Toitu te whenua
Land Information
New Zealand

Crown Pastoral Land Tenure Review

Lease name : MORVEN HILLS

Lease number : PO 359

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.

September 11

DOC CONSERVATION RESOURCES REPORT ON TENURE REVIEW OF

MORVEN HILLS PASTORAL LEASE

2011 UPDATE

PAL 14-04-359

UNDER PART 2 OF THE CROWN PASTORAL LAND ACT 1998

CONTENTS

PART 1

INTRODUCTION

1.1 INTRODUCTION:

The Morven Hills Pastoral Lease (PL) tenure review is being undertaken under the provisions of the Crown Pastoral Land Act 1998. As part of the tenure review process, a range of specialists have visited the property. Their reports identifying the significant inherent values on Morven Hills have been incorporated within this Conservation Resources Report (CRR). The re-inspection reports have added to the original work and have provided updated botanical, lizard, fish and historic information. Other aspects such as LENZ data have been updated where appropriate.

Morven Hills was originally inspected on the 26–30 January 2004 as part of an earlier tenure review application. The lessees (Morven Hills Ltd) have again applied to undertake tenure review, therefore a re-inspection of Morven Hills was undertaken to update the Conservation Resources Report. A botanical survey was undertaken 21-22 December 2010. A lizard survey was carried out 13-17 January 2011, however poor weather meant further work was required on 21-27 February, along with an additional historic and fish inspection. A final overview flight was undertaken on 24 March 2011.

Morven Hills comprises approximately 14207 ha of pastoral lease. It is located on the Lindis Pass Highway SH 8 approximately 60 km north of the town of Cromwell. It is bounded by SH8, the Lindis Pass Scenic Reserve to the north, Dunstan Downs Station to the east, and Shirlmar and Geordie Hills properties to the south. A small area of adjoining freehold located between SH8 and the Lindis River is farmed in conjunction with the PL and contains numerous historic farm buildings.

The property is situated within the Lindis Ecological District of the Central Otago Ecological Region. A Protected Natural Areas Programme survey report has been undertaken for the Lindis Ecological District. In the report six areas within the property were recommended for protection being Recommended Areas For Protection (RAPs) (see 4.1.2 Appendix 1-6).

PART 2

INHERENT VALUES: DESCRIPTION OF CONSERVATION RESOURCES AND ASSESSMENT OF SIGNIFICANCE

2.1 LANDSCAPE:

Location and Landscape Context:

Morven Hills includes Lindis Valley alluvial flats, a large upland area of broad undulating landform forming part of an ancient peneplain, as well as the distinctive landform of the Chain Hills and adjoining basins and alluvial surfaces. The eastern flank of the Chain Hills is within Dunstan Creek that drains into the Manuherikia River.

Tussock grassland is the dominant vegetation pattern ranging from depleted short tussock in the west to intact tall tussock in the east. Shrubland is also a significant vegetation pattern occupying predominantly incised gullies. Briar is a significant plant within more modified zones.

Methodology:

The property is divided into defined landscape units (LU). The units reflect areas of similar landscape character. Landscape character is the quality that makes an area different from another and can be defined as follows:

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

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

- Intactness: - refers to the condition of the natural vegetation, patterns and processes and the degree of modification present.
- Legibility: - refers to its expressiveness - how obviously the landscape demonstrates the formative processes leading to it.
- Aesthetic Factors: - include criteria such as distinctiveness - the quality that makes a particular landscape visually striking. Frequently this occurs when contrasting natural elements combine to form a distinctive and memorable visual pattern. A further criteria assessed under aesthetic factors is coherence. This is based on characteristics including intactness, unity, continuity, and compatibility. Intrusions, alterations, disruptions tend to detract from coherence.
- Historic Factors - refers to historically valued attributes in the context of a high country landscape
- Visibility - refers to the visibility from public places such as highways, waterways or local vantage points.
- Significance - is the significance of the characteristics and features, or combination of characteristics and features within individual units. If they are locally, regionally or nationally significant.
- Vulnerability - is a measure of each landscape unit's susceptibility to further ecological deterioration, which would impact on landscape values.

Landscape Description:

Landscape Units:

Morven Hills is divided into three large landscape units (refer Map 4.2.2). These include:

Landscape Unit One (LU1) Georges

Landscape Unit Two (LU2) Lindis

Landscape Unit Three (LU3) Dunstan Creek

Landscape Unit 1 (LU1) – Georges:

Character Description:

The Georges unit includes the narrow alluvial flats adjacent to the Lindis River and the narrow band of alluvial surface adjoining Goodger Road. The majority of this unit consists of the broad upland landform or plateau that extends to Dip Creek in the north and some 8-9 km to the east. The upland plateau consists of broad undulating ridges (remnants of a peneplain) with a series of generally south-west trending incised gullies.

The flats are highly modified and include mainly open pasture and scattered briar with willow along waterways. The Morven Hills historic farm buildings including stone woolshed, as well as early plantings are important historic/cultural features along the Lindis Valley that remain from the era when Morven Hills was a much larger land area.

The faces forming the edge of the plateau are lumpy slump topography and vary from easy to moderately steep. The gorge section by Black Bridge and the section south of Dip Creek are steep and rugged with extensive rock outcrops and spurs. Terracing along the foot of the slope occurs further north towards Dip Creek. Briar, scattered shrubland, depleted short tussock and pasture species are dominant vegetation types. Several vehicle tracks provide access up the face to the plateau.

The plateau surface itself rises steadily to over 1100 m to the east. Vegetation on the undulating ridges and sloping spurs varies considerably and includes depleted scattered short tussock, exotic grasses and weeds, (especially mouse ear hawkweed) as well as scattered shrubland (including matagouri, *Olearia*, and *Melicytus*.)

The higher eastern end grades into snow tussock (with hawkweed) of variable condition above approximately 900 m.

The incised gullies are asymmetric with steep rocky bands and shady face bluffs. The opposite flank is less steep, with bare degraded sunny faces.

Manuka/kanuka, grey shrubland and briar form significant vegetation patterns within the upper reaches of the incised and often rocky gullies. These gully remnants make a significant contribution to landscape character.

The majority of the unit has been extensively modified by pastoralism and has been oversown and topdressed.

Visual & Scenic Values:
The unit is typical of the Lindis Valley with a modified (cultural) valley floor, dry rugged hills and surrounded by more distant higher mountain ranges.

The plateau landform with smooth undulating ridges and incised gullies is visually interesting and reasonably distinctive, but not striking. The degraded vegetation cover present over the majority of the unit decreases natural visual values. Remnant shrubland within the incised gullies however is significant in terms of retaining indigenous character.

In terms of visibility the flats and plateau face along the Lindis Valley have high visibility within the SH8 corridor and form part of the Lindis Pass scenic highway. The Goodger Road faces and southern end of the plateau have moderate visibility, while the remainder of the unit is not visible from public places.

Evaluation Summary: LU1

Table 1

Criteria	Value	Comment
Intactness	Low	Vegetation patterns highly modified. Native shrubland remnants within incised gullies
Legibility	Medium to high	'Peneplain' and downcutting within gullies are legible
Aesthetic Factors	Medium	Degraded vegetation impacts on coherence.
Historic Factors	Medium	Historic Station buildings and early tree plantings form important historic/cultural and landmark features within Lindis Valley
Visibility	Medium	Flats and SH 8 faces highly visible. Plateau area has generally low visibility.
Significance	Low	Landscape values are typical of Lindis Area. Not nationally or regionally significant
Vulnerability	Low	Already modified

<u>Landscape Unit 2 (LU2) – Lindis:</u>

Character Description :
The large LU2 forms a very distinctive landscape with characteristics analogous with the Lindis Pass Landscape. It is the land north of Dip Creek including the Pass Burn faces, Double Peak and area surrounding the Lindis Pass Scenic Reserve. The unit also takes in the back basins from the crest of the Chain Hills and alluvial valley floor between the Chain Hills and Dip Creek. The boundary with LU1 (Georges) overlaps LU2, as part is within the visual catchment of the Lindis Unit.

The dominant characteristics of the unit are smooth colluvial landforms, often no rock outcrops and dominant tussock cover extending from high altitude to valley floor with varying degrees of integrity.

The steep south facing slopes below Double Peak form a complex of ridges and small steep valleys that drain into the north branch of Dip Creek with terraces and alluvial surfaces on the lower slopes. Red tussock and associated plant communities occur in moist alluvial surfaces

within upper Dip Creek. The southern face of Dip Creek gorge contains steep colluvial slopes and includes a tiny remnant of Hall's totara and associated shrubland.

Large exposed cliffs within upper Dip Creek, known as Blue Cliffs are a prominent feature at the base of the southern flank of Double Peak.

The Chain Hills faces are characteristically smooth colluvial slopes with a complex of distinctive low hills, knobs, and narrow sharp ridges and spurs. These extend down onto alluvial fans and merge with the valley floor. The hills and ridge formations provide a contrast with the gentle sloping fans and valley floor. The tussock mantle appears 'draped' over the bones of the smooth, flowing and undulating landform.

Other features characteristic of the steeper slopes of the Chain Hills are localised rock bands, slumping and as some sheet erosion. Above 900 m patches of talus and boulderfields occur associated with mixed shrublands. The talus patches reflect the transition from schist to greywacke and are very prominent on the St Bathans Range in the adjoining catchment to the east. Tussock remains the dominant vegetation throughout LU2 but is highly variable in condition. Tall tussock occurs from ridge to valley floor, but is severely depleted on sunny faces, lower slopes and on the valley floor. Lower hill slopes and alluvial terraces are dominated by short tussock with some inter tussock species, hawkweed and exotic pasture species. Shrubland (predominantly matagouri) is also a significant component of the vegetation pattern on the valley floor with some mixed shrubland that has survived fire and grazing.

Electricity pylons and their access roads are a dominant feature on the lower flanks of the Chain Hills. The access roads appear more intrusive than the pylons with steep cut batters and sideslopes. The pylons are in scale with the landscape and do not unduly detract from landscape values.

The southern catchment of the unit (Davis block) is significantly more modified, but retains similar landform and vegetation characteristics.

The Pass Burn faces from Dip Creek to the Scenic Reserve are north facing. Tussock is diminished on the lower slopes and valley floor. Mixed briar and native shrubland occur within intervening valleys. Large slumps and sheet erosion are features on upper steep slopes.

Visual & Scenic Values:
The Lindis Unit contains very high visual values derived from the highly distinctive landform patterns and dominant tussock cover from valley floor to ridgeline. The characteristics are similar to the Lindis Pass landscape which is widely recognised as an outstanding New Zealand iconic landscape.

The combination of steep smooth flowing landform and contrasting low hills, narrow ridges and spurs intersecting with alluvial fans and the association of tussock cover contributes to a remarkable landscape with very high visual values. The interplay of light and season on the landform and vegetation also contributes to visual values.

Visual values however are compromised to some extent by the degraded and diminished condition of the tussock cover in places. Also the pylon access road is disruptive from some viewpoints. This aside the unit retains very high visual values especially in a landform sense.

Evaluation Summary: LU2

Table 2

Criteria	Value	Comment
Intactness	Medium	Varies from good to poor
Legibility	High	
Aesthetic Factors	High	Visually striking and impressive landforms combined with dominant tussock cover. Access tracks and tussock depletion detract
Historic Factors	Low	Associated with pastoralism and station history
Visibility	Low	Out of view from public places
Significance	High	Continuation of Lindis Pass landscape
Vulnerability	High	Vulnerable to landuse changes which would further impact on landscape values

Landscape Unit 3 (LU3) Dunstan Creek:

Character description:
This unit forms a separate catchment on the eastern flank of the Chain Hills that falls within Dunstan Creek in the headwaters of the Upper Manuherikia River. Its natural characteristics are similar to LU2 in respect of the smooth colluvial mountain slopes and dominance of tussock from valley floor to ridge crest. At high altitude, there are slight effects of periglacial features as well as patches of talus.

Tall tussock is generally continuous and in better condition than on the western flank of the Chain Hills, particularly at lower altitudes. There is a visible distinction between sunny faces and shady faces with sunny faces showing signs of snow tussock depletion. Hawkweed is also widespread. The openness and scale of the tussock landscape is important.

The valley floor forms a tributary at the head of Dunstan Creek and includes alluvial valley floor wetlands of high natural character.

Visual & Scenic Values:
The unit forms part of Dunstan Creek and Upper Manuherikia catchment; an area recognised for its high visual and scenic values. The visual values are derived from the relatively intact tussockland set within the context of a backcountry valley and the visually impressive St Bathans Range, Dunstan Range and Chain Hills. The valley floor alluvial surfaces and wetlands, and lack of man made intrusions, also contribute to the high values. The presence of hawkweed and a level of tussock degradation are the only negative factors in an otherwise outstanding natural landscape.

The area within the lease is a small, but important part of the Dunstan Creek catchment as a whole. Though modified by pastoralism it retains its integrity as a natural backcountry tussock landscape.

Evaluation Summary: LU3

Table 3

Criteria	Value	Comment
Intactness	High	Natural patterns and processes intact
Legibility	High	Highly expressive of formative processes
Aesthetic Factors	High	High level of coherence.
Historic Factors	Low	
Visibility	Low	
Significance	High	Part of the highly significant Upper Manuherikia landscape with regional and national significance.
Vulnerability	High	Vulnerable to ecological degradation

Significance of Landscape Values

The following areas are identified on Morven Hills as having Significant Inherent Landscape Values (refer Map 4.2.2). Three categories have been identified. They include –

Category One: Dunstan Creek, Pass Burn Faces north of Dip Creek, the south side of Double Peak and adjoining tussock basins taking in all of LU2 (Lindis Unit)

Category Two: Shrublands and associated rocky outcrops within deeply incised gullies.

