steep-sided pyramidal hill at the north end of the Dunstan Range rising to 1464m asl. The hill straddles the transition from Torlesse greywacke to Haast semi-schist and is thus composed of both these rock types. The greywacke is predominantly dark grey and associated with black argillite. The hill is deeply but coarsely dissected in radial fashion with steep-sided V-shaped gullies, the larger ones with inter-locking spurs. Slopes are generally planar to broadly rounded and rise to a broadly rolling tussock-covered plateau summit. A thick mantle of scree and talus cover the slopes, giving the generally smooth surface. Bare colluvium is less extensive than on the Dunstan Range and large patches of talus lie across the higher southwest flank. Rock outcrop is a minor component and localised.

Ahuriri River Terrace

Two small areas of alluvial gravels underlie the homestead area at the northern tip of the property. South of SH8, under Killermont Hill, there is a small elevated remnant of fluvio-glacial gravels of "Aviemore" age. It is separated by a weathered vegetated scarp from adjacent old river gravels of the Ahuriri river. These lie on the north side of the road, forming an elevated pasture-covered terrace well above the modern Ahuriri river bed.

Lindis Hills

This unit comprises a complex area of more finely detailed, dissected semi-schist hill terrain lying between the Lindis Face/McClays Creek and Longslip Creek/SH8.

2.3 Climate

The climate is semi-arid with warm, dry summers and cold winters. The rainfall increases with altitude from about 500 mm at the homestead to an estimated 1600 mm on top of the ranges. Snow falls on the high St Bathans and Dunstan Ranges at any time of year and forms a near continuous cover for at least 4 months. The tops are exposed to high winds resulting in snow accumulation on leeward slopes in cirques with patches often remaining into late summer. The frequent winds also mean the tops are exposed and the conditions are harsh for the plants and animals living there.

2.4 Vegetation

The primary vegetative cover of the Dunstan Downs Pastoral Lease is tall tussock grassland with narrow-leaved snow tussock (*Chionochloa rigida*) at lower levels and slim-leaved snow tussock (*Chionochloa macra*) above. This has been modified by burning and grazing, and by over sowing and topdressing below about 1100 m so that the lower slopes are a mixture of tall and short tussockland with an increasing adventive component towards the valley floor. Small areas of red tussockland dominated by *Chionochloa rubra*, are found on the Longslip valley floor, along SH 8, together with patches of shrubland. Remnant montane shrublands are found in Dunstan Creek and McLays Creek and Halls totara forest occurs in McLays Creek area with minor remnants on boulderfields on northwest faces further north. McLays

Creek also contains an important *Olearia* shrubland. Small areas of subalpine snow totara and *Dracophyllum* shrublands are found at higher altitudes with a scattering of shrubs appearing in the tall tussockland. A few specialised plants occur on screes with cushion and fellfield plant communities occupying the broad, exposed summit areas and ridge tops. Wetlands and bogs tend to be found on the Dunstan Range and along the Dunstan Valley floor. Although modified by past activities and with much hawkweed, especially on parts of the valley floor, the Dunstan Valley still has a largely natural look with native tussock species dominating all communities and tall tussock descending to the valley floor.

Montane Forest – Halls totara (Podocarpus hallii)

An extensive area of shrubland occurs on an old shingle fan on the lower west face of the Dunstan Range on a small tributary of McLays Creek. The bouldery centre of this fan is occupied by a significant grove of Halls totara. The shrubland acts as a protective barrier from stock. Halls totara extends uphill to about 1150 m and the associated mountain toatoa (*Phyllocladus alpinus*) continues up to about 1300 m, all on boulderfields above the creek bed. Snow totara (*Podocarpus nivalis*) is common around the edges with associated species wild gooseberry (*Ribes uva-crispa*), golden speargrass (*Aciphylla aurea*), narrow-leaved snow tussock, mountain fescue (*Festuca mathewsii*) and the fern *Hypolepis millefolium* on the higher boulderfields, together with a diverse range of shrubs associated with the lower forest area.

One or two small patches of Halls totara are also found on boulderfields further north on the slopes of the Wether Range but are not associated with shrublands.

Montane Shrublands

Montane shrublands are found scattered across the lower slopes, on boulderfields and down many streambeds on the Wether, Dunstan and St Bathans Ranges. They also occur on the valley floor of Dunstan Creek and McLays Creek. Matagouri (*Discaria toumatou*) is the dominant species at most sites with *Coprosma propinqua, Melicytus alpinus,* sweet brier (*Rosa rubiginosa*) and the creepers *Muehlenbeckia complexa* and *Rubus schmidelioides*). *Olearia odorata,* native broom (*Carmichaelia petriei*) and golden speargrass (*Aciphylla aurea*) are often present. Damp sites as in Dunstan Valley, may also have *Olearia bullata* present. Coral broom (*Carmichaelia crassicaule*) occurs mainly as scattered plants on boulderfields, in tussockland and sporadically in shrubland.

The most interesting and diverse shrubland is found in the lower McLays Creek. Here on a steep, rocky, toe slope grows the rare tree daisy *Olearia fimbriata.* It is listed in the Threatened and uncommon plants of New Zealand (de Lange et. al. 1999) as Declining. Many large trees are growing at this site and some regeneration is occurring. Other trees and shrubs on this hill slope include *Coprosma propinqua, Coprosma* sp. aff. *parviflora, Olearia odorata, Olearia bullata, Corokia cotoneaster, Hebe rakaiensis,* matagouri, mountain wineberry (*Aristotelia fruticosa*), native broom and the climbers, *Muehlenbeckia australis, M. complexa* and the bush lawyer *Rubus schmidelioides.* Along the stream edge below, in a continuation of the shrubland is *Coprosma intertexta*, also listed in the Threatened and Uncommon plants list as Naturally Uncommon, Sparce. This was the only recording of this plant on Dustan Downs but it is present in the upper Manuherikia valley and was recorded on Twin Burn and Berwen Pastoral Leases. Two large Halls totara also grow here. This diverse shrubland spreads across to the Halls totara forest on a nearby fan, where sweet brier becoming more common.

Silver tussock (*Poa cita*), hard tussock (*Festuca novae-zelandiae*) and introduced grasses and herbs clothe the open spaces. The invertebrate life is likely to be high in this shrubland with *Olearia* species recognised as being host for a large number of specialist invertebrates.

These shrublands and the podocarp forest species (Halls totara, mountain toatoa) are representative of plant communities that were once widespread in the district and that have been severely reduced in area by fire and grazing (McGlone, 1998).

Native lizards (skink and gecko species) are common in the stony shrublands and on screes.

Sub Alpine Shrublands

At higher altitudes, mainly on south and east facing stony or rocky slopes, *Dracophyllum pronum* forms a low, open shrubland often in association with cushion plants. The larger *Dracophyllum uniflorum* is uncommon and mainly occurs as scattered shrubs in tall tussockland. Other shrubs in the sub alpine tussockland include cottonwood (*Ozothamnus fulvida*), coral broom, native broom, *Leucopogon suaveolens* and the scrambling coprosma, *Coprosma cheesemanii.* Around the edges of boulderfields, on the St Bathans Range in particular, grow snow totara, *Coprosma ciliata, Olearia cymbifolia* and dwarfed mountain toatoa.

Introduced grassland and mixed introduced/native grassland

Development on Dunstan Downs appears to have been confined primarily to the north-western faces of the Wether Range and the rolling hill country and north-west faces of the Dunstan Range that are both readily accessible from SH 8. Burning, oversowing and top-dressing has modified the native plant cover and severely reduced the shrublands along these areas. The introduced grasses, sweet vernal (*Anthoxanthum odoratum*) and browntop (*Agrostis capillaris)* with cocksfoot (*Dactylis glomerata*) and other introduced grasses and clovers, are prominent along the lower slopes below about 900 m and dominate these areas in places. Hard tussock (lower slopes) or mountain fescue (higher slopes) with blue tussock (*Poa colensoi*) and *Rytidosperma pumilum* as well as several small native shrubs and herbs including *Gaultheria novae-zelandiae, Leucopogon fraserii, Muehlenbeckia axillaris, , Raoulia subsericea, Bulbinella angustifolia, Deyeuxia avenoides, Helichrysum filicaule, Ranunculus multiscapus,* harebell (*Wahlenbergia albomarginata*), *Celmisia gracilenta* and *Geranium sessiliflorum* are generally present and often dominant. Mouse ear hawkweed (*Hieracium pilosella*) is generally present as is sheep's sorrel (*Rumex acetosella*). Hawkweeds, particularly mouse ear, but also king devil (*H. praealtum*) and to a lesser extent, tussock hawkweed (*H. lepidulum*) are prominent throughout the lower country and present to some degree in most communities including some of the upper fellfield and cushion plant communities. Patches of matagouri and sweet brier are often present also. Red tussockland occupies small areas of the wetter gully floors close to SH 8, generally with introduced grasses and herbs present and silver tussock can be important on disturbed sites such as farm track edges and riparian areas. Narrow-leaved tussock appears above about 800 m with scattered plants down to the road edge in places and it dominates the plant community above about 900 m.

Grassy areas dominated by introduced grasses exist amongst the tussockland and along the alluvial river terraces in the Dunstan Creek valley but the introduced grasses only dominate over small areas amongst the otherwise native plants communities. Mouse ear hawkweed is generally prominent on the valley floor.

Short tussock grasslands

The short tussockland dominated by hard tussock with blue tussock and *Rytidosperma pumilum* occurs at all lower altitudes and particularly on the valley floor of Dunstan Creek.
In places the hard tussock is 60-80 cm tall and dense, with silver tussock and brown top. In more open areas, mouse ear hawkweed is often the dominant inter-tussock species with

sweet vernal and white clover also common. Native species associated with the short tussock community include a number of herbs, grasses and small shrubs such as patotara (*Leucopogon fraserii*), *Coprosma petriei, Muehlenbeckia axillaris, Pimelea oreophila, Raoulia subsericea, Acaena inermis, Anisotome flexuosa, Brachyscome sinclairii,* harebell (*Wahlenbergia albomarginata*), native violet (*Viola cunninghamii*), *Geranium sessiliflorum, Celmisia gracilenta, Scleranthus uniflora, Luzula rufa, Rytidosperma pumilum, Blechnum penna marina,* lichens and mosses.