Category Three: SH8 (Lindis Pass) Visual Corridor

Category One - Dunstan Creek, Pass Burn Faces, North of Dip Creek, the south side of Double Hill and adjoining tussock basins.

This large area forms an important and highly significant landscape.

The area within Dunstan Creek is part of an important backcountry valley with a high level of intactness and naturalness which includes impressive mountain lands, tussocklands and valley floor wetlands. It is widely recognised as an area of outstanding landscape significance with no formal protection.

The western side of the Chain Hills, as well as south of Double Peak and adjoining basins, contain characteristics analogous with the Lindis Pass. The landforms within this area are particularly impressive and distinctive, with steep smooth slopes and a complex of low ridges, spurs, knobs and alluvial surfaces. The area is dominated and unified by tussock from crest to valley floor. Although seriously depleted in places, it retains the appearance of a tussock landscape as a whole. Wholeness is important. Protection of only the better areas of tussock (eg: RAPs) does not represent this landscape but only segments of it. Context and visual catchments are important for appreciation of landscape values.

The Pass Burn faces form part of the visual corridor of the Lindis Pass and are important in terms of the appreciation of the highway corridor landscape.

The Lindis Pass type landscape, typical of much of this zone is a highly distinctive New Zealand landscape of national significance, under represented in the public conservation estate. Its

location adjacent to the Dunstan and St Bathans Ranges and the edge of the Otago schist belt adds to its overall significance.

Category two - Shrublands within Incised Gullies
The shrublands associated with deeply incised gullies and steep rocky terrain form significant landscape features within the broad undulating plateau landform (LU1). These shrublands were once much more widespread. They are important to retaining landscape character and sense of place. In addition, the often steep rocky outcrops and bluffs associated with the shrublands are visually impressive and distinctive.

Category three - SH Visual Corridor
This area forms part of the visual corridor of the Lindis Pass Highway. The corridor is part of the southern end of the scenic highway experience.

2.2 LANDFORMS & GEOLOGY:

Morven Hills varies in altitude from 450 m at the south-west corner to1611 m at the highest point near the north-east boundary. Lindis Pass at 961 m is situated near the northern boundary within the adjoining Lindis Pass Scenic Reserve.

The majority of the property is steeply rolling with limited easy country. However, central parts are noted for their smooth rounded ridgetops. There are about 200 ha of flats along the Lindis River south of the homestead.

Morven Hills is on the edge of the schist belt of Otago and greywacke mountains typical of Canterbury. It has both extensive schist rock exposure and significant greywacke-like characteristics such as talus slopes on upper mountain faces.

In the Lindis District, the mid tertiary peneplain is responsible for Central Otagos large scale basin and range topography. It is expressed here on a smaller scale and a different style than the standard pattern. The old erosion surface is warped into a set of north-east trending folds.

The Dunstan Mountains typify the Central Otago pattern of fault-block mountain ranges uplifted along faults on their south-eastern edges and tilted to the northwest. The smooth upland topography of the area with long gently sloping ridges on the north-west slopes and smooth crests of the range are the remnants of a mid-tertiary peneplain surface. Valley floor features in this area include extensive terraces of alluvial gravels and localised moraines formed as a result of successive advances of the Clutha glacier and intervening down cutting of the river.

The rock underlying most of the region is Haast schist which is commonly exposed as tors or outcrop towers of platy laminated rock. The basement rock of Morven Hills is chlorite subzone III and IV, well foliated quartz feldspathic schist and lesser chlorite schist. The lower terraces are derived from Pleistocene gravels and moraines, superimposed at the base of the schist zone with fan detritus.

Soils:

Soils of the Lindis Ecological District (ED) are derived mainly from Haast schist, loess and alluvial gravels. Underlying soils patterns are typically dominated by an altitudinal and rainfall sequence. Brown-grey earths have formed in the driest zone (<500mm rainfall). Yellow grey earths occupy the lower mountain slopes, grading into high country yellow/brown earths above 700-1000 m. This sequence reflects increasing leaching and acidity with decreasing fertility. The

valley floors include limited areas of recent soils on alluvium of flood plains and fans. Many have been intensively modified. These soils may contain pockets of soluble salts.

Inspection reveals many quartz boulders in the farm block named "white rocks block". Also known as sarsen or China stones, these are mapped as Bannockburn and Dunstan formations with basal quartz and sand conglomerate, locally silica cemented.

An interesting geological feature is near the Lindis Pass Highway, about 3km north of the homestead. It is a block of calcium rock known as travertine located behind a raupo swamp. Travertine is a sedimentary rock that was formed from precipitated carbonate minerals. This is an unusual occurrence known to be associated with some swamps in Central Otago.

New Zealand Geopreservation Inventory:

The aim of the New Zealand Geopreservation Inventory (Arand *et al*. 1991) is to identify and document all landforms, geological sites and soil sites of international, national and regional, scientific and educational significance.

Morven Hills has a number of soil sites of significance (see 4.1.2 appendix 7 for details):

- Site 305-Chain Hills – Kaikoura soils with a moderate range of relatively unmodified vegetation types.
- Site 306-Dip Creek Beech – One of the few remaining remnants of yellow-grey earths with mountain beech forest cover in New Zealand. Also beech at its driest limits.
- Site 307-Dip Creek Totara – driest site in the district – notable for the Arrow soils under original vegetation cover.
- Site 308-Double Peak – one of the few remaining snow tussocklands in Lindis Ecological District that has not been extensively modified by oversowing and topdressing. This site is more diverse than the adjacent Lindis Pass Scenic Reserve.

Significance of soils:

The soil sites 305 and 308 are of regional and site 306 and 307 are of national importance.

2.3 LAND ENVIRONMENTS

Description

The environmental distinctiveness of this area has been assessed through the Land Environments of New Zealand (LENZ). This is a classification of New Zealand landscapes using a comprehensive set of climate, landform and soil variables chosen for their roles in driving geographic variation in biological patterns (Leathwick et al. 2003). It is presented at four levels of detail containing 20, 100, 200 or 500 environments nationally. The data in this report is presented at Level IV which more adequately reflects the distribution of biodiversity, past clearance and current vulnerability across the landscape than higher levels of LENZ (e.g. level II). Threat classification at level IV results in substantially more effective and efficient identification of threatened remaining indigenous cover.

When the Level IV LENZ information is combined with information describing the area of unprotected indigenous cover in threatened land environments, as identified in the national land

cover database (LCDB), the biodiversity most likely to be lost can be identified. Five categories identify those threatened environments containing indigenous biodiversity at most risk of loss. These categories which are derived from a combination of measures for the percentage of biodiversity legally protected and percentage of remaining indigenous vegetation cover, are described as follows (see plan attached as Appendix 4.2.5):

Table 4: Land Environments of New Zealand Threat Classification Categories

Threat Classification	Description
Acutely threatened	<10% indigenous vegetation cover remaining
Chronically threatened	10-20% indigenous vegetation remaining
At risk	20-30% indigenous vegetation cover remaining
Critically underprotected	> 30% indigenous vegetation cover remaining and <10% protected
Underprotected	>30% indigenous vegetation cover remaining and 10-20% protected
No threat	>30% indigenous vegetation cover remaining and >20% protected

Four LENZ environments (E, K, N & Q) (Leathwick et al. 2003) are present on the Lease. At Level IV classification the lease comprises E4.1b, K3.2a, N3.1d, N3.2a, N4.1b, N4.1c, N4.1d, N5.1a, N5.1b, N5.1c, Q1.1a, Q1.1b, Q1.1c, Q1.2a, Q2.1b, Q2.2a, Q3.3a, Q3.3b, and Q3.3c. Table 5 presents a full LENZ analysis for Morven Hills.

Table 5: LENZ environments present on Morven Hills Pastoral Lease

Threat Category	LENZ Level IV units	Area of LENZ unit on Morven Hills (ha) (Approx)	Area of LENZ unit as a % of Morven Hills	Area of LENZ unit as a % of LENZ level 4 category nationally
Acutely Threatened	N3.2a	30.65	0.22	0.18
	N5.1a	2.43	0.02	<0.01
	N5.1b	126.89	0.89	1.30
	N5.1c	262.94	1.85	0.70
Chronically Threatened	N3.1d	48.46	0.34	0.08
	N4.1b	2.91	0.02	<0.01
	N4.1d	1727.38	12.14	3.69
At Risk	E4.1b	171.01	1.20	0.29
	K3.2a	203.62	1.43	2.44
Critically Underprotected	N4.1c	18.76	0.13	0.03
	Q1.1b	317.47	2.23	0.61
	Q2.1b	107.13	0.75	0.11
	Q2.2a	8569.64	60.22	3.99
	Q3.3b	1.13	0.01	<0.01
Underprotected	Q1.1c	2372.26	16.67	0.91
	Q3.3c	0.61	0.00	<0.01
No threat category	Q1.1a	25.06	0.18	0.02
	Q1.2a	185.90	1.31	0.09
	Q3.3a	55.61	0.39	0.08
Total		**14229.86**	**c. 100**	

2.4 CLIMATE:

Annual rainfall averages around 550mm at the homestead to 1200mm in the higher country. Summer temperatures are high. Winters are cold with severe frosts. Snow is common, but lies only in higher areas for any length of time. There is a soil moisture deficit for much of the summer especially on sunny aspects. North-west and south-west winds can be severe at times.

2.5 VEGETATION:

Introduction
Two major land systems characterise the north-eastern sector of the Lindis Ecological District, spanned by Morven Hills. The George's land system is characterised by the uplifted warped plateau surface of the tertiary peneplain. Much of the old erosion surface is dissected rather shallowly with smooth surfaces and ridges predominant with moderate areas of outcropping rock. There is a high proportion of lower altitude zones than in the surrounding land systems and consequently a relatively low proportion of natural or semi-natural vegetation has been retained. Matagouri – *Coprosma* shrubland of low diversity is widespread in entrenched valleys, with lesser areas of kanuka shrubland.

The adjoining Chain land system to the east comprises the Chain Hills, an undulating ridge rising to 1600 m with many side spurs. Smooth colluvial slopes and a moderate scale of dissection are characteristic, with minor slumping and talus. The smooth slopes offer few fire refuges other than small talus patches. Consequently there is little shrubland vegetation, with snow tussockland strongly predominant. Small areas of red tussock have survived on wetter younger alluvial soils.

Properties to the west of Morven Hills have large and conspicuous beech forest remnants of which only one tiny example occurs on Morven Hills. Further east extensive tall snow tussocklands exist on the slopes of the St Bathans Range.

The likely nature and extent of the pre-human vegetation has been assessed as part of a wider study of the woody vegetation of Central Otago (Walker 2003). This suggests that at lowest altitudes (below 730 m) a kanuka-kowhai-Hall's totara dominated forest occurred. At higher elevations (720 – 1040 m) a beech-Hall's totara-snow totara forest probably prevailed below a bog pine-snow totara-mountain toatoa shrubland rising to 1340 m. At highest elevations alpine heaths in conjunction with tall tussocklands would have been the dominant vegetation.

At least one previous botanical assessment of this property has been carried out. The Lindis Ecological District along with the Pisa and Dunstan EDs were surveyed as part of the Protected Natural Areas Programme (PNAP) during the summer of 1984/85. The resulting report (Ward et. al 1994) identified 20 Recommended Areas for Protection (RAPs) within the Lindis ED of which six lie entirely within Morven Hills, these being Lindis A2, A3, A4, A5, A6 and B5; together making a total of 2780 ha. A subsequent report (DOC 1990) discussed conservation considerations arising from the desire to see appropriate management of the conservation resources identified in the Ward (1994) report and other relevant reports.

Morven Hills was first inspected for botanical values in 2004. The length of time that has elapsed since that survey, changes to criteria for assessing significant inherent values, and changes in Government policy, have necessitated a reappraisal of the property. This report amalgamates the findings of the previous surveys and reports with that of the most recent survey.

Survey Method

The original survey in January 2004 was undertaken by two botanists. The most recent survey was carried out in December 2010 when approximately 12 hours were spent on the property. It concentrated on areas where survey in 2004 had been compromised through time constraints and difficulty of physical access, but the opportunity was also taken to overview most of the property. Much of the property were accessible via internal 4WD tracks but steep terrain, creek beds, and other areas remote from tracks were surveyed on foot. Descriptions were made of the composition of major plant communities. Threatened plants were searched for in potentially suitable habitats. Digital photographs were taken of particular species, communities and landscapes to aid in interpretation. Specimens were collected of noteworthy or uncertain taxa for herbarium accession and determination. A short flight over the property was used to more accurately determine features and boundaries of interest.

Vegetation Description

Morven Hills has been broken up into units to assist the description of vegetation on the property. These units are based on topography and often lump together some of the farm blocks. The units are:

Lindis Valley: This includes the Lindis River valley floor and adjacent hill country. The unit consists of River flat, River face, Shearing Paddock, Homestead, Ram Paddock and Blue Slip farm blocks.
Long Slip: This includes the Long Spur Creek valley floor and adjacent hill country. The unit consists of Hectors, Howards, Kearns Face, Beckers, Mcleans and Little Rocky farm blocks.
Manuka Gullies: This includes some of the central Long Spur Creek tributaries. The unit contains hill country of moderate altitude and consists of Manuka Gullies, Rocky Hills and The Hummocks farm blocks.
Western hill country: The unit contains hill country of moderate altitude and consists of Ileans, Wrights, White Rocks, Hogget, G-Mars, Station Range, Top Airstrip and Farmers Gully blocks.
Lower Dip Creek: This includes the lower half of the Dip Creek catchment and consists of Dip Face, Ewe Block and Pass Burn Face farm blocks.
Upper Dip Creek: This includes parts of the Dip Creek headwaters arising from the Dark Side Black Hill farm block.
Upper Lindis Faces: This includes the faces overlooking the Lindis Pass – Tarras Road and consists of Sledges Hill and Sunny Side Black Hill farm blocks.
North-western Chain Hills: This contains the north-western slopes of the Chain Hills. The unit consists of the Blue Cliffs farm block.
Long Spur Creek headwaters: This contains the south-western slopes of the Chain Hills, including the headwaters of Long Spur Creek. The unit consists of the Davis farm block.
Eastern Chain Hills: This contains the eastern slopes of the Chain Hills. The unit consists of the Dunstan farm block.

Lindis Valley

The unit is generally dominated by exotic vegetation with areas of cultivated land on the valley floor. The hillslopes are dominated by exotic grass species with fescue (*Festuca novae-zelandiae*) tussockland becoming common with increasing altitude. The gullies and some hill faces contain shrublands in which briar (*Rosa rubiginosa*) is prominent. Major native vegetation present includes dryland vegetation, wetlands, rocky faces, shrublands and fescue tussockland.

Dryland vegetation: Dryland vegetation is fragmented, occurring on terraces in the north of the block (i.e. north of Farmers Creek). The vegetation is composed of a mixture of native and exotic species. The major native species include *Raoulia australis, R. beauverdii, R. parkii, Carex resectans, Carex breviculmis, Poa cita, Acaena buchananii, Muehlenbeckia axillaris,* and the lichen *Xanthoparmelia semiviridis.* The most common exotic species include exotic grasses sweet vernal (*Anthoxanthum odoratum*) and others, mouse-ear hawkweed (*Pilosella officinarum*), sheep's sorrel (*Rumex acetosella*) and haresfoot trefoil (*Trifolium arvense*.

Wetlands: A few valley floor wetlands are present. At Grid Ref. G40 E2234222 N 5614459 the wetland contains several distinct communities. There are two areas dominated by raupo (*Typha orientalis*), with *Carex secta, Carex maorica* and other species. Also present is sedgeland consisting of a mixture of *Carex coriacea, C. diandra, C. sinclairii, C. gaudichaudiana, Schoenus pauciflorus* and *Eleocharis acuta*. A turf community is dominated by *Hydrocotyle hydrophila*, with *Ranunculus glabrifolius, Eleocharis acuta, Epilobium chionanthum* and *Juncus pusillus.* Special elements from this wetland include *Triglochin palustris, Epilobium chionanthum* and *Carex maorica.*

A second wetland occurs at the foot of a terrace at Grid Ref. G40 344 149. The wetland contains *Carex coriacea, C. diandra, C. sinclairii, Eleocharis acuta, Juncus articulatus, Juncus conglomeratus*?, *Myosotis laxa* ssp. *caespitosa* and special elements including *Triglochin palustris* and *Epilobium chionanthum.*

A third wetland occurs at Grid Ref. G40 313 085 at the foot of a hillslope fed by seepages. It is fragmented with a drain through it. The wetland contains *Schoenus pauciflorus, Carex diandra, C. sinclairii, Eleocharis acuta, Juncus articulatus, Myosotis laxa* ssp. *caespitosa* and *Carex flaviformis.*

Rock faces/outcrops: In the south of the unit are extensive rock faces. These rock faces contain blue tussock (*Poa colensoi*), *Koeleria novozelandica, Rytidosperma unarede, Asplenium flabellifolium, Luzula banksiana* var. *migrata, Vittadinia australis, Senecio quadridentatus, Oxalis exilis, Raoulia australis, Carex breviculmis, Helichrysum intermedium* and *Melicytus alpinus*. As a consequence of the large extent of habitat and limited search time it is highly likely many additional species will also be present. The slopes between rock outcropping are dominated by briar with mingimingi (*Coprosma propinqua*) and *C. intertexta.*

Smaller scale rock outcropping is widespread within the unit. Typical species in such areas include *Asplenium flabellifolium, A. trichomanes, Cheilanthes sieberi, Vittadinia australis, Senecio quadridentatus, Melicytus alpinus* and *Epilobium* sp.

Shrublands: Most of the shrubland within the block is restricted to gullies and lower slopes and is dominated by briar. The only shrubland in this block that was examined is at Grid Ref. G40 346 149. This shrubland is dominated by matagouri (*Discaria toumatou*), mingimingi and briar, with *Rubus schmidelioides, Muehlenbeckia complexa, Olearia odorata, Melicytus alpinus* and elderberry (*Sambucus nigra*). The understorey includes *Blechnum penna-marina, Oxalis exilis, Carex breviculmis* and *C. inopinata*. The shrubland occurs on both colluvial soil and talus slopes. There is numerous rock outcropping within the shrubland.

Grassland/Tussockland: The grasslands and tussockland within this unit are dominated by exotic pasture species. Shrubs of briar, *Melicytus alpinus, Coprosma intertexta,* and other species are often scattered through the grasslands.

Long Slip

The unit is generally dominated by exotic vegetation with areas of cultivated land along the valley floor. The hillslopes are generally dominated by exotic grass species with fescue tussockland becoming common with increasing altitude. The gullies and some hill faces contain shrublands in which briar is prominent. Major native vegetation present includes dryland vegetation, rock outcrops, shrublands and fescue tussockland.

Drylands: The vegetation in these drylands is composed of a mixture of native and exotic species. The community occurs on both river terraces and sunny ridge crests/slopes. A numbers of sites were examined.

At Grid Ref. G40 345 072 dryland vegetation is located on valley floor terraces adjacent to the track. Native species include *Raoulia australis, R. beauverdii, R, parkii, Acaena buchananii, Leptinella serrulata, Geranium brevicaule, Oxalis exilis, Carex resectans, C. breviculmis, Poa maniototo, Rytidosperma* sp., silver tussock (*Poa cita*), *Coprosma petriei, Melicytus alpinus, Muehlenbeckia axillaris* and the lichen *Xanthoparmelia semiviridis*. The most common exotic species include mouse-ear hawkweed, sheep's sorrel, haresfoot trefoil and sweet vernal.

Another area examined is on a broad ridge above rock outcropping at Grid Ref. G40 337 085. At this site are *Raoulia australis, R. beauverdii, Leptinella serrulata, Acaena buchananii, Stellaria gracilenta, Carex breviculmis, Poa maniototo,* blue tussock, fescue tussock, *Melicytus alpinus, Muehlenbeckia complexa,* bryophytes and the lichen *Xanthoparmelia semiviridis*. The most common exotic species include *Rumex acetosella, Trifolium arvense,* hawksbit (*Crepis capillaris*), mouse-ear hawkweed and sweet vernal. An adjacent ablated gravelly area has the additional species *Carex resectans* and *Muehlenbeckia axillaris.*

Rock outcrops: Small scale rock outcropping is widespread within the unit. An area examined was at Grid Ref. G40 337 074. This rock outcrop contains *Asplenium flabellifolium, A. richardii, Crassula sieberiana, Wahlenbergia rupestris, Epilobium pubens, Dichondra repens, Hydrocotyle novae-zelandiae, Dichelachne crinita, Einadia allanii,* mingimingi, matagouri, *Rubus schmidelioides, Muehlenbeckia complexa* and *Melicytus alpinus*.

Shrublands: Most of the shrubland within the unit is restricted to gullies and lower slopes. These shrublands are generally dominated by briar, with variable amounts of matagouri, mingimingi, *Olearia odorata, Melicytus alpinus, Rubus schmidelioides, Muehlenbeckia complexa* and other native species.

Grassland/Tussockland: The grasslands and tussockland were not examined in detail as they are generally highly modified, being dominated by exotic pasture species.

Manuka Gullies

A feature of this unit is the kanuka (*Kunzea ericoides*) shrubland with associated rock outcrop systems. Other vegetation communities include other shrublands, fescue tussockland, drylands and wetlands.

Shrublands: A range of shrubland is present within the unit. These include kanuka, riparian valley floor and "grey scrub" on hill slope.

A number of gullies contain kanuka shrublands. The best developed of these are centered at Grid Ref. G40 373 107 and 385 098. The shrubland is dominated by kanuka up to 6 m tall, with some matagouri, mingimingi, *Rubus schmidelioides, Muehlenbeckia complexa* and briar with an understorey that includes *Carex inopinata.*

Riparian shrublands occur along the valley floors within the best developed areas of shrubland. The major species include matagouri, mingimingi, mountain wineberry (*Aristotelia fruticosa*), *Olearia odorata*, *Rubus schmidelioides* and *Muehlenbeckia complexa*. Other native components include *Melicytus alpinus*, koromiko (*Hebe salicifolia*), desert broom (*Carmichaelia petriei*), *Coprosma intertexta, Olearia fimbriata, Clematis marata, Parsonsia capsularis, Carmichaelia kirkii* and *Muehlenbeckia australis*. Understorey species include prickly shield fern (*Polystichum vestitum*), *Hypolepis millefolium, Urtica aspera, Chaerophyllum ramosum* and *Acaena anserinifolia*. Exotic shrubs include scattered briar, gooseberry (*Ribes uva-crispa*), elderberry and bittersweet (*Solanum dulcamara*). The best examples were recorded at Station Range (GR G40 372 108), Manuka Gullies (GR 385 099) and Hummocks (GR 399 087).

Grey scrub occurs on hillslopes and is relatively widespread within the unit. The community is dominated by matagouri, mingimingi and a variable amount of briar. Other native species include kanuka, *Olearia odorata,* desert broom, *Melicytus alpinus, Rubus schmidelioides, Muehlenbeckia complexa* and *Clematis marata*. The best examples were recorded at Station Range (GR G40 371 111), Manuka Gullies (GR 382 096) and Hummocks (GR 399 087). A further site in the Hummocks block includes a substantial population of the threatened *Olearia fimbriata*.

Rock outcrops: The largest scale rock outcrop systems are associated with steep slopes within kanuka or grey scrub; there are also smaller scale rock outcrops within tussockland. The vegetation present on these systems includes the ferns *Asplenium flabellifolium, A. richardii, A. trichomanes, Cheilanthes sieberi, Pellaea calidirupium,* prickly shield fern, *Polystichum neozelandicum* subsp. *zerophyllum*, *Blechnum penna-marina*; and the herbs *Wahlenbergia rupestris, Epilobium pubens, Pachycladon cheesemanii, Vittadinia australis, Senecio quadridentatus, Crassula sieberiana, Brachyglottis haastii, Anisotome brevistylis, Oxalis exilis* and *Pseudognaphalium luteo-album.*

Other common elements include the grasses *Koeleria novozelandica* and *Rytidosperma unarede*, the woodrush *Luzula banksiana* var. *migrata,* and shrubs *Melicytus alpinus, Helichrysum lanceolatum, Pimelea traversii, Coprosma intertexta, Gaultheria antipoda* and kowhai (*Sophora microphylla*).

Grasslands/Tussocklands: The fescue tussocklands at higher altitudes are in moderate condition. They retain a variable component of fescue tussock and many native species, but tend to be dominated by sweet vernal, mouse-ear hawkweed and other exotic species. The most common native species include harebell (*Wahlenbergia albomarginata*), *Leucopogon fraseri, Acaena caesiiglauca* and *Raoulia subsericea*.

Drylands: These are localised, tending to occur along dry ridges above the rock outcrop systems. The major native species include *Raoulia australis, R. beauverdii, R. parkii, Leptinella serrulata, Stellaria gracilenta, Colobanthus brevisepalus, Carex resectans, C. breviculmis, Poa maniototo, Luzula ulophylla, Melicytus alpinus, Leucopogon fraseri, Muehlenbeckia axillaris,* bryophytes and the lichen *Xanthoparmelia semiviridis*. The most common exotic species is sheep's sorrel, with some mouse-ear hawkweed, haresfoot trefoil and sweet vernal

Wetlands: There are small wetlands along the streams. Characteristic species include *Carex secta, C. coriacea, Eleocharis acuta, Schoenus pauciflorus,* and silver tussock.

Western Hill country

This unit is dominated by fescue and narrow-leaved snow tussock (*Chionochloa rigida*) tussockland. Other vegetation communities includes shrubland with some rock outcropping, drylands and wetlands. This block contains RAP A6 Morven Hills. The RAP A6 contains all the

major vegetation communities of the block, including fescue tussockland, narrow-leaved snow tussockland, kanuka shrubland, grey scrub, and riparian wetland.

Tussockland: Fescue tussockland in variable condition is widespread with narrow-leaved snow tussockland confined to higher ground (i.e. above 900-950 m). Fescue tussock is dominant with golden speargrass (*Aciphylla aurea*) and Maori onion (*Bulbinella angustifolia*) being locally prominent. There are many associated native species, the most common being harebell, *Leucopogon fraseri, Acaena caesiiglauca, Carex breviculmis* and *Raoulia subsericea*. Common exotic species include sweet vernal, mouse-ear hawkweed, and white clover (*Trifolium repens*).