Off the valley floor, hard tussock is replaced by mountain tussock. This community covers all lower slopes and drier ridges up to about 1200 m usually with scattered patches of narrow-leaved tussock and open, stony areas. Mountain tussock can have an 80% cover on good sites. Associated plants include *Coprosma petriei, Raoulia subsericea, Anisotome flexuosa, Brachyscome sinclairii,* harebell, narrow-leaved tussock, blue tussock, *Bulbinella angustifolia, Geranium sessiliflorum, Celmisia gracilenta, Scleranthus uniflora, Blechnum penna marina, Luzula rufa, Rytidosperma pumilum, Gaultheria novae-zelandiae,* mosses and lichens. *Celmisia lyallii* and golden speargrass are prominent in places with *Dracophyllum pronum* on rocky or stony sites. Mouse ear hawkweed is present providing up to 20 % cover in open situations as on the lower St. Bathans faces. King devil and tussock hawkweed are sporadically present.

Blue tussock dominates in places, mainly at higher altitudes where it forms a mosaic with slim-leaved tussock. A typical community at 1500 m on the Dunstan Range has a blue tussock cover of 40-50%, rock 30-40%, mountain tussock 5%, slim tussock, sheep's sorrel, golden speargrass, *Rytidosperma pumilum, Agrostis muelleriana, Pimelia prostrata, Dracophyllum pronum, Raoulia subsericea, Lycopodium fastigiatum, Carex wakatipu* and *Celmisia viscosa.*

Tall tussockland

Above about 1000 m tall tussock is the dominant plant community with the narrow-leaved snow tussock dominating at lower altitudes, below about 1400 m but up to about 1500 m on sunny slopes and frequently, right down to the valley floor. Slim-leaved snow tussock occupies the high altitude areas. In places the two grow together and hybrids between the two species are numerous here.

A typical association in the Dunstan valley at about 950 m has narrow-leaved tussock and/or slim-leaved snow tussock and hybrids dominating tall mountain fescue patches of mouse ear hawkweed, *Raoulia subsericea* and bare ground. Occasional matagouri, the native and coral brooms, and numerous native species are present including blue tussock, golden speargrass, patotara, *Scleranthus uniflorus, Pimelea oreophila, Bulbinella angustifolia, Lagenifera cuneata, Brachyglottis haastii, Leptinella pectinata, Luzula rufa, Geranium sessiliflorum, Celmisia gracilenta, Anisotome flexuosa,* harebell *Coprosma cheesemanii, Elymus solandri, Acaena inermis,* mosses and lichens. Adventive species include sweet vernal, white clover, tussock hawkweed, sheep's sorrel (*Rumex acetosella*), cats ear (*Hypochaeris radicata*), and Yorkshire fog (*Holcus lanatus*). At 1200 m, the foot of the steeper hill slopes where the ground is more stony and soils thinner, snow tussock cover (both species often present) still dominates with mountain fescue, mouse ear hawkweed, patotara, sweet vernal, golden speargrass, *Raoulia subsericea, Pimelea oreophila, Anisotome flexuosa, Lagenifera cuneata* and *Gaultheria novae-zelandiae.* A steep (45°), stony, west to northwest facing slope at 1300-1400 m contains good narrow-leaved tussock, rock/stones, mountain fescue, blue tussock, patotara, golden speargrass, *Raoulia subsericea, Celmisia gracilenta, Anisotome flexuosa, Scleranthus uniflorus, Leucopogon suaveolens, Pimelea oreophila, Brachyglottis bellidioides, Epilobium atriplicifolium, Geranium sessiliflorum, tussock* hawkweed, sheep's sorrel, cats ear and mouse ear

hawkweed. On a rocky ridge matagouri is present with the small blue-flowered hebe, *Hebe pimelioides.*

On the Dunstan Range at 1200 m where the soil is deeper, narrow-leaved tussock is dominant and associated species include *Celmisia lyallii*, Raoulia subsericea, Rytidosperma pumilum, mountain tussock, *Anisotome flexuosa, Kelleria dieffenbachii, Gaultheria novae-zelandiae, Scleranthus uniflorus, Pimelea oreophila, Luzula rufa,* sheep's sorrel, tussock hawkweed and occasional *Celmisia viscosa.* A nearby ridge top had been burnt and contained a few tall tussocks but mountain tussock dominated. At 1400 m slim tussock dominates with a similar community to the above. A sheep camp on a rocky east face at 1700 m has severely cropped slim-leaved tussock with sheep's sorrel, *Melicytus alpinus, Scleranthus uniflorus, Raoulia grandiflora, Epilobium tasmanicum, Rytidosperma pumilum, Carex wakatipu, Blechnum penna-marina, Geranium sessiliflorum, Taraxacum magelanicum, Neopaxia sessiliflora,* moss, violet and blue tussock. A steep, rocky, south slope contains a mosaic of slim tussock, rock, *Dracophyllum pronum, Celmisia lyallii,* blue and mountain tussock. A stony, north-west face at 1400 m had narrow-leaved tussock, rock, mountain fescue, blue tussock, golden speargrass, sheep's sorrel, tussock hawkweed, *Scleranthus uniflora, Celmisia lyallii, Pimelea oreophila* with scattered coral broom. Narrow-leaved tussock communities occur where sufficient soil has accumulated, as isolated patches in vast screes or boulderfields.

South faces tend to have a denser tussock cover (60-80%) and less open ground (c. 10%) than north or west faces (tussock 25-60%, stones/rock 25-50%). On the exposed ridge crests there is a mixed community of slim-leaved snow tussock, cushion plants and open blockfield or fellfield (finer, stones).

Wetland and bog communities

Wetland and bog communities are found along the Longslip and Dunstan Creeks and adjacent areas, on flush zones on hill slopes in occasional gullies and in small cirque basins along the Dunstan Range. The montane wetland communities are made up of a variety of rushes, sedges, grasses and herbs, some of which are adventive. They include, *Carex secta, Carex coriacea, Carex kaloides, Schoenus pauciflorus, Bulbinella angustifolia, Elaeocharis acuta, Hydrocotyle hydrophila, Ranunculus foliosus, Epilobium macropus, Potamogeton cheesemanii, Lemmna minor, Juncus articulatus, Juncus conglomeratus, Mimulus guttatus* and Yorkshire fog. The tiny sedge *Carex capillacea*, classified as Naturally Uncommon, Sparce, in the Threatened and uncommon plants of New Zealand list (de Lange et.al.1999) was found in the lower Dunstan Creek.

Flush zones are generally dominated by comb sedge (*Oreobolus pectinatus*) and/or *Schoenus pauciflorus* with mosses, liverworts and small native plants such as *Coprosma atropurpurea, Euphrasia dyeri, Utricularia monanthus, Epilobium komarovianum, Gaultheria parvula, Isolepis aucklandica, Carex gaudichaudiana* and *Nertera balfouriana.* On shallow slopes comb sedge bogs are not uncommon with a similar range of species including *Abrotenella caespitosa, Lagenifera barkeri, Pratia angulata, Agrostis pallescens, Deschampsia chapmanii, Ranunculus cheesemanii, Ranunculus gracillipes, Brachyscome* sp. rhizomatus, *Luzula leptophylla, Bulbinella angustifolia, Uncinia divaricata, Psychrophylla obtusa, Colobanthus apetalus, Neopaxia sessiliflora, Gonocarpus micranthus, Luzula" tenuis", Gnaphalium laterale,* and *Celmisia* sp. "rhizomatus".

The most extensive and richest wetland was in the cirque basin just to the east, under Old Man Peak. This area contained most of the species already mentioned as well as *Ourisia caespitosa, Celmisia sessiliflora, Epilobium minutiflorum, Ranunculus royi, Plantago lanigera* and *Plantago triandra.*

Alpine Cushion vegetation of fellfield and snow banks

Cushion plant communities occur on most ridge tops where the soil is thin or skeletal and the area exposed to the wind. The plants here include *Dracophyllum muscoides Dracophyllum pronum, Raoulia hectorii, Hectorella caespitosa, Chionohebe thompsonii, Craspedia lanata, Kelleria villosa, Leptinella pectinata* var. *villosa, Luzula pumila, Chionohebe densifolia, Celmisia sessiliflora, Ourisia glandulosa, Acaena saccaticupula, Phyllachne colensoi, Epilobium tasmanicum, Rytidosperma pumilum,* blue tussock and *Brachyscome "montana".* Large patches of *Celmisia viscosa* are prominent on some fellfield areas. In places, where the soil is deeper such as in small hollows, slim-leaved snow tussock forms patches. A diverse, mounded cushionfield occurs on the saddle north of Old Man Rock where blue tussock dominates and *Dracophyllum muscoides*, *Raoulia hectorii* and many other plants are present.

Other plants found on the stony or rocky ground are Hebe *pinguifolia, Schizeilema hydrocotyloides, Colobanthus buchananii, Poa buchananii, Poa lindsayii, Raoulia youngii, Agrostis muelleriana, Luzula traversii, Celmisia laricifolia,* and *Raoulia grandiflora.* Lichens are often prominent

Snow banks are not extensive and contain a similar cushion plant community but with fewer species present. *Celmisia sessiliflora* is prominent with *Celmisia haastii* and several tiny plants such as *Lobelia linnaeoides, Plantago lanigera, Euphrasia zealandica* and several mosses and lichens.

Blockfields, scree and rock outcrops

The higher ridge and spur crests often contain much rock with patchy snow tussock and cushion vegetation or frost shattered blockfields with scattered cushion plants and tufts of slim-leaved snow tussock. Among the angular stones and rocks are found *Dracophyllum muscoides, Raoulia hectorii, Luzula pumila, Poa colensoi, Dracophyllum pronum, Phyllachne colensoi, Hebe buchananii, Anisotome flexuosus* and several lichen species. *Raoulia petriensis* occurs sporadically along the top of the St Bathans Range. The small scree hebe, *Hebe haastii* var. *humilis* forms occasional small populations. Large areas contain virtually no plants at all although the rounded, orange mounds of the compact speargrass *Aciphylla dobsonii* is dotted about the summit plateau of the St Bathans Range. Specialised scree plants include *Ranunculus haastii,* rare in this area, *Ranunculus crithmifolius* and *Epilobium pychnostachyum.* Rock outcrops provide habitat for plants such as *Celmisia angustifolia, Celmisia densiflora,* which is also found in rocky tussockland, *Koelaria cheesemanii, Luzula traversii* and *Epilobium porphyrium.*

Evaluation

The Lindis Pass Scenic Reserve adjoins the northwestern edge of the property. Its vegetation is similar to the adjacent Dunstan Downs land. Both have been modified by burning and grazing but still have native plant communities dominating the vegetation. The greatest development has taken place along SH 8 where over sowing and top dressing has occurred and adventive species are prominent and dominant on most flat land. Most land above about 900 m has a dominant native cover even though hawkweeds are common to higher altitudes.