The narrow-leaved snow tussockland is dominated by a moderate cover of narrow-leaved snow tussock, with some fescue tussock, blue tussock, *Raoulia subsericea,* harebell, *Leucopogon fraseri, Acaena caesiiglauca, Scleranthus brockiei* and *Pimelea oreophila*.

Shrublands: A range of shrublands are present within the unit. These include kanuka, riparian valley floor and "grey scrub" on hill slope. Kanuka shrublands occur at Grid Ref. G40 355 146, 363 126 and 353 122. The composition of these shrublands is similar to that previously described for Manuka Gullies.

Grey scrub and riparian shrublands occur in Farmers Gully and Hogget blocks. Their composition is similar to that previously described for the Manuka Gullies.

Rock outcrops: The largest rock outcrop systems are associated with steep slopes within kanuka or grey scrub, but there are also smaller scale rock outcrops within tussockland. The vegetation associated with these is similar to that previously described for the Manuka Gullies unit. Additional species include *Myrsine nummularia, Hebe buchananii, Celmisia prorepens, Colobanthus strictus* and *Leptinella serrulata*.

Wetlands: A feature of this unit is the localised wetlands on the floors of minor gullies. The composition of these wetlands is variable, with some of the major associations being:

- dense swards of cutty grass with a range of other associated species. Localised wetlands of this type are scattered along the streams in Farmers Gully, Hogget Block and elsewhere within this unit.
- open stands of pedicelled sedge (*Carex secta*) with a ground cover containing *Hydrocotyle novae-zelandiae* var. *montana, Ranunculus glabrifolius, R. maculatus, R. foliosus, R. royi, Epilobium chionanthum, Carex kaloides, Eleocharis acuta* and other species.
- Turf areas containing *Hydrocotyle novae-zelandiae* var. *montana, Juncus pusillus, Potentilla anserinoides, Rumex flexuosus, Montia fontana, Isolepis caligenis, Carex kaloides* and other species.
- Sward of *Carex inversa*.

A small tarn (the only tarn observed on the property) occurs at Grid Ref. NZMS 260 G40 344 096. The tarn area is dominated by exotic grasses and white clover, but contains *Lobelia angulata* and an unidentified rush. The surrounding fescue tussockland contains *Hydrocotyle novae-zelandiae* var. *montana, Acaena buchananii, Carex breviculmis, Rytidosperma* sp. and patches of *Dichondra brevifolia*.

Lower Dip Creek

Shrublands: Contiguous riparian shrublands extend along the course of Dip Creek from its confluence with the Pass Burn upstream for over 3 km, with extensions up several tributaries. In parts they are of such density and stature as to be almost impenetrable. Common shrubs include matagouri, mingimingi, *Olearia odorata,* mountain wineberry and koromiko. Some large

matagouri have reached tree proportions. The rare scrambling shrub *Carmichaelia kirkii* is present sporadically along the length of the shrubland belt. Other lianes are very common and include *Parsonsia* sp., *Muehlenbeckia complexa*, and *Rubus schmidelioides*. Shrub weeds are minor and restricted to briar, gooseberry and in the lowest reaches, elderberry.

Similar shrublands are also present in a less contiguous manner on the steep shady slopes on the true right of Dip Creek in damp gullies and in and around bouldery colluvium. The drier lower valley slopes on the true left (Pass Burn Face farm block) have considerable regenerating kanuka, along with matagouri and briar.

Forest: Two small forest remnants are present on steep slopes on the true right of Dip Creek and have previously been identified as RAP A4 and RAP A5. A 1 ha stand of mountain beech (*Nothofagus solandri* var. *cliffortioides*) occupies the western side of a steep mid slope gully. It has a fragmented canopy caused by apparent windthrow, but some regeneration is present. A little further upstream, a talus cone adjacent to Dip Creek supports a Hall's totara (*Podocarpus cunninghamii*) forest/treeland with a mingimingi, *Olearia odorata* and *Hebe rakaiensis* margin. Hall's totara regeneration is vigorous with several distant outliers suggesting continuing spread.

Wetlands: A swamp in the middle reaches of Dip Creek is variously dominated by *Juncus* spp., *Carex sinclairii, C. coriacea, Schoenus pauciflorus*, and exotic grasses. A lone crack willow (*Salix fragilis*) is present. Drier margins support silver tussock. Very small examples of similar *Carex* dominated wetlands are present on low-lying terraces along the length of Dip Creek.

Rock outcrops: Several small schist rock outcrops near the valley bottom have a distinctive drought –tolerant flora which includes blue tussock, *Rytidosperma setifolium, Elymus* sp., *Pellaea calidirupium, Oxalis exilis, Luzula banksiana* var. *migrata, Senecio quadridentatus, Vittadinia australis, Crassula sieberiana*, and occasionally *Pachycladon cheesemanii*. Exotic plants include viper's bugloss (*Echium vulgare*), woolly mullein (*Verbascum thapsus*), haresfoot trefoil (*Trifolium arvense*) and tussock hawkweed (*Hieracium lepidulum*). Outcrops in the sub-alpine zone have a suite of native shrubs and herbs including *Helichrysum intermedium, Hebe buchananii, Coprosma cheesemanii,* desert broom, *Myrsine nummularia, Gaultheria antipoda,* and *Asplenium flabellifolium.*

Tussock grasslands: Narrow-leaved tussocklands are mostly restricted to the mid - upper reaches of the Ewe Block where they occur in association with regenerating shrublands and rock outcrop communities. The much drier Dip Face is almost devoid of substantial tall tussock communities which have instead been replaced by hawkweed communities, short tussock and briar.

Upper Dip Creek

Ridge crest: The highest parts of this unit c. 1400 m have degraded cushionfields comprising scattered narrow-leaved tussock, *Scleranthus uniflorus*, golden speargrass, *Raoulia subsericea* and *Carmichaelia vexillata*. Mouse-ear hawkweed and tussock hawkweed are common exotic components.

Tussocklands: A narrow belt of slim snow tussock (*Chionochloa macra*) extends along the slopes at highest altitude, particularly on shady aspects. This abruptly merges into more extensive narrow-leaved tussocklands which extend down into Dip Creek headwaters on favourable aspects. Common associated species include alpine fescue (*Festuca mathewsii*), blue tussock, *Gaultheria crassa, Pimelea oreophila*, harebell and *Acaena caesiiglauca.*

Short tussocklands predominate on lower sunny slopes, particularly at the western end of the unit, where the tall tussock community has been reduced to scattered individuals. Although dominated by alpine fescue, other native grasses include *Elymus solandri* and *Deyeuxia avenoides*.

Groundcover is dominated by a range of native and exotic herbs similar in composition to those described for the lower reaches of the north-western Chain Hills unit.

Red tussock (*Chionochloa rubra*) is an occasional component of wetlands and damp alluvial surfaces in the head of Dip Creek.

Wetlands: Below the pylon access road a narrow belt of wetlands occupies the alluvial valley floor through which the headwaters of Dip Creek meander. Vegetation is a mixed tussock/sedge community dominated by narrow-leaved tussock, red tussock and a range of sedges including *Carex sinclarii, C. secta, C. inversa* and *C. diandra*. Other common species include silver tussock, Maori onion, *Schoenus pauciflorus, Mentha cunninghamii, Viola cunninghamii, Uncinia divaricata, Blechnum penna-marina* and *Ranunculus* spp.

Shrublands: Small areas of riparian shrubland are present along the margins of Dip Creek and are mostly comprised of matagouri, *Olearia odorata, Muehlenbeckia complexa* and occasionally briar.

Rock outcrops: Steep rocky ribs adjacent to Dip Creek have a diverse range of shrubs and herbs including several species uncommon elsewhere on the property. Shrubs present include *Olearia cymbifolia, Coprosma dumosa, Myrsine nummularia, Hebe buchananii, Helichrysum intermedium* and *Gaultheria crassa*. Herbs include *Celmisia densiflora, Anisotome brevistylis, Brachyglottis haastii* and *Dolichoglottis lyallii.*

Upper Lindis Faces

This unit of broad north-facing tussock and shrubby slopes shows improving naturalness and condition across a west-east gradient.

Ridge crest: At highest altitudes in the east (c. 1400 m) there are somewhat degraded cushionfields described above under the Upper Dip Creek unit.

Tussocklands: Moderately dense but low stature narrow-leaved tussocklands are present just below the ridge crest in the east and extend across the broad hilltop plateau in the west. Common intertussock species include alpine fescue, blue tussock, *Leucopogon fraseri,* golden speargrass, *Carmichaelia vexillata, Celmisia gracilenta, Pimelea oreophila, Craspedia* sp., *Muehlenbeckia axillaris* and *Luzula rufa*. Bare ground and patches of mouse –ear hawkeed are prevalent.

The condition of tussocklands improves substantially lower down the slopes in the east (c. 1200 m) with much less bare ground and hawkweed and more tussock litter. Intertussock herbs include many of those listed above but also the orchids *Prasophyllum colensoi* and *Thelymitra longifolia*, along with *Gentianella corymbosa,* harebell, *Brachyscome* sp., and *Carex breviculmis*.

At c. 1100 m and below, small areas of steep hillslopes are almost devoid of tall tussock and have a developed a prostrate herbaceous cover dominated by mouse-ear hawkweed but with occurrences of the rare daisy *Kirkianella novae-zelandiae* and tiny *Stackhousia minima*. Patchy tall tussockland interspersed with short tussock and hawkweed on sunny slopes, continue down-slope to the property boundary at the Lindis – Tarras Road within Sunny Side Black Hill.

Shrublands: Eastern gullies in particular have retained substantial riparian shrubland vegetation dominated by indigenous species. Shrubs present include mingimingi, *C. intertexta,* matagouri, desert broom, *Melicytus* aff. *alpinus, Olearia odorata, O. bullata, O. lineata* and mountain wineberry. These are often entwined with the lianes *Clematis marata, Muehlenbeckia complexa* and *Rubus schmidelioides*. Shrublands in the west are dominated by briar and are not restricted to gullies, extending over large areas of the lower slopes.

Rock outcrops: Rock outcrops are common on the steeper slopes of Sledges Hill and the western end of Sunny Side Black Hill block. At highest elevations they exhibit a range of native shrubs and herbs including *Helichrysum intermedium, Hebe buchananii, Coprosma cheesemanii,* desert broom, *Myrsine nummularia, Gaultheria antipoda, Asplenium flabellifolium* and *Colobanthus acicularis*. At lower elevations native diversity is much reduced and exotic shrubs and herbs become more prevalent. A small outcrop near the Lindis – Tarras Road near the northern extent of the property has a small population of the rare cress *Pachycladon cheesemanii*.

North-western Chain Hills

This unit retains intact vegetation sequences from valley floor narrow-leaved snow tussockland up the hill slope into slim snow tussockland and onto the ridge crest summit of the Chain Hills. Much of this block was identified within RAP A3 and B5 in the Lindis-Pisa-Dunstan PNAP survey. A tributary catchment immediately north of RAP A3 is however in a much degraded condition with truncated vegetation sequences.

Ridge crest: Ridge crests with rock outcropping contain *Rytidosperma setifolium,* edelweiss (*Leucogenes grandiceps*), *Koeleria novozelandica, Colobanthus buchananii, Cardamine bilobata, Leptinella pectinata, L. pusilla, Raoulia grandiflora, Scleranthus uniflorus, Acaena saccaticupula, Hebe buchananii* and other species. Other ridge crest outcrop sites contain *Schizeilema hydrocotyloides, Brachyscome* sp., *Celmisia laricifolia* and other species.

Tussocklands: The upper altitude snow tussockland consists of slim snow tussock with a moderate to good cover and healthy condition. Associated species include blue tussock, fescue tussock, snowberry (*Gaultheria depressa* var. *novae-zelandiae*), *Pimelea oreophila, Lycopodium fastigiatum,* harebell, *Raoulia subsericea, R. grandiflora, Luzula rufa* and other species. Some sunny faces have abundant *Carmichaelia vexillata.* On shady faces *Celmisia laricifolia, Lobelia linnaeoides,* occasional cottonwood (*Ozothamnus vauvilliersii*), and golden speargrass are present.

Within the slim snow tussockland, areas of bare ground contain *Poa lindsayi, Epilobium tasmanicum, Leptinella pectinata, Rytidosperma pumilum,* scree pea *(Montigena novae-zelandiae),* sheep's sorrel and mouse-ear hawkweed. Areas of talus within the grassland contain scattered slim snow tussock, *Coprosma cheesemanii, Dracophyllum pronum, Melicytus alpinus, Celmisia lyallii, Anisotome aromatica,* snowberry, *Pentachondra pumila, Lycopodium fastigiatum,* and *Blechnum penna-marina*.