Small areas of red tussock occur in wet gullies along the Longslip Valley floor with associated adventive species.
The whole of the Dunstan Creek catchment and upper Dunstan Range has a very good cover of native plant communities typical of the region with a variety of habitats and altitudinal sequences. Although the valley floor and lower slopes are modified in places, with

hawkweed being common, the overall impression is of a dominant native plant cover which would tend to increase with the cessation of burning and grazing.

Shrublands show the most modification and have contracted significantly with the development of the land so they are mainly remnant, riparian strips and local matagouri dominated patches. Sweet brier is only common along the lower Dunstan and Wether Range slopes but not common in the Dunstan Creek valley. The best shrublands are found in the lower part of McLays Creek, adjoining the Halls totara forest and extending well upstream. Here is found the rare and threatened tree daisy, ***Olearia fimbriata*** in diverse shrubland with ***Coprosma intertexta,*** (listed in the Threatened and Uncommon plants list as 'naturally uncommon'). The three *Olearia* species that occur in the lower shrublands are recognised as providing important invertebrate habitat and the shrublands generally have important natural values both as a community in their own right and for the invertebrate, lizard and bird life that they support.

The **Halls totara** together with snow totara and mountain toatoa form an important remnant plant community. They are part of a community that was once much more widespread (McGlone 1998). McGlone envisages a pre-Maori vegetation for the Mackenzie country of a complex mosaic of forest, scrub, shrubland and grassland determined by aspect, slope stability, soil fertility and moisture and local site climate. Mountain toatoa, bog pine (*Halocarpus bidwillii*), Halls totara together with, snow totara and other small trees and grey scrub species (matagouri, *Olearia, Aristotelia, Melicytus, Coprosma, Corokia, etc*) probably formed the dominant vegetation of the dry inland basins and adjacent mountain slopes such as those of the Dunstan, Wether and St Bathans Ranges.

Much of the summit plateau is fellfield and rockfield or boulderfield with sparce or scattered vegetation. Large, generally coarse, screes descend the upper slopes of the St Bathans Range and these have only a few specialised plants growing on them. Typically, aspect is important with the cooler south and easterly faces having a more diverse and denser plant cover than the drier, sunny north and west faces. The stony nature of these mountains with their thin soils and dry climate ensures that much of the tall tussock community, in particular, is quite open with a relatively low plant cover. ***Raoulia petriensis*** is another special plant found here but is not common, occurring sporadically in stable blockfields and fellfield. Its type locality is Mt. St. Bathans. A small, creeping plant in the Scrophulariaceae family was seen on the edge of the cushionfield near Old Man Peak, but not collected for identification. This was the only area in which it was seen so needs to be identified as it may be special.

The scree buttercup (*Ranunculus haastii*) occurs in very small numbers and is highly palatable as is the threatened scree pea (*Montigena novae-zelandiae*), which was not seen on this survey but is likely to occur in low numbers on the St Bathans Range. Coral broom occurs as scattered plants in the tussockland and on boulderfields.

Wetlands are generally small and uncommon. All are valuable for their intrinsic value, as part of the diversity of the mountain lands and for the diverse flora that they contain. ***Carex capillacea*** is a tiny sedge listed in the threatened and uncommon plants list and is found in one of the lower valley wetlands.

2.5 Fauna

2.5.1

Observations by some of the field team were made at the time of the tenure review survey and notes made by ornithologists over the last 15 years list a total of 28 bird species found on Dunstan Downs. For the endemic and native species the main habitats these birds are found in are the Dunstan Creek and Longslip Creek riverbeds and associated flats (black-

fronted terns, black shag, banded dotterel, paradise duck, welcome swallow, black-billed gull), the cirque basins and tops (banded dotterel, falcon, Pied oystercatcher), and in valley floor shrublands (pied fantail, silvereye and grey warbler). Pipits and skylarks are found across the whole property, and New Zealand falcons are occasionally seen over the property.

2.5.2 Reptiles

Four species that are known from this property are the common grey gecko (*Hoplodactylus* aff. *maculatus* 'Southern Alps') in rocks, scrub and screes, the common skink (*Oligosoma nigriplantare polychroma)*, spotted skink (*Oligosoma linneoocellatum)* and McCann's skink *(Oligosoma maccanni)*.

2.5.3 Fish

A total of 4 freshwater species are known from the property, two endemic and two species of introduced fish, however it is likely that other species may be uncovered with a more extensive investigation. These were the Canterbury galaxiid (*Galaxias vulgaris*) and the upland bully (*Gobiomorphus breviceps*). Both were not common in any stream, due to the presence of Brown trout which is common. Brook Char have also been recorded.

2.6 Historic

No history of significance has been raised during this investigation.

2.7 Public Recreation

2.7.1 Physical Characteristics

Most of the property consists of steep mountain slopes of the St Bathans Range, Dunstan and Wether Ranges. St Bathans is the highest range in Central Otago, with the main ridge gradually rising to St Bathans (2088m), the southern boundary of the property. The western escarpment rises over 1200m from the bed of Dunstan Creek as an uninterrupted face.

Dunstan Creek is a major valley system that starts in Otago and flows to the Wether and Dunstan Range.

2.7.2 Legal Access

SH8 forms part of the north-western boundary of the property. There is a legal road on or close to a farm track that follows the high tension lines through a saddle east of the Lindis Pass. There are no other legal roads on the property. A 4WD track that runs for practically the entire length of Dunstan Creek is not a legal road. This track runs for almost 30km up the valley floor from St Bathans until it climbs over Old Man Peak and drops down to the Lindis Pass highway (SH 8) near the junction of McLays Creek and Longslip Creek. Dunstan Creek does have a marginal strip following the river for most of its length.

2.7.3 Activities

The recreational significance of this property lies in its position at the northern end of the Dunstan Range (adjacent to the Lindis Pass highway) and the routes it provides over the Dunstan Range into Dunstan Creek or along the crest of the Wether and St Bathans Ranges to Omarama Saddle and beyond. The route down the Dunstan Creek to St Bathans is

becoming increasingly popular for recreational use particularly by 4WD, mountain bike users and horse trekkers. The St Bathans Range provides magnificent all round vistas of distant mountains and spectacular valleys. The mountain ranges and the Dunstan Valley provide many opportunities for a wide range of recreational activities including day walks, extended tramping, mountain bike and horse riding trips, cross country skiing and ski touring in winter, valley walking and more passive pursuits such as fishing, photography, botanising and bird watching.

PART 3

OTHER RELEVANT MATTERS & PLANS

3.1 Consultation

Meetings were held on 25 September 2001 in Christchurch and 26 September 2001 in Timaru with representatives from Federated Mountain Clubs, New Zealand Deer Stalkers Association, Peninsula Tramping Club, Canterbury Conservation Board, New Zealand Mountain Bike Association, Forest and Bird Society, Canterbury University Tramping Club, Opus Consultants, Mount Cheeseman Ski Club, Environment Canterbury, Friends of Lewis Pass, QEII, Pegasus Pig Hunting Club, as well as Public Access New Zealand, Fish and Game Council, QV Valuations, Knight Frank Ltd, Geraldine Tramping Club, 4 WD Club, Temuka Tramping Club, and Environment Canterbury in Timaru to discuss the Tenure Review of Dunstan Downs and several other properties.

The main issues relating to this property brought up in the meeting were:

Old Man Peak is attractive for ski touring, walking and tramping with quick access from the Lindis Pass. It is outstanding in the right conditions.

The whole of Dunstan Creek over to the Dunstan Range and Lindis Road should be reserved as an area of grassland.

Dunstan Creek has opportunities for recreation with extensive opportunities for mountain biking, horse riding and walking. It is an outstanding area that deserves attention for its landscape and vegetation values.

3.2 District Plans

Dunstan Downs is in the Waitaki District. The proposed Waitaki District Plan was publicly notified in December 1996. Following public submissions and hearings on the proposed plan, the District Plan as amended by Council decisions was released in September 1999. Dunstan Downs lies within the Rural S (Rural Scenic) Zone. The Rural Scenic Zone contains areas of the District which have significant scenic values – the high country, rangelands and inland basin areas. The majority of this zone lies above the 400 m contour (a.s.l).

The Plan establishes what sort of activities are Permitted, Controlled, Discretionary or Non-complying. The Plan also establishes Site Development Standards and Critical Zone Standards for these activities. A permitted or controlled activity that does not comply with any one or more of the Site Development Standards becomes a restricted discretionary activity. However, the Plan has undergone a number of changes in the Rural Scenic Zone

following Council's decisions on submissions. The Plan is still under discussion with agencies, individuals and interested parties.

3.3 Conservation Management Strategies & Plans

Dunstan Downs Pastoral Lease lies in both the Canterbury and Otago Conservancies and is therefore covered by two Conservation Management Strategies (CMSs)

In the Canterbury CMS Dunstan Downs forms part of the unit known as Waitaki. The key objectives for this unit relevant to tenure review are:

- to seek to protect, maintain and enhance the natural landscapes and natural landscape values of the Waitaki – through appropriate methods such as tenure review and district plans
- to identify the significant indigenous vegetation and threatened species of the unit and to use a range of effective methods to protect the indigenous biodiversity as well as protecting and enhancing the viability of priority threatened species populations and their habitats in the unit.
- For recreation and access the Conservancy's objectives are to provide new recreational facilities and opportunities by the Department, other organisations and concessionaires where natural and historic resources and cultural values are not compromised, and to liaise with adjacent landholders to resolve conflicts over access for recreation to land managed by the Department.
- To reduce and maintain rabbit and thar densities to levels that ensure their adverse effects on natural values are minimised

Other priorities identified in the CMS that are Conservancy wide and relevant to tenure review on these properties are – to undertake necessary actions to secure the conservation of Category A and B species, including predator control, fencing and habitat protection. The species listed as priority include New Zealand falcon, wrybill, black-fronted tern and banded dotterel.

In the Otago Conservation Management Strategy - The St Bathans – Hawkdun – Ida Ranges area has been recognised as one of 41 Special Places. The objective for the St Bathans – Hawkdun – Ida Ranges Special Place is:

- To protect on an extensive scale, the high altitude landscape, nature conservation and historic resources of the area, principally by acquiring adjoining lands of high natural, historic and recreational value, through pastoral lease or occupation licence reviews, to link existing areas administered by the Department thus providing for more recreational opportunities, better protection of values and efficient integrated management of those values."