Below c.1100 m on shady faces and c.1300 m on sunny faces narrow-leaved snow-tussock becomes dominant. The narrow -leaved snow tussock retains a moderate to good cover and healthy condition. Associated species include fescue tussock, blue tussock, golden speargrass, *Pentachondra pumila,* snowberry, *Leucopogon fraseri, Celmisia gracilenta,* harebell, *Raoulia subsericea, Carmichaelia vexillata, Carmichaelia crassicaulis* subsp. *racemosum* and *Luzula rufa.*

Within the narrow-leaved snow tussockland are talus slopes with desert broom, celery pine (*Phyllocladus alpinus*), *Hebe buchananii, Coprosma dumosa, C. cheesemanii, Melicytus alpinus, Myrsine nummularia, Leucopogon suaveolens, Muehlenbeckia axillaris,* golden speargrass, *Craspedia* sp. aff. *lanata, Hypolepis millefolium, Blechnum penna-marina* and other species. Some sites also contain mingimingi, *C. intertexta*, matagouri, mountain wineberry, *Corokia cotoneaster, Hebe rakaiensis* and *Clematis marata.*

At lower altitudes the narrow-leaved snow tussock becomes more open, with more fescue tussock, mouse-ear hawkweed, tussock hawkweed and sweet vernal. Associated native species include *Gaultheria crassa, Pimelea oreophila,* snowberry, *Leucopogon fraseri, Celmisia gracilenta,* harebell, *Raoulia subsericea,* golden speargrass, and Maori onion. Along the river flats exotic

grasses, mainly Yorkshire fog (*Holcus lanatus*), sweet vernal, browntop (*Agrostis capillaris*) and fescue grass (*Festuca* sp.) and herbs (white clover, *Linum cartharticum*, mouse-ear hawkweed) become dominant with scattered narrow-leaved snow tussock, fescue tussock, silver tussock, Maori onion, *Schoenus pauciflorus, Carex flagellifera, Acaena inermis, Rumex flexuosus,* and occasional *Olearia bullata.*

The terrace along the lower valley contains narrow-leaved snow tussock with a variable cover. Associated native species include fescue tussock, *Leucopogon fraseri, Raoulia subsericea, Acaena caesiiglauca*, harebell, *Brachyscome* sp., occasional matagouri, *Muehlenbeckia complexa*, and golden speargrass. Common exotic species include mouse-ear hawkweed, tussock hawkweed, sweet vernal, white clover and occasional briar.

Wetlands: Wetlands are much less common on the western side of the Chain Hills than the eastern side and are largely restricted to flushes along the gullies. One flush contains *Schoenus pauciflorus*, Maori onion, *Uncinia divaricata, Rytidosperma buchananii*, bryophytes, *Ranunculus gracilipes, Gonocarpus aggregatus, Lagenifera barkeri, Hydrocotyle novae-zelandiae* var. *montana, Viola cunninghamii, Anaphalioides bellidioides, Microtis oligantha, Gaultheria parvula, Juncus novae-zelandiae, J. pusillus, Euchiton traversii*, and *Euchiton polylepis.* The exotic component includes white clover, sweet vernal and *Linum catharticum*.

Rock outcrops and associated talus and drylands: This community includes *Dichondra repens, Raoulia beauverdii, Scleranthus uniflorus, Geranium brevicaule, Acaena caesiiglauca, Psuedognaphalium luteo-album, Asplenium flabellifolium, Carex breviculmis, Luzula banksiana* var. *migrata*, and *Melicytus alpinus*.

Shrubland: Woody vegetation is uncommon within this block and other parts of the Chain Hills. The rubblefields described earlier have provided a fire refuge. There are also shrub patches on lower altitude valley floor and sunny faces. These shrub patches contain matagouri, with occasional *Olearia odorata, O. bullata, Coprosma intertexta* and briar. There are also localised areas of open desert broom shrubland on sunny and rocky slopes.

Long Spur Creek headwaters

This unit includes the headwaters of Long Spur Creek, being the south-western portion of the Chain Hills. This block retains intact vegetation sequences from valley floor narrow-leaved snow tussockland up the hill slope into slim snow tussockland and onto the ridge crest summit of the Chain Hills.

Tussocklands: Slim snow tussockland occupies the upper slopes, but is largely restricted to shady aspects. This community is generally similar to that described in the Western Hill country block. Within the tussockland are scattered *Dracophyllum pronum*, some talus/rubblefield slopes and rock outcropping.

Narrow-leaved snow tussockland extends down to the valley floor, though decreases in condition and density at lower altitudes. This community is generally similar to that described in the Western Hill country block.

Shrubland: At lower altitude is "grey scrub" dominated by matagouri, with much mingimingi, briar, *Rubus schmidelioides, Muehlenbeckia complexa* and occasional *Olearia odorata*, mountain wineberry, koromiko, desert broom, *Melicytus alpinus, Coprosma intertexta, Clematis marata* and prickly shield fern. Along the stream within the shrubland are *Urtica aspera, Coriaria plumosa, Chaerophyllum ramosum, Anaphalioides bellidioides, Acaena fissistipula, A. caesiiglauca, Hydrocotyle moschata*, silver tussock, *Schoenus pauciflorus, Rytidosperma buchananii*, and *Carex petriei*. A steep gorge has *Olearia cymbifolia, Hebe pauciramosa, H. buchananii,*

Coprosma cheesemanii, Gaultheria crassa, Celmisia densiflora, Anisotome cauticola, Dolichoglottis lyallii, Brachyglottis haastii, Grammitis patagonica and *Asplenium richardii.*

Eastern Chain Hills
This unit retains intact vegetation sequences from valley floor narrow-leaved snow tussockland up the hill slope into slim snow tussockland and onto the ridge crest summit of the Chain Hills. A feature of the unit is the extent and diversity of wetland communities. The northern sector of this unit was identified within RAP A3 in the Lindis-Pisa-Dunstan PNAP survey.

Ridge crest: The ridge crest vegetation has previously been described within the North-western Chain Hills unit.

Snow tussocklands
Summit slim snow tussock: The community consists of a moderate-low density, rocky, slim snow tussockland, with much alpine fescue tussock, sheep's sorrel, mouse-ear hawkweed, tussock hawkweed, rock and bare ground. Other species present include *Rytidosperma setifolium, Raoulia grandiflora, R. hectorii, R. subsericea, Kelleria dieffenbachii, Scleranthus uniflorus, Leucopogon fraseri, Pimelea oreophila*, snowberry, blue tussock and king devil hawkweed.

Rubbly slim snow tussock: This slim snow tussock is located below the summit crest. The ground cover is dominated by rock with a moderate-low density of slim leaved snow tussock and *Dracophyllum pronum*. Other species present include alpine fescue tussock, blue tussock, *Kelleria dieffenbachii, Phyllachne colensoi*, snowberry, *Lycopodium fastigiatum, Raoulia grandiflora,* and occasional *Aciphylla montana* and *Olearia cymbifolia.* The community is of high naturalness, containing very few exotic species.

Slim snow tussock slopes: A moderate density, slim snow tussockland extends down to c. 1100 m on shady aspects. The slim snow tussock is 40-60 cm tall and in healthy condition. Associated species include blue tussock, alpine fescue tussock, *Lycopodium fastigiatum, Raoulia grandiflora,* snow berry, *Leptinella pectinata, Lobelia linnaeoides, Ourisia caespitosa, Kelleria dieffenbachii* and occasional *Dracophyllum pronum*. The community is of high naturalness, containing very few exotic species.

Rock outcrops within this slim snow tussockland contain *Brachyglottis haastii, Aciphylla montana, Celmisia laricifolia, Anaphalioides bellidioides, Anisotome aromatica* and occasional *Celmisia angustifolia*.

Narrow-leaved snow tussockland slopes: A moderately dense narrow-leaved snow tussock extends down to the valley floor. Other dominant plants are fescue tussock, tussock hawkweed and mouse-ear hawkweed. Associated species include snowberry, *Raoulia subsericea, Leucopogon fraseri, Pimelea oreophila, Celmisia gracilenta*, blue tussock, *Luzula rufa, Lycopodium fastigiatum, Carmichaelia vexillata* and *Anisotome aromatica.* Locally the narrow-leaved snow tussock is sparse; in these areas mouse-ear hawkweed dominates with much fescue tussock and tussock hawkweed. Some of these areas contain small populations of scree pea. There are occasional cottonwood and matagouri.

Valley floor narrow-leaved snow tussockland: The narrow-leaved snow tussock varies greatly in stature and density. Associated species include mouse-ear hawkweed, tussock hawkweed, sweet vernal, *Leucopogon fraseri, Rytidosperma pumilum, Raoulia subsericea, Celmisia gracilenta*, harebell, *Coprosma atropurpurea, Gaultheria parvula, Acaena inermis*, with occasional golden speargrass and matagouri. The uncommon sedge *Carex muelleri* is locally abundant in this community.

Lower sunny aspects faces: These areas contain a limited amount of degraded, dryland herbaceous vegetation including *Plantago spathulata*, with occasional taller shrubs of desert broom and *Carmichaelia vexillata*.

Wetlands
The diversity and extent of wetlands is a special feature of the eastern side of the Chain Hills.

Hill slope flush/seepage systems: These flush/seepage systems occur along minor stream beds. These systems are somewhat variable in composition dependent upon site conditions. Turf-sward areas contain a rich assemblage of plant species including bryophytes, *Psychrophila obtusa, Coprosma atropurpurea, Gaultheria parvula, Ranunculus gracilipes, Nertera balfouriana, Isolepis aucklandica, Hydrocotyle novae-zelandiae* var. *montana, Anaphalioides bellidioides, Chaerophyllum* sp. "bog", *Nertera depressa, Lobelia angulata, Epilobium komarovianum, Colobanthus apetalus, Rytidosperma australe, Agrostis pallescens, Carex gaudichaudiana, C. acicularis, Juncus pusillus* and *Schoenus pauciflorus*. At high to mid altitude these flush systems appear highly natural. At lower altitudes *Schizeilema nitens, Lagenifera barkeri, Viola cunninghamii, Juncus novae-zelandiae* and *Epilobium brunnescens* are also present. At still lower elevations white clover, sweet vernal, Yorkshire fog and other exotic species become increasingly common.

Locally *Schoenus pauciflorus* dominates, usually in association with Maori onion, and a variety of herbaceous species. On damp banks are *Ourisia caespitosa, Dolichoglottis lyallii, Geum leiospermum, Anaphalioides bellidioides, Ranunculus gracilipes, Psychrophila obtusa, Acaena saccaticupula, Viola cunninghamii, Uncinia divaricata* and bryophytes.

Valley floor wetlands: These wetlands systems are variable dependent upon site conditions. Some are swampy fertile systems dominated by sedges, while others are peaty, less fertile systems. The swampy systems contain *Carex gaudichaudiana, C. diandra, Schoenus pauciflorus, Eleocharis acuta, Ranunculus glabrifolius, R. cheesemanii, R. maculatus, R. gracilipes, Hydrocotyle sulcata*, the liverwort *Marchantia* sp., a number of bryophytes along with the exotic *Carex ovalis, Juncus articulatus,* Yorkshire fog, and white clover.

The peaty areas contain comb sedge (*Oreobolus pectinatus*), *Celmisia* sp. "rhizomatous gracilenta", *Ranunculus gracilipes, Gonocarpus micranthus, Gaultheria parvula, Microtis oligantha, Euchiton laterale,* and a number of bryophytes (including sphagnum moss).

Shrublands: There is very little woody vegetation on the east side of the Chain Hills. On the lower slopes are a few small patches of matagouri, desert broom and *Carmichaelia vexillata* with occasional *Olearia bullata*.

Significance of Vegetation

Morven Hills contains a wide variety of the ecosystems, plants and vegetation types of the northern part of Lindis Ecological District. Ecosystems reflect both a climatic gradient and the strongly partitioned land systems of the ecological district. Much of the land has been substantially modified by fires since Polynesian settlement and by a combination of fires, grazing and browsing over the last 150 years. The impact of fire is particularly evident in the distribution and shape of forest and shrubland remnants. At least 277 native vascular plant species are present on Morven Hills (see Appendix 9).

The Lindis ED along with the Pisa and Dunstan EDs were surveyed as part of the Protected Natural Areas Programme (PNAP) during the summer of 1984/85. The resulting report (Ward et.

al 1994) identified 20 Recommended Areas for Protection (RAPs) of which six lie entirely within Morven Hills.

The most recent evaluation of the inherent values confirms and endorses the RAP descriptions in Ward (loc. cit.) but notes extensions to these RAPs which contain similar inherent values. Lindis RAP A4: Dip Creek, Beech, in the gorge of Dip Creek, is a 1 ha stand of mountain beech. Its recommendation for protection arose from its identification as the southeastern driest outlier of the beech forest remnants characteristic of the northwestern Lindis District. Lindis RAP 5: Dip Creek, Totara, also in the gorge of Dip Creek, is a small stand of Hall's totara. It is the easternmost and driest site for Hall's totara in the District and the only example of totara on a talus fire refuge in the District. Lindis RAP A6: Morven Hills is a 330 ha area encompassing the middle and upper reaches of a small tributary of the Lindis River. It is a compact area including all the major indigenous ecological features of the Georges land system. It is notable for the good representation of the combination of narrow-leaved snow tussockland with the two main shrubland types: kanuka and matagouri-*Coprosma*.

Lindis – RAP A2 Double Peak is a 650 ha area south of the Lindis Pass Scenic Reserve. The RAP has a much greater effective altitudinal range than the reserve because of the predominance of shady faces. Snow tussockland density and diversity is superior to that within the reserve. Lindis RAP A3: Chain Hills is 1230 ha encompassing a west-east transect across the northern end of the Chain Hills. The RAP includes a full range of tussocklands including red tussockland and significant mixed shrublands on talus and boulderfields which include celery pine. Celery pine on talus fire refuges is unusual in the Lindis District. Lindis RAP B5:West Chain Hills is a 540 ha area adjoining the southern boundary of RAP A3. Although the mid-upper altitude tussockland is in poorer condition than the neighbouring RAP it has superior vegetation at lower altitudes.