The stated priority for the St Bathans – Hawkdun – Ida Ranges Special Place is:

- "Pastoral lease and pastoral occupation licence tenure review negotiations will be the priority method for implementation of the objective."

The Lindis Pass area is included in the Hawea-Lindis Special Place (#23) and the CMS notes that *"the area contains many magnificent landscapes able to be viewed by travellers on State Highways 6 and 8. The latter includes Okahu (the Lindis Pass), a journey through depleted short tussock and snow tussock covered hills which is renowned for its dramatic light and shadow effects on the subtly detailed terrain and vegetation. The Lindis Pass has been recognised as a nationally significant landscape."*

The objectives for the area include the following:

- To manage and enhance recreational opportunities on lands administered by the department in the area to maintain the natural and historic resources of areas while providing an appropriate range of recreational activity of high quality.
- To achieve permanent protection for areas of significant nature conservation importance in the area.

The stated priorities for the area include:- *"Consolidation of protected areas and protection of key habitats, and improving public access through tenure review negotiations."*

PART 4

MAPS ETC.

Appendix 1: Bird species found on Dunstan Downs

Endemic species

Black fronted tern	*Sterna albostriata*
Paradise shelduck	***Tadorna variegata***
Grey warbler	***Gerygone igata***
New Zealand falcon	***Falco novaeseelandiae***

Native species:

Australasian harrier	***Circus approximans***
Spur winged plover	***Vanellus miles novaehollandiae***
Welcome swallow	***Hirundo tahitica neoxena***
Black shag	***Phalacrocorax carbo***
Black backed gull	***Larus dominicanus***
Pied fantail	***Rhipidura fuliginosa***
Silvereye	***Zosterops lateralis lateralis***
Banded dotterel	***Charadrius bicinctus***
Pied oystercatcher	***Haematopus ostralegus finschi***
Pipit	***Anthus novaeseelandiae***

Introduced species

House sparrow	***Passer domesticus***
Hedge sparrow	***Prunella modularis***
Blackbird	***Turdus merula***
Song thrush	***Turdus philomelos***
Starling	***Sturnus vulgaris***
Chaffinch	***Fringilla coelebs***
Goldfinch	***Carduelis carduelis***
Greenfinch	***Carduelis chloris***
Redpoll	***Carduelis flammea***
Yellow hammer	***Emberiza citrinella***
Skylark	***Alauda arvensis***
White backed magpie	***Gymnorhina tibicen hypoleuca***
Chukor	*Alectoris chukar*
Mallard duck	*Anas platyrhynchos platyrhynchos*

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4.2 Photographs

4.3 Illustrative Maps

Lower slopes of Wether Range. View of Lindis Pass highway (SH8), McLays Creek (line of willows) and Halls totara forest on boulder slopes (middle distance), matagouri and sweet brier and adventive grassland in foreground.

DUNSTAN DOWNS PASTORAL LEASE

Northwest end of Dunstan Downs from top of Dunstan Range with SH 8 at centre right.

Tall tussock land above McLays Creek with patches of matagouri/Coprosma shrubland below.

View south down Dunstan Creek from above huts (right centre). St Bathans at left. Narrow-leaved and mountain tussock in foreground and down slope.

View west from slopes of St Bathans Range towards Dunstan Range and Upper Dunstan Creek. Farm hut at left. Good snow tussock in foreground at approx. 1000 m.

Vegetation Assessment - CRR Dunstan Downs

DUNSTAN DOWNS PASTORAL LEASE

ECOLOGICAL ASSESSMENT

FOR TENURE REVIEW

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April 2002

ECOLOGICAL ASSESSMENT FOR TENURE REVIEW OF DUNSTAN DOWNS PASTORAL LEASE OMARAMA

Introduction

Dunstan Downs Pastoral Lease is a long, nearly 30 km, relatively narrow (4-8 km) strip of mountain land lying in a north to south direction from State Highway 8 (SH 8), about 16 km west from Omarama. The northern section of the property is bounded by SH 8 to the west rising to the top of the Wether Range to the east. This eastern boundary then extends south along the St. Bathans Range as far as Mt. St Bathans, the highest point on the property at 2088 m. From here a straight-line southern boundary crosses to the Dunstan Creek, which it then follows northwards to reach SH 8 just below the Lindis Pass and taking in the Dunstan Range and Old Man Rock at 1826 m. The lowest point on the property is at the northern tip by the Ahuriri River and near the junction of Birchwood Road and SH 8. Here a small area of flat terrace land lies at about 570 m with the homestead nearby. Access to Dunstan Creek can be difficult, either by a rough 4WD track over Old Man Peak, where there is a tele-communications building and aerials, or a long route via Goodger Road and the Chain Hills to the south. Power pylons extend along SH8 and cross Dunstan Downs through a low pass not far south of the Lindis Pass. The Lindis Pass Scenic Reserve with its modified tussockland adjoins Dunstan Peaks at the northwestern corner.

Most of the pastoral lease falls within the St Bathans Ecological District, part of the Waitaki Ecological Region. The northern catchments, from the top of the Dunstan and Wether Ranges, fall into the McKenzie Ecological Region and Ahuriri Ecological district.

Most of the northern part of the Pastoral Lease is very stony, greywacke country, with steep lower slopes and broad, planar ridge tops Flat land is confined to the small area around the homestead and stretching down to the Ahuriri River and a narrow strip along parts of SH 8. The southern half of the lease takes in the western scarp of the St Bathans Range with its broad planar summit ridge. The steep, stony upper slopes fan out lower down to form broad, gently sloping terraces, which descend to the wide valley floor of the Dunstan Creek. The lowest point of this southern end is 770 m in the most southern corner. Only a very small area of this southern valley floor and a relatively small area in the north, above SH 8, lies below 800 m in altitude.

Dunstan Creek, a major tributary of the Manuherikia River, rises at the junction of the Wether and Dunstan Ranges and flows southwards along the foot of the St Bathans Range, fed by numerous small tributaries. Only small streams drain the northern faces of The Dunstan and Wether Ranges apart from McLays Creek that flows from near Old Man Peak and has a slightly larger catchment. It has important vegetation attributes that will be discussed later.

Several small tarns and small wetlands are found along the south side of the Dunstan Range otherwise wetlands are virtually confined to the valley floor of Dunstan Creek and Longslip Creek, the latter flowing along part of the northeastern boundary and SH 8.

The climate is semi-arid with warm, dry summers and cold winters. The rainfall increases with altitude from about 500 mm at the homestead to an estimated 1600 mm at the top of the range. The soils are shallow and stony, especially on the steeper slopes where screes are often prominent, but deeper on the valley floors and some lower slopes.

Survey

This property was surveyed from the 20th to 22nd January 2002 by 4WD vehicle with numerous stops for vegetation sampling. Parts of the property were traversed on foot. Binoculars were used to check more distant vegetation where access was difficult.

Vegetation

The primary vegetative cover of the Dunstan Downs Pastoral Lease is tall tussock grassland with narrow-leaved snow tussock (*Chionochloa rigida*) at lower levels and slim-leaved snow tussock (*Chionochloa macra*) above. This has been modified by burning and grazing, and by over sowing and topdressing below about 1100 m so that the lower slopes are a mixture of tall and short tussockland with an increasing adventive component towards the valley floor. Small areas of red tussockland dominated by *Chionochloa rubra*, are found on the Longslip valley floor, along SH 8, together with patches of shrubland. Remnant montane shrublands are found in Dunstan Creek and McLays Creek and Halls totara forest occurs in McLays creek area with minor remnants on boulderfields further north, on northwest faces. McLays Creek also contains an important *Olearia* shrubland. Small areas of subalpine snow totara and *Dracophyllum* shrublands are found at higher altitudes with a variety of shrubs appearing in the tall tussockland as scattered plants. A few specialised plants occur on screes with cushion and fellfield plant communities occupying the broad, exposed summit areas and ridge tops. Wetlands and bogs mainly found on the Dunstan Range and along the Dunstan Valley floor. Although modified by past activities and with much hawkweed, especially on parts of the valley floor, the Dunstan Valley still has a largely natural look with native tussock species dominating all communities and tall tussock descending to the valley floor (photos 4,5)

Montane Forest – Halls totara (*Podocarpus hallii*)

An extensive area of shrubland occurs on an old shingle fan on the lower west face of the Dunstan Range on a small tributary of McLays Creek. The bouldery centre of this fan is occupied by a significant grove of Halls totara (photos 14,19,22). The shrubland acts as a protective barrier from stock. Halls totara extends uphill to about 1150 m and the associated mountain toatoa (*Phyllocladus hallii*) continues up to about 1300 m, all on boulderfields above the creek bed. Snow totara (*Podocarpus nivalis*) is common around the edges with wild gooseberry (*Ribes uva-crispa*) golden speargrass (*Aciphylla aurea*), narrow-leaved snow tussock (*Chionochloa rigida*), mountain fescue (*Festuca mathewsii*) and the fern *Hypolepis millefolium* are associated species on the higher boulderfields with a diverse range of shrubs associated with the lower forest area.

One or two small patches of Halls totara are also found on boulderfields further north on the slopes of the Wether Range but are not associated with shrublands.

Montane Shrublands

Montane shrublands are found scattered across the lower slopes, on boulderfields and down many streambeds on the Wether, Dunstan and St Bathans Ranges (photos 2,3,14,17,). They also occur on the valley floor of Dunstan Creek and McLays Creek (photos 8-11, 23). Matagouri (*Discaria toumatou*) is the dominant species at most sites with *Coprosma propinqua, Melicytus alpinus,* sweet brier (*Rosa rubiginosa*) and the creepers *Muehlenbeckia complexa* and *Rubus schmidelioides*). *Olearia odorata,* native broom (*Carmichaelia petriei*) and golden speargrass (*Aciphylla aurea*) are often present. Damp sites such as along Dunstan Creek, may also have *Olearia bullata* present and coral broom (*Carmichaelia crassicaule*) occurs mainly as scattered plants on boulderfields, in tussockland and sporadically in shrubland.