Threatened and At Risk species

Of the native vascular plant species present, six are listed as 'Threatened' and 18 as 'At Risk' in the most recent threat classification system listing (de Lange et al. 2009). A list of these species with their threat of extinction status and distribution within Morven Hills is provided below in Table 6.

The New Zealand Threat Classification System provides a tool for assigning a threat status to candidate taxa. Species listed in the super category 'Threatened" are grouped into three categories: 'Nationally Critical', Nationally Endangered', and 'Nationally Vulnerable'. Taxa in these three categories are facing a very high risk of extinction in the wild.

The latest revision (Townsend et al. 2008) of the 2002 system includes the addition of the new categories 'Declining', 'Naturally Uncommon', 'Recovering' and 'Relict' within a super category 'At Risk'. Declining taxa do not qualify as 'Threatened' because they are buffered by a large total population size and/or slower decline rate. However, if the declining trends continue, these taxa may be listed as 'Threatened' in the future. The category 'Naturally Uncommon' is adopted to distinguish between biologically scarce and threatened taxa. 'Recovering' allows for threatened taxa whose status is improving through management action and 'Relict' is used to encompass taxa that have experienced very large historic range reductions and now exist as remnant populations that are not considered unduly threatened.

In addition, three species that are uncommon in Otago (Regionally Significant) or uncommon in this area but reasonably common in the rest of Otago (Locally Notable species) were found. A list of these species is provided below in Table 7.

Table 6 Threatened and At Risk plant species found on Morven Hills

Super Category	Threat Category	Species	Location on property
Threatened	Nationally Critical	*Triglochin palustris*	Two wetlands adjoining the Lindis Pass – Tarras Road
	Nationally Endangered	*Carex inopinata*	Three sites in shrubland in Lindis valley and Long Spur Creek tributaries
	Nationally Vulnerable	*Carmichaelia crassicaulis* subsp. *racemosum*	A few snow tussockland sites on the Chain Hills and ridge north of Dip Creek
		Kirkianella novae-zelandiae	Herbfield on upper Lindis Face
		Olearia fimbriata	Several gorge and hill slope sites in tributaries of Long Spur Creek
		Pachycladon cheesemanii	Several rock outcrops in mid Dip Creek, Long Spur Creek tributaries, and alongside Lindis Road
At Risk	Declining	*Carmichaelia kirkii*	Riparian shrubland within Dip Creek, Long Spur Creek and tributary
		Carmichaelia vexillata	Several sites on the Chain Hills, Lindis Faces, and near airstrip
		Lobelia ionantha	Wetland on Chain Hills
		Olearia lineata	One site in a Pass Burn tributary
	Naturally Uncommon	*Anisotome cauticola*	Riparian vegetation within Long Spur Creek tributary of Chain Hills
		Cardamine bilobata	Rocky ridge crest of the Chain Hills
		Colobanthus brevisepalus	Dryland sites above bluffs in western hill country
		Einadia allanii	Rock outcrop in Long Spur Creek tributary
		Euchiton paludosus	Wetland on western Chain Hills
		Euchiton polylepis	Wetland on western Chain Hills
		Hebe pimelioides subsp. *faucicola*	Rock outcrop in Chain Hills
		Lagenifera barkeri	Wetland on western Chain Hills
		Leptinella serrulata	Relatively widespread amongst dryland vegetation
		Montigena novae-zelandiae	A few sites near the summit of the Chain Hills
		Ranunculus maculates	Two wetland sites in Dunstan Creek tributaries and western hill country
		Raoulia beauverdii	Relatively widespread in dryland areas
		Urtica aspera	Shrublands and talus in Long Spur Creek tributaries
	Relict	*Coprosma intertexta*	Shrubland at foot of Chain Hills, Long Spur Creek and tributaries and Lindis Road rocky faces

Table 7 Regionally significant and locally notable plants found on Morven Hills

Status	Species	Location on property
Regionally significant	*Podocarpus cunninghamii*	Dip Creek gorge
	Phyllocladus alpinus	Talus slopes on western Chain Hills
Locally notable	*Nothofagus solandri* var. *cliffortioides*	Hill slopes above Dip Creek

Rare Ecosystems

Terrestrial ecosystems that were rare before human colonisation of New Zealand often have highly specialised and diverse flora and fauna characterised by endemic and nationally rare species. Rare ecosystems are defined as those having a total extent less than 0.5% (i.e. < 134 000 ha) of New Zealand's total area (268 680 km2). A framework has been developed (Williams et al. 2007) based on descriptors of physical environments that distinguish rare ecosystems from each other and from more common ecosystems. Using this framework 72 rare ecosystems have been defined using pertinent environmental descriptors selected from soil age, parent material, soil chemistry and particle size, landform, drainage regime, disturbance, and climate

On Morven Hills three rare ecosystems were identified, all in the wetland category: cushionbog, ephemeral wetland, and seepages and flushes.

2.5.1 PROBLEM PLANTS

While many exotic plant species are found on the property relatively few are considered problem plants and some are quite localised. The problem plants include:

Briar - widespread on the property and is locally dominant on lower slopes in the west of the property. Elsewhere it is generally a minor component of montane shrublands and does not appear to significantly compromise their integrity.

Gooseberry - widespread in shrublands though not common. Its early control would prevent more serious impacts in the future.

Elderberry – present in a few gully shrubland sites from which it would be desirable to remove.

Radiata pine - a few widely scattered wilding trees are present. Their removal before coning age is desirable.

Crack willow – mostly confined to streams and some wetlands in the more developed parts of the property. Isolated willows in wetlands of less developed parts of the property should be removed to prevent future degradation of those systems.

Buddleja davidii - a few plants are present along the Lindis Pass highway. They present some risk through possible spread to areas of identified inherent value and should be removed.

Mouse-ear hawkweed - common through most grassland and tussockland areas and the dominant vegetative cover over extensive areas of sunny depleted hillslope. Restoration of a denser tall tussock cover may reduce its impact in areas where tall tussock is still present.

Tussock hawkweed - locally common in both shrubland and tussockland areas. It presents particular risks to rare species on rock bluff sites (Wardle 1999) which may necessitate site-specific control measures.

King devil hawkweed – localised populations only, requiring surveillance to determine their possible impact on communities of interest.

2.6 FAUNA

2.6.1 INVERTEBRATE FAUNA:

Ten land units of a different configuration to landscape or vegetation units, based on existing farm blocks, were identified for the purpose of describing invertebrate resources (shown on values map 4.2.3). The aim was to survey a range of habitats found in the Morven Hills PL for invertebrate values within the limits of the reporting time. The report presents an annotated inventory of specimens recorded, their conservation significance based on current knowledge, and an assessment of the conservation value of the habitats sampled.

A total inventory of 211 species was found including records of moths (110 species), beetles (31 species), grasshoppers, caddis and bugs. Entomologists have not visited the area extensively in the past, but published information concerning habitats and adjacent regions is relevant (Patrick 1994, Patrick 2000).

Invertebrates were hand collected or collected at night using an ultraviolet light, between 26-30 January 2004.

Invertebrate faunal context:
A range of representative and significant habitats of invertebrates are included in the extensive rolling lands and uplands of the lease. The southern and western parts of the lease are characterised by a Central Otago dryland fauna. The arid naturally open areas and on sunny spurs are significant for faunal assemblages among the hills adjacent to the Lindis River. East of the Chain Hills and north towards Lindis Pass, upland insects and insects typical of tall tussock and wetland (extensive community in valley floor at Dunstan Creek) are represented. Woody vegetation cover reflects a pastoral history and is patterned by rocky fire refuge, and shallow to deep soils of generally reasonable soil fertility. Small leaved *Coprosma* and *Olearia* species as well as *Muehlenbeckia* vines harbour complex invertebrate communities. The richness of lianes and dry shrub species is significant for insects. Invertebrates inhabiting disturbed sites and open areas have expanded their range due to historical pastoral impacts.

Rock outcrops provide for distinctive faunal assemblages as well as harbouring shrub and herb communities less affected by fire. A few moths associated with rockface lichens and mosses are characteristic of montane tor areas in Central Otago.

More than 95% of the moth species recorded during the survey were native. Among this fauna are species of very local occurrence being endemic to habitats in Central Otago. There are also species shared with inland Canterbury and with Eastern Otago-Southland as well as those that are widespread in New Zealand. An extensive moth fauna of open areas is represented and indicative of the retention of natural character for invertebrates among thinly vegetated areas. Extensively

represented at mid and low altitude on the property are areas with exposed soils and rubbly areas where mats and turfs of both native and exotic herbs occur among sparse grassland. The native plant cover that remains continues to support a diverse insect fauna. Some insects have an ancient history of association with such areas and have taken to the litter, roots or shoots of exotic plants that now colonise their habitat.

In addition, significant moth associations with mixed shrublands, kanuka and wetlands are documented and the alpine moth fauna is found to be characteristic of Central Otago rather than Canterbury mountains.

Station Range, Manuka Gullies and The Hummocks:
These blocks are characterised by broad spur-tops, scattered brier and shrub among grassland on the slopes and dense shrub in the riparian of permanent watercourses. Features include steep sunny bluffs with kanuka stands and narrow streamside areas of open sedgeland-grassland. A representative moth fauna is recorded from rock outcrop including moths *Helastia scissa* and *Gadira acerella* (larvae eat rockface mosses). *H. scissa* is an eastern South Is. species. Moth *Phaeosaces apocrypta* (larvae eat lichens) and moth *Eudonia cymatias* also inhabit rocky areas. Rocky areas in all these blocks are fire refuge for shrubs and herbs and their associated fauna.

Thirty moth species are recorded from shrubs in the survey. Of note are two rare species feeding in *Olearia odorata*. These are *Meterana exquisita* and *Pseudocoremia* sp. "knobby". Females are flightless and thus dispersal is limited. Also of note is the rich fauna of 8 moths recorded for the vine *Muehlenbeckia complexa*, which is common in shrubland. The moth *Strepsicrates ejectaria* is abundant in kanuka. Also in kanuka are clapping cicada, manuka beetles *Pyronota* spp. and a rich array of flower visiting insects including hover flies, butterfly species, pollen feeding beetles and native bee species. The seasonal floral resources of kanuka are significant in the region.

The predatory burrowing beetle *Metaglymma tibiale* is endemic to semi-natural areas in Central Otago and black cicada *Maoricicada campbelli* and grasshopper *Phaulacridium otagoense* have localised populations in low montane herbfields of Canterbury, Otago and Northern Southland. Many moths are characteristic of natural dry herbfield with semi-natural vegetation. Three species recorded have flightless females and limited dispersal ability. These are the moths *Leptocroca* "*honesta*", *Leptocroca asphaltis* and *Eurythecta zelaea*. Such records indicate the significance of semi-natural areas that remain adjacent to rock outcrops, on thin spur-top soils and in areas of seasonal water deficiency.

Gully flushes and streamside flushes are common and characteristic in Long Spur Creek and its tributaries. The sedges, grasses, rushes and herbs in these damp situations have a common and widespread insect fauna. This includes abundant longhorn grasshoppers *Conocephalus semivittatus* abundant leaf hopper bugs (families: cixidae and cicadellidae), damselflies, craneflies and day active moths (particularly in the genera *Glyphipterix* -leaf miners and *Orocrambus* -litter and foliage feeding). The giant darning needle dragonfly *Uropetala chiltoni* has predatory larvae inhabiting retreats in wet banks. Shrub margins in sheltered gully floor areas are rich in liane species with their associated insects. Glade and common copper butterflies *Antipodalycaena* spp. and day active moths *Pseudocorema indistincta*, *Tingena melinella* and *Udea flavidalis* are common among the many insects flying along these margins. Some areas of wetland and sheltered shrubland with these associations, particularly in the Hummocks Block (at 680 m, Grid Ref G40 405089) are of reasonable size and significant for the Lindis Ecological District.

Ileens:
This modest sized block includes a range of distinctive headwater communities on broad south-east dipping spurs. Shallowly incised gullies have wet sedge-grass filled channels with adjacent patches of short tussock and mixed shrub. Representative insects include some described above

and also insects of damp herbs such as the moth *Orocrambus aethonellus* and the moth *Kiwaia schematica* (larvae eat bidibid). Adjacent are dry grass and herbfield areas with bare soils where basking insects such as grasshopper *Phaulacridium otagoense*, moth *Eurythecta zelaea* and moth *Diasemia grammalis* are represented. The mix of habitats at moderate altitude 660 -700 m and inclusion of open wetland with some seasonally drying out is distinctive among the spur top communities recorded on the property.

Farmers Gully/RAP A6, G-Mars, Top Airstrip, Hogget Block and White Rocks:
These blocks have more gentle relief and less enclosed gully systems than the adjacent blocks to the east. Significant faunal habitats in these blocks are more fragmented but include areas of kanuka shrubland among rubbly north faces. In contrast the toe slopes, with a south aspect, have mixed matagouri, olearia and coprosma patches. Some areas of eroded soils are present. There are significant areas of rock outcrop particularly in shaded faces in Farmers Gully block. Some of the more natural and regionally representative habitat sequences are located in RAP A6 and also in the central Hogget Block extending into lower G-Mars. These include faunal habitats of:
1) damp and shaded shrubland on deeper soil; 2) eroded slopes with thin vegetation of herbs and grasses and scattered shrub; 3) permanent streams in semi-arid valleys. The faunal assemblages resemble those widely occurring between 500-800 m in the Central Otago Ecological Region.