The most interesting and diverse shrubland is found in the lower McLays Creek. Here on a steep, rocky, toe slope grows the rare tree daisy *Olearia fimbriata* (photos 17,19-25). It is listed in the Threatened and uncommon plants of New Zealand (de Lange et. al. 1999) as Declining. Many large trees are growing at this site and regeneration appears to be happening. Other trees and shrubs on this hill slope include *Coprosma propinqua, Coprosma* sp. aff. *parviflora, Olearia odorata, Olearia bullata, Corokia cotoneaster, Hebe rakaiensis,* matagouri, mountain wineberry (*Aristotelia fruticosa*), native broom and the climbers, *Muehlenbeckia australis, M. complexa* and *Rubus schmidelioides*. Along the stream edge below, in a continuation of the shrubland is *Coprosma intertexta*, also listed in the Threatened and uncommon plants list as Naturally Uncommon, Sparce. This was the only site noticed for this plant but it is present in the upper Manuherikia valley and was recorded on Twin Burn and Berwen Pastoral Leases. Two large Halls totara also grow here. This diverse shrubland spreads right across to the Halls totara forest on the nearby fan, but with sweet brier becoming much more common here.

Silver tussock (*Poa cita*), hard tussock (*Festuca novae-zelandiae*) and introduced grasses and herbs clothe the open spaces. The invertebrate life is likely to be high in this shrubland with *Olearia* species recognised as being host for a large number of specialist invertebrates.

These shrublands and the podocarp forest species (Halls totara, mountain toatoa) are representative of plant communities that were once widespread in the district and that have been severely reduced in area by fire and grazing (McGlone, 1998).

Native lizards (skink and gecko species) are common in the stony shrublands and on screes.

Sub Alpine Shrublands

At higher altitudes, mainly on south and east facing stony or rocky slopes, *Dracophyllum pronum* forms a low, open shrubland often in association with cushion plants. The larger *Dracophyllum uniflorum* is uncommon and mainly occurs as scattered shrubs in tall tussockland. Other shrubs in the sub alpine tussockland include cottonwood (*Ozothamnus fulvida*), coral broom, native broom, *Leucopogon suaveolens* and the scrambling coprosma, *Coprosma cheesemanii.* Around the edges of boulderfields, along the St Bathans Range in particular, grow snow totara, *Coprosma ciliata, Olearia cymbifolia* and dwarfed mountain toatoa (photo 51).

Introduced grassland and mixed introduced/native grassland

Development on Dunstan Downs appears to have been confined primarily to the north-western faces of the Wether Range and the rolling hill country and north-west faces of the Dunstan Range that are both readily accessible from SH 8 (photos 12,14,17). Burning, oversowing and top-dressing has modified the native plant cover and severely reduced the shrublands along these areas. The introduced grasses, sweet vernal (*Anthoxanthum odoratum*) and browntop (*Agrostis capillaris)* with cocksfoot (*Dactylis glomerata*) and other introduced grasses and clovers, are prominent along the lower slopes below about 900 m and dominate these areas in places. Hard tussock (lower slopes) or mountain fescue (higher slopes) with blue tussock (*Poa colensoi*) and *Rytidosperma pumilum* as well as several small native shrubs and herbs including *Gaultheria novae-zelandiae, Leucopogon fraserii, Muehlenbeckia axillaris, Prasophyllum colensoi, Raoulia subsericea, Bulbinella angustifolia, Deyeuxia avenoides, Helichrysum filicaule, Ranunculus multiscapus, Lagenifera cuneata,* harebell (*Wahlenbergia albomarginata*), *Celmisia gracilenta* and *Geranium sessiliflorum* are generally present and often dominant. Mouse ear hawkweed (*Hieracium pilosella*) is generally present as is sheep's sorrel (*Rumex acetosella*). Hawkweeds, particularly mouse ear, but also king devil (*H. praealtum*) and to a lesser extent, tussock hawkweed (*H. lepidulum*) are prominent throughout the

lower country and present to some degree in most communities including some of the upper fellfield and cushion plant communities. Patches of matagouri and sweet brier are often present also. Red tussockland occupies small areas of the wetter gully floors close to SH 8, generally with introduced grasses and herbs present and silver tussock can be important on disturbed sites such as farm track edges and riparian areas. Narrow-leaved tussock appears above about 800 m with scattered plants down to the road edge in places and it dominates the plant community above about 900 m.

Grassy areas dominated by introduced grasses exist amongst the tussockland and along the alluvial river terraces in the Dunstan Creek valley (photos 7, 48) but the introduced grasses only dominate over small areas amongst the otherwise native plants communities. Mouse ear hawkweed is generally prominent on the valley floor (photo 7, 11).

Short tussock grasslands

The short tussockland dominated by hard tussock with blue tussock and *Rytidosperma pumilum* occurs at all lower altitudes and particularly on the valley floor of Dunstan Creek (photos 2, 7,9,11). In places the hard tussock is 60-80 cm tall and dense, with silver tussock and brown top. In more open areas, mouse ear hawkweed is often the dominant inter-tussock species with sweet vernal and white clover also common. Native species associated with the short tussock community include a number of herbs, grasses and small shrubs such as patotara (*Leucopogon fraserii*), *Coprosma petriei, Muehlenbeckia axillaris, Pimelea oreophila, Raoulia subsericea, Acaena inermis, Anisotome flexuosa, Brachyscome sinclairii,* harebell (*Wahlenbergia albomarginata*), native violet (*Viola cunninghamii*), *Geranium sessiliflorum, Celmisia gracilenta, Scleranthus uniflora, Luzula rufa, Rytidosperma pumilum, Blechnum penna marina,* lichens and mosses.

Off the valley floor, hard tussock is replaced by mountain tussock (*Festuca mathewsii*). This community covers all lower slopes and drier ridges up to about 1200 m usually with scattered to patches of narrow-leaved tussock and open, stony areas. Mountain tussock can have an 80% cover on good sites. Associated plants include *Coprosma petriei, Raoulia subsericea, Anisotome flexuosa, Brachyscome sinclairii,* harebell, narrow-leaved tussock, blue tussock, *Bulbinella angustifolia, Geranium sessiliflorum, Celmisia gracilenta, Scleranthus uniflora, Blechnum penna marina, Luzula rufa, Rytidosperma pumilum, Gaultheria novae-zelandiae,* mosses and lichens. *Celmisia lyallii* and golden speargrass can be prominent in places and *Dracophyllum pronum* on rocky or stony sites. Mouse ear hawkweed can be present to providing up to 20 % cover in open situations such as found on the lower St. Bathans faces and king devil and tussock hawkweed are sporadically present.

Blue tussock dominated in places, mainly at higher altitudes where it could form a mosaic with slim-leaved tussock. A typical community at 1500 m on the Dunstan Range had a blue tussock cover of 40-50%, rock 30-40%, mountain tussock 5%, slim tussock, sheep's sorrel, golden speargrass, *Rytidosperma pumilum, Agrostis muelleriana, Pimelia prostrata, Dracophyllum pronum, Raoulia subsericea, Lycopodium fastigiatum, Carex wakatipu* and *Celmisia viscosa.*

Tall tussockland

Above about 1000 m tall tussock is the dominant plant community with the narrow-leaved snow tussock dominating at lower altitudes, below about 1400 m but up to about 1500 m on sunny slopes and frequently, right down to the valley floor, while slim-leaved snow tussock occupies the high altitude areas. In places the two grow together and hybrids between the two species are numerous here.

A typical association in the Dunstan valley at about 950 m are narrow-leaved tussock and/or slim-leaved snow tussock and hybrids with a cover of between 30% and 75% and up to 80 cm tall with mountain fescue 10% and dominating in patches, mouse ear hawkweed to 25%, *Raoulia subsericea 5%* bare ground from 5% to 20% and with occasional matagouri, the native and coral brooms, and numerous native species including blue tussock, golden speargrass, patotara, *Scleranthus uniflorus, Pimelea oreophila, Bulbinella angustifolia, Lagenifera cuneata, Brachyglottis haastii, Leptinella pectinata, Luzula rufa, Geranium sessiliflorum, Celmisia gracilenta, Anisotome flexuosa,* harebell *Coprosma cheesemanii, Elymus solandri, Acaena inermis,* mosses and lichens. Adventive species included sweet vernal, white clover, tussock hawkweed, sheep's sorrel (*Rumex acetosella*), cats ear (*Hypochaeris radicata*), and Yorkshire fog (*Holcus lanatus*) (photo 5). At 1200 m, the foot of the steeper hill slopes where the ground is more stony (25-30%) and soils thinner, snow tussock cover (both species often present) was 25-30%, mountain fescue 10%, mouse ear hawkweed 10-20%, with patotara, sweet vernal, golden speargrass, *Raoulia subsericea, Pimelea oreophila, Anisotome flexuosa, Lagenifera cuneata* and *Gaultheria novae-zelandiae.* A steep (45°), stony, west to northwest facing slope at 1300-1400 m contained good narrow-leaved tussock at 30-50% cover, rock/stones 30-40%, mountain fescue 5-10%, blue tussock 2-5%, patotara 1-5% with golden speargrass to 2%, *Raoulia subsericea, Celmisia gracilenta, Anisotome flexuosa, Scleranthus uniflorus, Leucopogon suaveolens, Pimelea oreophila, Brachyglottis bellidioides, Epilobium atriplicifolium, Geranium sessiliflorum, tussock* hawkweed, sheep's sorrel, cats ear and mouse ear hawkweed (photo 53) On a rocky ridge matagouri was present with the small blue-flowered hebe, *Hebe pimelioides.*

On the Dunstan Range at 1200 m where the soil was deeper, narrow-leaved tussock had a cover of 60-75% with bare ground 10-15%, *Celmisia lyallii* 5%, Raoulia subsericea, Rytidosperma pumilum, mountain tussock, *Anisotome flexuosa, Kelleria dieffenbachii, Gaultheria novae-zelandiae, Scleranthus uniflorus, Pimelea oreophila, Luzula rufa,* sheep's sorrel, tussock hawkweed and occasional *Celmisia viscosa.* A nearby ridge top that had been burnt contained few tall tussocks and was dominated by mountain tussock. At 1400 m slim tussock dominated with a similar community to the above. A rocky east face at 1700 m where sheep had camped (photo 28) contained chewed down slim-leaved tussock with much sheep's sorrel, *Melicytus alpinus, Scleranthus uniflorus, Raoulia grandiflora, Epilobium tasmanicum, Rytidosperma pumilum, Carex wakatipu, Blechnum penna-marina, Geranium sessiliflorum, Taraxacum magelanicum, Neopaxia sessiliflora,* moss, violet and blue tussock. A steep, rocky, south slope contained a cover of slim tussock 30-40%, rock 10-50%, *Dracophyllum pronum 30-40%, Celmisia lyallii 5%,* blue and mountain tussock (photo 47). A stony, north-west face at 1400 m had narrow-leaved tussock 50-60%, rock 30-40%, mountain fescue 15%, blue tussock 10%, golden speargrass, sheep's sorrel, tussock hawkweed, *Scleranthus uniflora, Celmisia lyallii, Pimelea oreophila* with scattered coral broom. Narrow-leaved tussock communities occur as isolated patches in vast screes or boulderfields also, where sufficient soil has accumulated

South faces tend to have a denser tussock cover (60-80%) and less open ground (c. 10%) than north or west faces (tussock 25-60%, stones/rock 25-50%). On the exposed ridge crests there is a mixed community of slim-leaved snow tussock, cushion plants and open blockfield or fellfield (finer, stones) (photos 28-30).