Snow tussock habitats within these blocks have retreated to low alpine areas in the Top Airstrip Block The grassland fauna here is an extension of that described in Blue Cliffs and Davis blocks below.

Blue Slip:
Above the Lindis River and SH8 is a distinctive toe slope to terrace landform with two associated wetlands. Much of the fauna of wetlands described above for sedge and wet turf will be represented here. The paucity of ponded waters and emergent damp vegetation in an otherwise dry environment add to the faunal significance of these sites. While no insects were recorded here, insects associated with *Carex* spp., *Juncus* spp., *Ranunculus* spp. and *Plantago* spp. are among many specialists expected. In contrast are the very well drained soils on the scarps and the tops of small terraces. The fauna of such sites is described above and includes blue butterfly *Zizina oxleyi* which have larvae on clover. Larvae of the moth *Crocydopora cinigerella* survive dry periods and extreme temperatures by feeding underground. The presence of scattered mixed dry shrubland adds habitat diversity to the wetland and depleted grassland habitat at this site.

Blue Cliffs, and Davis Block including RAP A3 and RAP B5:
Isolated in the central Chain Hills, these west draining catchments are extensively clothed in native grassland and have repeated sequences of alpine vegetation to intermontane herb grass and shrub associations. Soil moisture and fire history are both significant influences on faunal values.

Expansive valley floor grasslands and wetlands occur between 700 to 900 m. 76 moth species and 17 species of stream and wetland caddis are recorded from these valley floors. They inhabit numerous inter-tussock herbs, sub-shrubs and shrubs as well as litter in damp and dry situations. Many moths are associated with grasses. Some are associated with mosses or with rocky sites. The fauna is representative of cool montane areas of reasonable rainfall in west and north Otago. Wet-sedge habitats of reasonable size, present in the RAPs and in nearby areas, are of significance. Also of note are two rare moths *Meterana exquisita* and *Pseudocoremia* n.sp. ‘Olearia’(now known as *Pseudocoremia* sp. "knobby"), which feed on *Olearia odorata*. These are also in the adjacent blocks.

Among mid altitude slopes, a moth fauna representative of open grasslands is dominant and includes the moths *Heliothela atra*, *Glyphipterix cionophora*, *Glyphipterix oxymachaera* and *Capua semiferana*. *G. oxymachaera* is a widespread moth but only considered common in

patches throughout its distribution. The larvae of *C. semiferana* are common and widespread litter feeders in open environments. The native field cricket *Pteronemobius bigelowi* was also common in this area and throughout the lease.

Of note in the RAPs are remnant shrubland and herb associations on active talus-scree fields. Shrubs such as celery pine, *Corokia* and mountain wineberry are present along with other less widely represented woody vegetation. This adds to the likely diversity of litter and foliage feeding insects represented on the lease. The faunal habitats associated with the middle and lower Davis Block are more wooded and less affected by fire than the neighbouring blocks. Along Long Spur Creek in this block a complex vegetation cover is retained that includes diverse shrub elements. Among other insects recorded here are seepage caddis *Oeconesus maori* and the moth *Orocrambus ephorus*, whose larvae eat toetoe.

At higher altitudes (1600 m), the predatory carabid beetles *Holcaspis angustula, Megadromus bullatus* and *Scopodes edwardsi* are present and associated with tussock grasslands where they prey on soft-bodied invertebrates. The native bee *Leioproctus fulvescens* is abundant here, but its distribution is restricted to the drier eastern areas of the South Island, and Central Otago and the Mackenzie Country (B. Donovan pers. comm.).

Present in silken retreats under stones are large *Hexathele* sp. aff. *rupicola* spiders. These spiders are seldom collected but are widespread in Central Otago and mid Canterbury. The manuka beetle *Pyronota edwardsi* is another species characteristic of montane to alpine Otago environments.

The flowerheads of golden speargrass plants provide a valuable food source for many invertebrates including the weevil *Sargon sulcifer*. This weevil is often very localised in distribution, but has a widespread range. The same is true of the lygaeid bug *Hudsonema anceps*.

Of note is the presence of the predatory ground beetle *Holcaspis angustula* at its new western limit. The nearest record is from the Manuherikia Valley and other localities to the east in Otago and Canterbury. Of interest also is the find of an atypical example of the ground beetle *Notagonum feredayi*. This is widespread in South Island; however a fully winged form is unusual for this beetle.

Dunstan and catchments east Chain Hills:
This range comprised mainly tussock, with tors on the ridge tops and patches of scree habitat present at the higher altitudes (above 1000 m). *Aciphylla*, matagouri and *Dracophyllum* were also present at scattered sites on the slopes. Numerous small seepages and wet flushes provided alternative habitat for invertebrates. Below 1000 m numerous small streams and flood channels, edged with *Bulbinella* cut through the tussock. Extensive wetland communities are present in the lower reaches of the valley floor. A large patterned valley floor wetland in Dunstan Creek has more than 50 ha represented within the property. The moth community recorded here reflects wetland and flush habitat with *Orocrambus ramosellus*, *Orocrambus apicellus*, *Glyphipterix codonias*, *Eudonia epicremna*, *Epichorista siriana* and *Glaucocharis helioctypa* all present

The drier slopes are home to the native bee *Lasioglossum sordidum*, common in drier areas of the South Island.

Dark Side Black Hill:
These slopes are steeper and wetter than those adjacent on the Blue Cliffs block, with a stream and associated wetlands present in the valley floor. Steep rock faces border the stream at places. Golden speargrass, matagouri and bouldery talus are plentiful on the slopes above the stream.

Wetland species such as the cranefly, *Leptotarsus (Macromastix) montanus* and moth: *Eudonia octophora* are abundant. Dryland species such as the native bee *Leioproctus fulvescens* and the open herbfield moths *Diasemia grammalis* and *Eudonia cataxesta* (larvae eat *Raoulia* mat daisy) are characteristic of these areas.

The large *Hexathele* sp. aff. *rupicola* spiders, mentioned previously in the report, are also present in this area.

Dip Face and Ewe Block:
A range of regionally representative and significant faunal habitats are linked along Dip Creek and its main tributaries. Riparian shrub and liane communities are similar in faunal character and significance to those described in Manuka Gullies. Valley floor sedge and rushland occur upstream within extensive short tussock communities. The broad sedge swamps present here and in many other parts of the lease are a significant feature and are rich productive habitats for insects, as described in the Hummocks and in RAP B5.

While slopes and ridge tops are dominated by exotic shrub and grassland, common and widespread native insects continue to be recorded. The beech and totara stands likely host insects that specialise in feeding on these trees. None were recorded though the moth *Planotortrix pictoriana* (larvae eat beech leaves) was recorded elsewhere on the property.

Sledges Hill and Sunny Side Black Hill:
Tussock, *hieracium* and bare ground dominate the upper slopes, with matagouri, *coprosma* and brier shrublands occupying gullies and slope toes. Thinly vegetated dry slopes are characteristic of these north-west facing blocks.

A diverse range of day active insects are present. The moth *O. ramosellus* is characteristic of damper grassland areas, whilst blue butterfly, *Zizina oxleyi* and many moths in the genera *Eudonia* and *Orocrambus* fly low over grasses and herbs during late summer. The small leaf mining moths *Glyphipterix euastera* and *G. oxymachaera* are characteristic of open areas. *G. euastera* is widespread but rare, occurring in montane areas with open rocky grassland. The litter feeding moths *Leptocroca asphaltis* and *Orophora unicolor* also occur in these grasslands.

Sunny Side Black Hill spans a considerable altitudinal sequence from below 800 m at the highway to 1440 m at the hill crest. Above 950 m, there were three moth species found which have flightless females, *O. crenaeus*, *O. ordishi* and *L. asphaltis*. Flightless females have limited dispersal and are indicative of a long-term natural association in the landscape.

The alpine grass moth *Orocrambus dicrenellus*, is also present here.

A range of beetles were also present including the predatory carabid beetles *Holcaspis ovatella* and *Mecodema* cf. *lucidum*, both species occur in the southern half of the South Island. Small weevils associated with speargrass seedheads, *Eugnomus* sp.cf. *dispar* and *Eugnomus* sp.cf. *durvillei* were abundant. The manuka beetle *Pyronota edwardsi* has a localised distribution in alpine Otago.

Remaining lower altitude and developed blocks including –Ram Paddock, River Flat, Shearing Paddock, River Face, Hectors, Howards, Kearns Face, Wrights, Beckers, Mcleans, Little Rocky and associated un-named blocks:
These blocks have much simplified faunal associations where significant habitat areas are small and fragmented. However, in the Howards Block distinctive and formerly widely represented turf and mat communities (for the Lindis Ecological Region) have retained insects endemic to Otago. This is significant for the low altitude (420 –440 m) areas associated with terrace landforms and

deeper loess soils. The burrowing predatory beetle *Metaglymma tibiale* is an Otago endemic species. The moth *Kiwaia schematica* is likely hosted on *Acaena buchananii* mats here and typical of mat vegetation are grasshopper *Phaulacridium marginale* and bug *Nysius huttoni*.

Significance of Invertebrate Fauna

A number of faunal habitat areas on the property are of significance for the Central Otago Ecological Region. The invertebrate fauna is significant in the extensive repeated complexes of permanent streams, gully shrublands and sedgelands in the blocks, Manuka Gullies, The Hummocks and Station Range. These are linked by extensive slopes and broad summits of depleted herbfield, grassland and also more locally to rock outcrop and kanuka shrubland. Further ribbons of native woody vegetation of faunal significance occur in Dip Creek, RAP A6, Hogget Block and Davis Block. All these communities are highly representative of the Lindis Ecological District. Insects typical of open sparse vegetation are often endemic to montane regions from Central Otago to mid Canterbury have an ancient association with the property. They have expanded their range due to the history of pastoral disturbance. In the Ileens farm block, the mix of habitats at modest altitude 660 -700 m and inclusion of open wetland, with some seasonally drying out, is distinctive among the spur top communities recorded on the property.

At higher altitudes above 950 m, or in the wetter parts of the property towards Lindis Pass and Dunstan Creek, invertebrate assemblages include elements at their western and southern limit. The uplands have a typical Central Otago fauna associated with wet flush, rock, herbs and tall tussock. Fauna inhabiting woody vegetation in these north-eastern parts of the property is as fragmented and scarce as their host shrub elements. In largely indigenous grassland mostly free of woody weeds the future potential for remnant shrubland insects is significant.

Dunstan Creek wetlands as faunal habitat
Areas of intermontane basin floor wetland and grassland habitat in the Dunstan are extensive (in excess of 50 hectares) and retain considerable natural character. Together with the adjacent wetland (outside the property) this is of national significance for invertebrate communities.

A rich day active moth fauna
Ten species of day active moth in the genus *Orocrambus* are recorded from Morven Hills. This is a significant number of species. In the genus *Orocrambus*, there are 50 species in New Zealand, with 27 listed as being from tussock grassland. To find 10 spp in a short period of time (as many of these species are seasonal in their emergence) is significant. It indicates that this property has high natural diversity of non-forest habitats (wetlands, drylands, short tussock, tall tussock, open areas, lowland to montane/alpine), the combination of which indicate the presence of complex and varied communities within this property.

Insects ranked as threatened with extinction (Molloy et al 2002, Hitchmough 2002) present on Morven Hills:
Pseudocoremia sp. "knobby" (threat of extinction status, Nationally Endangered). This rare moth is only known from a few sites in Central Otago where its host shrub *Olearia odorata* is threatened by land use change. Females of this moth are flightless and thus dispersal is limited. The moth is present in some mixed shrublands with *O. odorata* in the hill country west of the high axis of the Chain Hills to the Lindis River.

Moth *Meterana exquisita* (Gradual decline) widespread at moderate to low altitude on the lease with larvae on the shrub *Olearia odorata*. Elsewhere it inhabits patches of divaricated *Olearia* spp. shrubland throughout eastern South Island.

Other insect records of note are listed below:

- Predatory ground beetle *Holcaspis angustula*, is present on the highest parts of the Chain Hills at its western limit. The beetle's known distribution is in Manuherikia Valley and other localities to the east in Otago and Canterbury.
- Predatory ground beetle *Notagonum feredayi*. This is widespread in South Island; however a fully winged form is unusual for this beetle and possibly distinctive for this part of its range.
- Leaf mining moth *Glyphipterix codonias***.** A new record for the species at its western known limit in the Dunstan Creek catchments on the property.
- Alpine grassland moth *Orocrambus dicrenellus*. The presence of this grass moth is indicative of reasonably natural grasslands. This moth has a restricted distribution in alpine grassland from Mid-Canterbury to North Otago. Its presence here also represents its southern distributional limit.
- Of note for the lease is the number of moths recorded with flightless females and therefore limited dispersal ability. Seven are known including an *Olearia* looper, *Pseudocoremia* sp. "knobby" (noted above), litter moth *Leptocroca* "honesta" (sparse dryland vegetation), litter moth *Leptocroca asphaltis* (dryland slopes), mat plant leaf roller *Eurythecta zelaea* (sparse dryland vegetation), tussock case moth *Orophora unicolor* (tall tussock grassland) and two upland grassland moths *Orocrambus crenaeus* and *Orocrambus ordishi*.