Wetland and bog communities

Wetland and bog communities are found along the Longslip and Dunstan Creeks and adjacent areas, on flush zones on hill slopes (photo 17) in occasional gullies and in small cirque basins along the Dunstan Range (photos 16,30, 34, 40-44). The montane wetland communities are made up of a variety of rushes, sedges, grasses and herbs, some of which are adventive. They include, *Carex secta, Carex coriacea, Carex kaloides, Schoenus pauciflorus, Bulbinella angustifolia, Elaeocharis acuta, Hydrocotyle hydrophila, Ranunculus foliosus, Epilobium macropus, Potamogeton cheesemanii, Lemmna minor, Juncus articulatus, Juncus conglomeratus, Mimulus guttatus* and Yorkshire fog. The tiny sedge *Carex capillacea*, classified as Naturally Uncommon, Sparce, in the Threatened and uncommon plants of New Zealand list (de Lange et.al.1999) was found in the lower Dunstan Creek.

Flush zones are generally dominated by comb sedge (*Oreobolus pectinatus*) and/or *Schoenus pauciflorus* with mosses, liverworts and small native plants such as *Coprosma atropurpurea, Euphrasia dyeri, Utricularia monanthus, Epilobium komarovianum, Gaultheria parvula, Isolepis aucklandica, Carex gaudichaudiana* and *Nertera balfouriana.* On shallow slopes comb sedge bogs are not uncommon with a similar range of species including *Abrotenella caespitosa, Lagenifera barkeri, Pratia angulata, Agrostis pallescens, Deschampsia chapmanii, Ranunculus cheesemanii, Ranunculus gracillipes, Brachyscome* sp. rhizomatus, *Luzula leptophylla, Bulbinella angustifolia, Uncinia divaricata, Psychrophylla obtusa, Colobanthus apetalus, Neopaxia sessiliflora, Gonocarpus micranthus, Luzula" tenuis", Gnaphalium laterale,* and *Celmisia* sp. "rhizomatus".

The most extensive and richest wetland was in the cirque basin just to the east, under Old Man Peak. This area contained most of the species already mentioned as well as *Ourisia caespitosa, Celmisia sessiliflora, Epilobium minutiflorum, Ranunculus royi, Plantago lanigera* and *Plantago triandra.*

Alpine Cushion vegetation of fellfield and snow banks

Cushion plant communities occur on most ridge tops where the soil is thin or skeletal and the area exposed to the wind (photo 28-36). The plants here include *Dracophyllum muscoides Dracophyllum pronum, Raoulia hectorii, Hectorella caespitosa, Chionohebe thompsonii, Craspedia lanata, Kelleria villosa, Leptinella pectinata* var. *villosa, Luzula pumila, Chionohebe densifolia, Celmisia sessiliflora, Ourisia glandulosa, Acaena saccaticupula, Phyllachne colensoi, Epilobium tasmanicum, Rytidosperma pumilum,* blue tussock and *Brachyscome "montana".* Large patches of *Celmisia viscosa* are prominent on some fellfield areas. In places, where the soil is deeper such as in small hollows, slim-leaved snow tussock forms patches. A diverse, mounded cushionfield occurs on the saddle north of Old Man Rock (photo 36) where blue tussock dominates with a cover of 60%, *Dracophyllum muscoides* 10%, *Raoulia hectorii* 5-10%, bare or dead 10% and with many other plants present.

Other plants found on the stony or rocky ground are Hebe *pinguifolia, Schizeilema hydrocotyloides, Colobanthus buchananii, Poa buchananii, Poa lindsayii, Raoulia youngii, Agrostis muelleriana, Luzula traversii, Celmisia laricifolia,* and *Raoulia grandiflora.* Lichens are often prominent

Snow banks are not extensive and contain a similar cushion plant community but with fewer species present. *Celmisia sessiliflora* is prominent with *Celmisia haastii* and several tiny plants such as *Lobelia linnaeoides, Plantago lanigera, Euphrasia zealandica* and several mosses and lichens.

Blockfields, scree and rock outcrops

The higher ridge and spur crests often contain much rock with patchy snow tussock and cushion vegetation or frost shattered blockfields with scattered cushion plants and tufts of slim-leaved snow tussock (photos 1, 28-34). Among the angular stones and rocks are found *Dracophyllum muscoides,*

Raoulia hectorii, Luzula pumila, Poa colensoi, Dracophyllum pronum, Phyllachne colensoi, Hebe buchananii, Anisotome flexuosus and several lichen species. *Raoulia petriensis* occurs sporadically along the top of the St Bathans Range. The small scree hebe, *Hebe haastii* var. *humilis* forms occasional small populations. Large areas contain virtually no plants at all although the rounded, orange mounds of the compact speargrass *Aciphylla dobsonii* can be dotted about the summit of the St Bathans Range. Specialised scree plants include *Ranunculus haastii,* rare in this area, *Ranunculus crithmifolius* and *Epilobium pychnostachyum.* Rock outcrops provide habitat for plants such as *Celmisia angustifolia, Celmisia densiflora,* which is also found in rocky tussockland, *Koelaria cheesemanii, Luzula traversii* and *Epilobium porphyrium.*

Evaluation/discussion

Dunstan Downs crosses two Ecological Regions. Most of the property is in the Central Otago Region, St. Bathans Ecological District while the northern portion lies within the Mackenzie Ecological Region and Ahuriri Ecological District, the Dunstan Range forming the boundary between the Ecological Regions. The Lindis Pass Scenic Reserve adjoins the northwestern edge of the property. Its vegetation is similar to the adjacent Dunstan Downs land. Both have been modified by burning and grazing but still have native plant communities dominating the vegetation. The greatest development has taken place along SH 8 where over sowing and top dressing has occurred and adventive species are prominent and dominant on most flat land. Most land above about 900 m has a dominant native cover even though hawkweeds are common to higher altitudes.

Small areas of red tussock occur in wet gullies along the Longslip Valley floor with associated adventive species. They are probably too small and isolated to protect without protecting the larger area.

The whole of the Dunstan Creek catchment and upper Dunstan Range has a very good cover of native plant communities typical of the region with a variety of habitats and altitudinal sequences. Although the valley floor and lower slopes show much modification in places, with hawkweed in particular being common, the overall impression is of native plant cover which has the potential to improve with the cessation of burning and grazing.

Shrublands show the most modification and have contracted significantly with the development of the land so that there are mainly remnant, riparian strips and local patches left with matagouri the major species. Sweet brier is only common along the lower Dunstan and Wether Range slopes but not common in the Dunstan valley. The best shrublands are found in McLays Creek, adjoining the Halls totara forest and extending well upstream, on both sides of the creek in its lower part. Here is found the rare and threatened tree daisy, ***Olearia fimbriata*** in diverse shrubland with ***Coprosma intertexta,*** (listed in the Threatened and uncommon plants list as Naturally Uncommon, Sparce). The three *Olearia* species that occur in the lower shrublands are recognised as providing important invertebrate habitat and the shrublands generally have important natural values both as a community in their own right and for the invertebrate, lizard and bird life that they support.

The **Halls totara** with snow totara and mountain toatoa is an important remnant plant community. They are part of a community that was once much more widespread (McGlone 1998). McGlone envisages a pre-Maori vegetation for the Mackenzie country of a complex mosaic of forest, scrub, shrubland and grassland determined by aspect, slope stability, soil fertility and moisture and local site climate. Mountain toatoa, bog pine (*Halocarpus bidwillii*), Halls totara together with, snow totara and other small trees and grey scrub species (matagouri, *Olearia, Aristotelia, Melicytus, Coprosma, Corokia, etc*) probably formed the dominant vegetation of the dry inland basins and adjacent mountain slopes such as those of the Dunstan, Wether and St Bathans Ranges.

Much of the summit plateau is fellfield and rockfield or boulderfield with sparce or scattered vegetation. Large, generally coarse, screes fall down the upper slopes of the St Bathans Range and these have only a few specialised plants growing on them. Typically aspect is important with the cooler south and easterly faces having a more diverse and denser plant cover than the drier, sunny north and west faces. The stony nature of these mountains with their thin soils together with the dry climate ensures that much of the tall tussock community in particular, is quite open with a relatively low plant cover. ***Raoulia petriensis*** is another special plant found here but is not common, occurring sporadically in stable blockfields and fellfield. Its type locality is Mt. St. Bathans. A small, creeping plant in the Scrophulariaceae family was seen on the edge of the cushionfield near Old Man Peak, but not collected for identification. This was the only area in which it was seen so needs to be identified as it may be special.

The scree buttercup (*Ranunculus haastii*) occurs in very small numbers and is highly palatable as is the threatened scree pea (*Montigena novae-zelandiae*), which was not seen on this survey but is likely to occur in low numbers on the St Bathans Range. Coral broom occurs as scattered plants in the tussockland and on boulderfields.

Wetlands are generally small and uncommon. All are valuable for their intrinsic value, as part of the diversity of the mountain lands and for the diverse flora that they contain. ***Carex capillacea*** is a tiny sedge listed in the threatened and uncommon plants list and is found in one of the lower valley wetlands.

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Geomorphology - CRR Dunstan Downs

DUNSTAN DOWNS - LANDFORMS AND GEOLOGY

Dunstan Downs Pastoral Lease (*Dunstan Downs*) straddles the South Canterbury- North Central Otago regional boundary, being partly located in the Longslip Creek/north Lindis Pass valley and partly in Dunstan Creek valley.

Dunstan Downs essentially comprises two mountain ranges - the Dunstan Range and the Wether/St Bathans Range. It also includes a smaller area of hill country in the vicinity of Lindis Pass.
The ranges are part of the distinctive fault-block mountain range landscape that forms the transition from Canterbury greywacke to Otago schist. They are also distinctive for their cirque glaciation and peri-glacial features. Fluvial and slope processes have shaped the land at mid to lower altitudes.
The Dunstan Range is a major enclosing range for both the Longslip Creek/north Lindis Pass valley and the upper west part of Dunstan Creek valley. The Wether/St Bathans Range encloses the east side of the Dunstan Creek valley.

Land Types and Land Systems

The landforms can broadly be described in terms of ***Land Types*** (for the Canterbury Region)[1] and ***Land Systems*** (for the Lindis Ecological District, north Otago)[2]. There was no definitive landform classification for the west side of the Wether and St Bathans Range or the east side of the Dunstan Range at the time of writing.

Land Types

The west side of the Dunstan Range and the hills near Lindis Pass are part of an **H15 Southern Sub-Humid to Humid Mountain Range Land Type.** This land type typically comprises steep, dissected mountain ranges formerly both valley and cirque glaciated with narrow sharp ridges and extensive scree and bedrock outcrop at higher elevations. Significant moraine and kame terrace and deep colluvium mantle the rectilinear lower slopes.

The east side of the Wether and St Bathans Ranges (outside the lease) are part of an **H18 Semi-Arid to Humid Fault Block Mountain Range Land Type**. Typical features include broad plateau crests with deep blockfield mantle, cirque glaciation, extensive scree and bedrock outcrop, broad rolling spurs and deep, steep-sided narrow-floored valleys cut by streams.
The west side of the Wether/St Bathans Range, and the east side of the Dunstan Range - going by the description - could probably be classified as an H18 Land Type.

Land Systems

The Lindis Ecological District at the time the report was published overlapped the Canterbury region thus the hills in the Lindis Pass area and the west side of the large ridge heading north from Old Man Peak - called the Lindis Face here - can also be described as part of the **Pass Land System**.
This land system is comprised of semi-schist with landforms dominated by smooth colluvial slopes with minor slumping and talus patches. It has a complex drainage pattern developed under a higher rainfall compared to the adjacent land system to the southeast (described below), featuring inter-connected valleys surrounding isolated hill blocks of strongly undulating ridges. A distinctive dissection pattern with a younger generation of gullies incised into a smoother older generation of slope development is characteristic. This is related to a lowering of erosional base level. Open valley floors with a width of a

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[1]A Land Type is a major physiographic landform unit, depicting largely lithologically based macro-relief units and frequently bounded by structural dislocations or contrasting rock terranes. Extracted from Land Types of the Canterbury Region by Ian Lynn in the Canterbury Regional Landscape Study, Vol II - Boffa Miskell Partners and Lucas Associates 1993.

[2]A land system is an area in which topography, soils and vegetation form a recurring pattern recognisably distinct from that of adjacent land systems (Christian and Stewart 1954, in Grove (ed.) 1994. Extracted from the Lindis, Pisa and Dunstan Ecological Districts Survey Report, Grove P ed. 1994.

few hundred metres of alluvial terraces and fans are also characteristic of the Pass Land System.

The area west of the Dunstan Creek Fault, from Old Man Peak southward, is part of the **Chain Land System**. It is structurally a block of fault-bounded semi-schist separated to the west from adjacent schist by a fault system across the line of saddles linking the headwaters of all the east-flowing Lindis River tributaries, and separated from the St Bathans Range by the Dunstan Creek fault, which runs the length of the valley just to the east of Dunstan Creek and through Old Man Peak.
The system is characterised by distinctive landforms too. Smooth colluvial slopes are dominant, with a moderate scale of dissection and minor localised slumping and presence of talus.
Fan gravels and alluvial valley fill were shed west and east but are more extensive in the west. Western slopes are markedly steeper than those in the east, because Dunstan Creek is relatively higher than the Lindis River thus setting a higher base level.

LANDFORMS ON DUNSTAN DOWNS

Land Types and Systems provide a useful broad over-view of the landforms. At the property level, six geomorphic units can be recognised as follows :

St Bathans Range
Dunstan Range (East Side)
Dunstan Range (West Side)
Killermont Hill
Ahuriri Terraces
Lindis Hills

St Bathans Range

The St Bathans Range and its northern extension, the Wether Range, is a large and long (about 30km in total) fault-block mountain range trending north/northwest to south/southeast forming the east side of the spacious Dunstan Creek valley. It is comprised of non-foliated, quartzo-feldspathic semi-schist of the Haast Schist Group, Chlorite Subzone 2, with phyllite and marble.
The range has a broadly convex summit profile, rising in the middle to its highest peak, Mt St Bathans at 2088m asl. This represents the southern end of *Dunstan Downs*. North of Mt St Bathans, the range crest is mostly over 1700m asl.
Structurally, the west side of the range is a long, high and very steep scarp face of a large uplifted block of ancient peneplain which slopes away to the east from the summit (hence the characteristic flat summit). The active fault controlling the fault-block runs in a slight southeast-northwest alignment through the Dunstan Creek valley, lying between 500 and 1500m east of the creek. It passes under the creek at a point about 1km upstream of the musterers hut then runs up to Old Man Peak. Thus the upper part of the range does not seem to be fault-controlled although the form and appearance of the range is broadly consistent all along its length. It is thought the upper Dunstan creek valley is instead an erosional form where the creek has cut down into the fault-block surface of the uplifted peneplain that must have once extended from Old Man Peak across to and beyond the modern Wether/St Bathans Range crest.
A second fault comes from the southwest across the Chain Hills and meets the Dunstan Creek fault at an angle, at a point about 1.5km southeast of the hut. Further down-valley, at a point about 4km upstream from the south boundary, the Dunstan Creek fault branches. There are no obvious surface features to delineate these two additional fault lines.
The western face of the range has a broadly concave profile. The upper slopes are very steep and planar overall, thickly mantled in colluvium which gives a smooth surface. Talus and both fresh pale grey and stable dark grey scree are extensive, typical of semi-schist terrain. Bedrock exposure and rock outcrop is also common especially along the summit. Mid-altitude terrain is of more moderate slope and consists of planar to rolling to lumpy landforms. The valley floor comprises gently angled lower colluvial slopes and fans, and the flat floodplain of Dunstan Creek which varies from less than 100m wide to nearly 700m at the widest part. Two parallel and off-set bands of gravels laid down in the last glacial periods underlie the

gentler lower valley floor terrain from just up-valley of the hut to the south boundary. In the widest part of the valley, from the hut down-valley for about 6km, a band some 500-800m wide of "Ranfurly" gravels from the last glacial period run parallel and close to the creek. A similarly sized band of weathered rusty-brown gravels from the older "Drybread" glacial advance (penultimate or older advance) lie above the Ranfurly gravels initially, starting at a point about 2km down-valley of the hut. Where the younger gravels run out as the valley narrows, the older gravels then become situated next to Dunstan Creek all the way to and beyond the south boundary.

The range face has been subjected to mostly shallow to moderate fluvial dissection along it length, with generally straight to simply branched gullies regularly spaced along the range separated by angular to rounded spurs and planar triangular faces. Over the mid to lower slopes, gullies are generally small, some tending to be angular in form, and often taking a wiggly course down to Dunstan Creek. Detritus carried down the gullies often forms small to moderate sized fans at the base of the slope. Fresh detritus is visible as a pale grey ribbon within some of the gullies. Dunstan Creek has cut a short cuspate scarp all the way down the gravel bands. It is notched by gullies or covered over in places with small alluvial fans. A large scarp exists at the south boundary, where the creek has truncated a much larger alluvial fan.
Dunstan Creek itself is a clear boulder and gravel-bottomed creek several metres wide, flowing within a well-defined meandering channel incised in former (now vegetated) floodplain. Previous courses and minor streams form sinuous channels in the floodplain surfaces, and on some surfaces, the braided wind-generated mound-and-hollow micro-topography typical of outwash surfaces is evident. The floodplain is widest in the middle part of the valley where it reaches 700m or so in width. It quickly narrows up-valley of the hut and disappears altogether in the head of the valley. It also narrows down-valley, over the 4-5km or so before the south boundary is reached.

The summit of the Wether/St Bathans Range is distinctive. It is a remnant of the ancient uplifted peneplain, explaining its flat to broadly rolling plateau form of variable width. It is broadest over the northern half, and narrows over the higher southern half, where cirque glaciation on the east side has eaten back into the crest. Rocky knobs punctuate the undulating crest especially in the southern section. Peri-glacial processes have been active in the past on the summit, reducing rock tors and outcrop that would have featured on the peneplain to a deep mantle of angular fragments of shattered rock. Most fragments have been worked by subterranean ice to lie flat, forming a remarkably even rock pavement. Occasionally the rocks stand on end or edge in lines or little groups. Stone patterning is an intriguing feature of the surface, where the rock fragments are formed into lines ("drains") and polygons ("nets"). These processes are as yet not well understood and they remain an enigma. Frost stripes are also evident in finer scree.

The range can be subdivided into four sub-units based on localised variations in landform:

The head of the valley - the ***west side of the Wether Range*** - is of smaller scale overall with no valley floor adjacent. It is of simple form, with the steep planar slopes shallowly dissected to produce a coarse corrugated effect of shallow straight V-shaped gullies and narrowly rounded spurs. The summit is narrowly rounded and undulating with rock outcrop forming several conical knobs along its length.

The ***upper part of the St Bathans Range*** is distinguished by a coarser and deeper form of dissection. Several funnel-shaped basins leading into deep V-shaped valleys lie across the upper and mid-slope. Wide planar slopes to large ridges separate the valleys and basins. Lower down, there are five large distinct knobs spaced at regular intervals and of similar altitude. These knobs are curiously skewed down-valley as if truncated and bull-dozed by glacier ice in the past. Large alluvial fans with a central ribbon of fresher grey detritus lie between the knobs fed by the eroding higher valleys and basins. Dunstan Creek has formed a narrow winding floodplain on the valley floor.
Scree and talus are extensive but rock outcrop is virtually absent. The summit is at its flattest and widest over this portion of the range.

A mid-slope "shoulder" is the distinguishing feature of the ***mid-valley section*** along with the fact the valley is at its widest here with correspondingly the widest floodplain. The shoulder lies at about the 1100m contour. It is composed of a mix of several discrete rocky knobs and lumpy terrain. It roughly

coincides with the fault line and therefore may be a manifestation of it. However the shoulder diverges northeast away from the fault line at the hut to continue as the skewed knobs described above.
This section of the valley also contains the two bands of gravels forming the lower valley slopes. The summit of the range is narrower here, and rock outcrop is extensive across the upper slopes.

The ***downstream section of the range*** lacks the mid-slope shoulder and exemplifies the smooth concave profile best. It is the highest part of the range culminating in Mt St Bathans. An uncharacteristically large deep valley with associated large steep alluvial fan lies below the peak.

Dunstan Range (East Side)

The east side of the Dunstan Range forming the upper west side of the Dunstan Creek valley, is also a high steep mountain range comprised of semi-schist. It trends southwest-northeast and is some 13km long, the northern 7.5km being within *Dunstan Downs*. Its summit is slightly lower overall than the St Bathans Range, falling as low as 1400m asl at saddles. Its highest point is Old Man Peak at 1826m asl. The range continues south to become the Chain Hills, and to the north it converges with the Wether Range to form the head of the Dunstan Creek valley.
It is largely distinguished by cirque glaciation that has shaped its upper slopes. Four large cirque basins lie side by side north of Old Man Peak and several shallower, less well-developed basins form the upper slopes at the northern end and the head of the valley. The cirque basins drop away into large deep V-shaped valleys separated by large rounded spurs. The lower slopes of the range and the valley side-slopes are large, steep and planar to broadly rounded. Glacial erosion is possibly the cause of the planar main valley slopes and the truncated spurs.
The general profile of the Dunstan Range is opposite to that of the St Bathans Range, being broadly convex. The original peneplain surface forms the generally flatter upper slope form, and steeper erosional slopes form the lower part of the range.
The summit is similar to that of the St Bathans Range but has a greater proportion of vegetation cover.

Dunstan Range (West Side)

The west side of the Dunstan Range is similar to the St Bathans Range overall, being high, steep and generally planar in form with a west-facing concave profile and similarly extensive scree and talus over the higher slopes and summit. Rock outcrop and exposure is much less common however. The deep colluvium mantle produces generally smooth surfaces on the slopes.
The terrain of the mid to lower slopes is variable. In some places, the sweeping concave profile is complete, and the lower slopes flatten out. In the mid-section of the range, they are divided into rectilinear surfaces by several small but deep angular gullies. Longslip Creek has cut a short scarp at the toe of these surfaces. Just north of McClays Creek and next to SH8 is a small elevated rolling area underlain by gravels deposited on a rocky outcrop during the last "Aviemore" glacial period (thus protected from subsequent removal by fluvial action).
To the north however, the mid to lower slopes increase in height whilst Longslip Creek, flowing northeast along the base of the range, creates an ever-decreasing erosional base level. Consequently this terrain is characterised by ridge and valley topography of scale increasing northwards. Ridges tend to be rounded to narrowly rounded with smooth sides and meeting the upper range slopes at an angle. The last and largest ridge however has secondary dissection along its north side, producing a coarsely corrugated pattern of gullies and spurs. Rock outcrop and talus (generally absent over the lower slopes) is also present here. Valleys are narrow but contain small flat alluvial floors which widen into small alluvial fans feeding into Longslip Creek. The creek has also truncated the ridges giving them planar ends that also show rock outcrop.

The upper range slopes are shallowly to moderately dissected. With moderate dissection, funnel-shaped basins are spaced just under the range crest descending into deep but open V-shaped valleys separated by large narrowly rounded to broadly rounded spurs which expand downslope into triangular planar faces. Elsewhere straight shallow gullies produce an undulating slope surface.

The west side of the Dunstan Range can be subdivided into three sub-units :

The Lindis Face, below Old Man Peak, is characteristically smoother and of larger scale, with an extensive mosaic of dark grey stable scree and talus and brown to reddish brown subalpine vegetation. Slumping of the thick mantle of colluvium gives a hummocky micro-topography. Four Late Quaternary fault traces also exist on this face. One lies just below Old Man Peak and is possibly manifested in the two prominent knobs there. Two others lie at the base of the range, one marked by a bench with "sag ponds" on it to the south of the boundary at Dip Creek. The fourth angles up across the face for about 1200m towards the north end, visible as a thin line of distortion in some lights.

McClays Creek is a large, deep north-flowing stream valley formed in the range face to the north of Old Man Peak. Its side slopes with a coarse scale of secondary dissection are of similar appearance to the rest of the range.

The remainder of the Dunstan Range north of McClays Creek forms the third sub-unit.

Killermont Hill

This is a large steep-sided pyramidal hill at the north end of the Dunstan Range rising to 1464m asl. The hill straddles the transition from Torlesse greywacke to Haast semi-schist and is thus composed of both these rock types. The greywacke is predominantly dark grey and associated with black argillite.
The hill is deeply but coarsely dissected in radial fashion with steep-sided V-shaped gullies, the larger ones with inter-locking spurs. Slopes are generally planar to broadly rounded and rise to a broadly rolling tussock-covered plateau summit. A thick mantle of scree and talus cover the slopes, giving the generally smooth surface. Much of it is vegetated however, and bare colluvium is less extensive than on the Dunstan Range. Larger patches of talus in a mosaic with subalpine shrubland lie across the higher southwest flank. Rock outcrop too is a minor component, tended to occur in clusters in localised areas..

Ahuriri River Terrace

Two small areas of alluvial gravels underlie the homestead area at the very north end of the property. South of SH8, under Killermont Hill, there is a small elevated remnant of fluvio-glacial gravels of "Aviemore" age, less than .2ha in area. It is separated by a weathered vegetated scarp from adjacent old river gravels of the Ahuriri river. These lie on the north side of the road, forming an elevated pasture-covered terrace of similar area well above the modern Ahuriri river bed.

Lindis Hills

This unit comprises a complex area of more finely detailed, dissected semi-schist hill terrain lying between the Lindis Face/McClays Creek and Longslip Creek/SH8.
It comprises two distinct sub-units. The northern half of the unit consists of two large steep hills. The smaller of the two reaches 943 m asl and is a discrete elongated cone shape with steep planar to rounded side-slopes with little dissection. The second larger hill has twin peaks at 1105 and 1050m asl. It is more deeply dissected in radial fashion with a mix of large deep gullies and smaller shallower ones.
The southern half of the unit is a complex of three relatively small undulating ridges of varying size and shape, and a lower plateau landform with steep scarp edges, all radiating southwest through to northwest from a central high point of 1103m asl.
Rock outcrop and scree is a very minor element in this unit, with tussock grassland covering the landforms from toe to summit. A few pale slip scars are present on the larger hill.

SIGNIFICANT LANDFORMS

There are no known special landforms or geopreservation sites on *Dunstan Downs.*

There are a number of features of interest however :
- the mid-slope "shoulder" and skewed knobs on the St Bathans Range
- the St Bathans Range as a whole
- the distinctive plateau summits with their stone patterning
- the cirque basins
- the late Quaternary Fault traces on the Lindis Face

The ability to see a whole range of clearly defined and inter-related intact landforms in a visually natural state (ie, under an apparently uniform tussock grassland/subalpine shrubland cover) over the whole of the upper end and east side of the Dunstan Creek valley is of great value. Very rarely do whole valley landscapes under pastoral use remain, as far as one can see virtually, free of obvious cultural elements and patterns that fragment or are superimposed over the landforms.

The landforms about the Lindis Pass together with their uniform tussock grassland cover (albeit modified by AOSTD and hieracium invasion) are the key element underlying the unique and highly valued scenic quality of the Pass landscape. Although not as distinctive and aesthetically dominant as the ridge and valley terrain on the west side of the highway or at the head of the valley (Double Peak) the hills on the east side of the valley do contribute to the overall value of the area primarily because of their visually intact and well-defined landform. The contrasting high planar Lindis Face with its mosaic of scree/talus and vegetation encloses the Pass landscape to the east, and, because it is so different visually, it accentuates the character of the Pass topography.

Bird Species - CRR Dunstan Downs

Bird species found on Dunstan Downs

Endemic species

Black fronted tern	*Sterna albostriata*
Paradise shelduck	*Tadorna variegata*
Grey warbler	*Gerygone igata*
New Zealand falcon	*Falco novaeseelandiae*

Native species:

Australasian harrier	*Circus approximans*
Spur winged plover	*Vanellus miles novaehollandiae*
Welcome swallow	*Hirundo tahitica neoxena*
Black shag	*Phalacrocorax carbo*
Black backed gull	*Larus dominicanus*
Pied fantail	*Rhipidura fuliginosa*
Silvereye	*Zosterops lateralis lateralis*
Banded dotterel	*Charadrius bicinctus*
Pied oystercatcher	*Haematopus ostralegus finschi*
Pipit	*Anthus novaeseelandiae*

Introduced species

House sparrow	*Passer domesticus*
Hedge sparrow	*Prunella modularis*
Blackbird	*Turdus merula*
Song thrush	*Turdus philomelos*
Starling	*Sturnus vulgaris*
Chaffinch	*Fringilla coelebs*
Goldfinch	*Carduelis carduelis*
Greenfinch	*Carduelis chloris*
Redpoll	*Carduelis flammea*
Yellow hammer	*Emberiza citrinella*
Skylark	*Alauda arvensis*
White backed magpie	*Gymnorhina tibicen hypoleuca*
Chukor	*Alectoris chukar*
Mallard duck	*Anas platyrhynchos platyrhynchos*

Fauna - CRR Dunstan Downs

Birds

No specific fauna survey was carried out for tenure review, but observations by some of the field team were made at the time of the tenure review survey and notes made by ornithologists over the last 15 years list a total of 28 bird species found on Dunstan Downs (see Appendix 2 for a list of species). For the endemic and native species the main habitats these birds are found in are the Dunstan Creek and Longslip Creek riverbeds and associated flats (black-fronted terns, black shag, banded dotterel, paradise duck, welcome swallow, black-billed gull), the cirque basins and tops (banded dotterel, falcon, Pied oystercatcher), and in valley floor shrublands (pied fantail, silvereye and grey warbler). Pipits are found across the whole property.

Reptiles

No specific reptile survey was carried out, but the four species that are known from this property are the common grey gecko (*Hoplodactylus* aff. *maculatus* 'Southern Alps') in rocks, scrub and screes, the common skink (*Oligosoma nigriplantare polychroma)*, spotted skink (*Oligosoma linneoocellatum)* and McCann's skink *(Oligosoma maccanni).*

Freshwater fish

There was no specific fish survey work done on Dunstan Downs for this tenure review survey but previous work in Dunstan Creek has shown the creek is dominated by exotic species – brown and rainbow trout, and brook char are all common. No native species have been recorded in the upper tributaries (NIWA database).