2.6.2 HERPETOFAUNA:

Introduction

The most recent lizard surveys were carried out in January and February 2011. Sites were surveyed whenever weather conditions appeared likely to be suitable, and the quality of survey conditions assessed and recorded. In some cases, deterioration of weather conditions meant that survey was limited to assessment of habitat quality. Poor weather conditions meant that not all planned sites were able to be fully surveyed during the initial visit. The additional February inspection period made it possible to complete the planned survey series and to re-visit sites in order to confirm presence of skinks (e.g. sighting animals when scat had previously been found).

The priority for the inspection was to determine the current status of the threatened Otago skink (*Oligosoma otagense*) at previously identified sites. Previous surveys and monitoring had identified the locations of likely habitat and established the existence of populations by sighting animals at nine sites on the property and a sloughed skin at a further site.

Previous Work

Oligosoma otagense were discovered on the PL in 1982 at what is now known as the Trig P site. This record was followed with a formal survey of the Lindis area in April 1984 (Whitaker 1984). As a result of that work a further five sites were recorded for *O. otagense* on Morven Hills. These sites are now known as: Dip Creek, Farmers Gully Lower, Farmers Gully Upper, Hogget Block and G Mars.

The 1984 survey also recorded *O. otagense* on Glenfoyle station some 12 km to the south-west of Morven Hills. Subsequent work as part of tenure review inspections has recorded Otago skinks at another site on Glenfoyle station and also on the adjacent Deep Creek and Sandy Point properties. The original surveys recorded higher numbers at Morven Hills than at these other inspection sites. In 1984 the threatened grand skink *(O. grande)* were recorded on the Forest Range property across

the Lindis River, Rostrevoir Station (to the north of Morven Hills) and Lake Hawea Station to the north-west. The most significant of these is the Breast Creek site on the latter property, some 10 km north-west of Morven Hills. Otago and grand skinks on these properties has shown a decline in populations over the periods they have been monitored.

During the 1998/99 summer a detailed survey of the Otago skink populations on Morven Hills was undertaken, including repeated site surveys (McFarlane 1999). This work also discovered new populations of Otago skinks at Middle Farmers Gully and upper G-Mars.

Between 1999 and 2004 further surveys of Morven Hills and other leases in the Lindis area, were undertaken informally as resources have permitted (Stu Thorne, DOC Wanaka, pers. comm.). Whilst no new populations were recorded, these surveys have confirmed that skinks have persisted at the known sites.

The HERPETOFAUNA database (DOC BIOWEB HERPETOFAUNA database) contains approximately 47 records of common skinks and geckos from Morven Hills between 1982 and 1999. This data shows that the range of the common gecko *Hoplodactylus* aff. *maculatus* 'Southern Alps' extends from Double Peak in the north-east, south through Dip Creek as far as the western boundary of the G-Mars/Station Block. The McCann's skink (*Oligosoma maccanni)* occurs from the western end of Dip Creek, at the confluence with the Lindis River, south as far as Trig P in the east and the White Rocks Block in the west.

In January 2004 when the property was surveyed as part of the first tenure review inspection, it was restricted by rain on two of the five days which meant that not all known habitats were searched. The priority for the inspection was to identify new sites for the threatened Otago skink (*Oligosoma otagense*) rather than return to previously identified sites. In addition, one day was spent searching for the threatened scree skink (*Oligosoma waimatense)* in screes on the Chain Hills in the eastern part of the lease.

A new population of *Oligosoma otagense* was located on the true left of Dip Creek along with two *O. grande*.

A sloughed skin from an *O. otagense* was recorded in the rock bluff systems in the Big Gully.

The most common skink on the property was *Oligosoma maccanni* which was present under rocks and in tussock grasslands throughout the property. On warm days during the inspection *O. maccanni* were encountered everywhere, confirming the species was more abundant and widespread on the property than the existing HERPETOFAUNA records suggest.

The common skink (*O. nigriplantare polychroma)* was less common on the property than *O. maccanni*. It was mostly found in lower parts of the eastern portion of the property, notably along the pylon road.

The cryptic skink (*O. inconspicuum)* is recorded along the pylon road in the eastern section of the property and also in the screes above the road on the Chain Hills.

The gecko *Hoplodactylus* aff. *maculatus* 'Southern Alps' was present throughout the property in suitable rock habitat. Compared with the existing HERPETOFAUNA data, the major outcome of the inspection was the extension of its range east onto the Chain Hills.

Survey Method

For the 2011 surveys, past and likely habitat sites at Morven Hills were identified and prioritized. It is well known that both grand and Otago skinks (in particular) exhibit low and in the case of the

later variable detection probabilities meaning that only a percentage of resident lizards would be out basking on any given day. Usually the highest detection probabilities are found during sunny, windless and warm (but not hot) conditions. To account for variable detection probabilities resurveying has to be done which is typically ~ 4-5 times for Otago skinks. Given the time constraints such repeat site surveys were not practical and variable detection probabilities were not able to be accounted for.

Photo re-sight is now the standard method which is used by the Grand and Otago Skink Recovery Programme. It allows large areas to be covered rapidly without disturbance to habitat, and allows lizards to be individually identified thereby preventing the same animal being counted multiple times.

Typically teams of two people surveyed representative sections of habitat for these two lizard species. Each area was generally searched for a minimum of 10 minutes unless the area could be comprehensively searched in less time. Total time searching each area was recorded so that counts could be scaled using 'catch' per unit effort. Due to the known factoring of weather a five point scale was used which corresponded to the observer's expectation of seeing skinks if they were there given the current weather:

Comparisons with historic records were undertaken using a formal statistical technique. Analysis of previous Morven Hills survey data was conducted in program R for sites which had been visited a total on three or more occasions. Raw count data were transformed by search time into hourly equivalents. The possibility of population trends being apparent through time were explored using regression and correlation techniques. This detailed statistical information is held by DOC Otago (Report ref: DOCDM-721449).

In January, 96 search events were undertaken and in February a further 29, some of these being revisits of the January locations. The February survey work was undertaken due to poor weather conditions in January and the requirement to survey some additional sites. The weather in January was in fact graded (on a five point scale) as 2.81 slightly better but more variable than that of February which was graded as 2.57. Despite this more skinks were seen at repeat survey sights in February than in January, this is likely an example of skinks showing higher emergence in average conditions after prolonged periods of bad weather.

Description of Values

Grand skinks

Grand skinks were previously encountered in 2004 at New Dip Creek. This area was resurveyed in February 2011 during good weather and no skinks were found.

Otago skinks

Otago skinks were encountered at a number of widespread locations across Morven Hills.

Two Otago skinks were found in Kanuka Gully. This is the first time Otago skinks have been recorded from this locality which is >500m north of the nearest known population at Trig P.

No Otago skinks were sighted at the following sites: New Dip Creek, Hogget Block, Big Gully or Farmer's Gully Upper.

Table 8 summarizes per-site skink totals, search effort and average search conditions, allowing skink sightings per unit effort to be assessed.

Table 8.: Summary of per-site search effort and weather conditions

Site	Numbers of Otago skinks	Minutes	Mean weather grade (0-5)
Big Gully	0	312	2.67
Dip Creek	3	140	2.00
Farmer's Gully Lower	1	560	3.48
Farmer's Gully Mid	1	459	2.75
Farmer's Gully Upper	0	405	2.38
G-Mars	2	603	2.15
G-Mars Upper	11	566	2.27
Hogget Block	0	366	1.67
Kanuka Gully	2	280	3.17
New Dip Creek	0	200	2.00
Trig P/ Rocky Hill	3	1043	2.93
Grand Total	23	4934	

Assessment of Morven Hills Otago skink populations

Some Otago skink populations have shown clear negative trajectories through time: Trig P/ Rocky Hill, Farmer's Gully Upper and G-Mars (Figure 1). For these sites the regression equations explain ~ 58-69% of the variation in the data at these sites. Historically Trig P/ Rocky Hill and G-Mars once had the largest populations in Morven Hills, however now they appear to be substantially reduced.

Trig P/ Rocky Hill and G-Mars once held the highest Otago skink populations, while G-Mars Upper and Hogget block had the highest skink sightings per hour.

It appears that G-Mars Upper is the most appropriate area for local scale conservation. Other sites have potential to benefit from landscape-scale conservation. This takes account of the potential for predator management and for monitoring of skink population response to that management.

Hogget Block and Trig P/Rocky Hill and Dip Creek have intermediate Otago skink values. Farmer's Gully Mid and Farmer's Gully Upper and Big Gully would appear to have low viability on Otago skink conservation values alone.

It appears that Morven Hills now contains smaller vestigial pockets of moderate sized populations which are set in a widespread but low density meta-population. In the absence of effective management intervention the declining trend could be expected to continue. However, collectively the Morven Hills meta-population probably still contains the majority of Otago skinks in the Lindis area.

A rough estimate of the likely total population at the sites surveyed suggests that around 300 Otago skinks may still persist at Morven Hills.

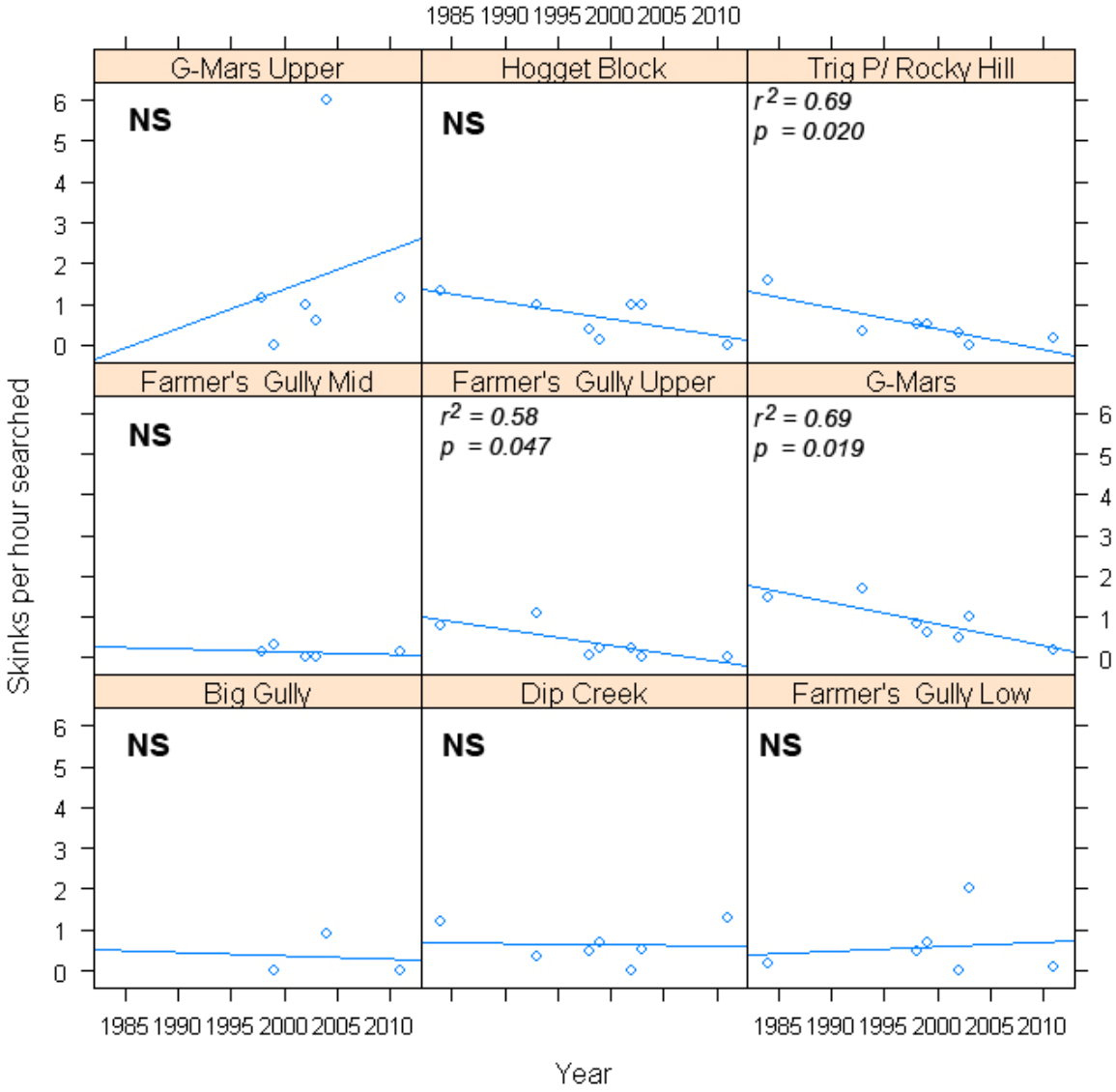

Figure 1: Abundance trends through time. Linear regression plots and accompanying regression statistics. NS indicates not significant at $\alpha = 0.10$.

Observations of other herpetofauna

McCann's skinks were seen at widespread locations associated with rock outcrops. They were generally recognized as being common but not abundant.

Common skinks are associated more with vegetation than rock habitat. No systematic attempt was made to enumerate their abundance or note their presence.

Cryptic skinks were not recorded as their known habitat near the pylon road was not re-inspected.

Common geckos were seen on occasion at Morven Hills when surveyors looked into rock crevices for grand and Otago skinks. During this inspection no attempt was made to formally identify which gecko species are present on Morven Hills.

Observations of invasive predators

Morven Hills has from all accounts a high predator loading. Anecdotal accounts have been made by numerous survey parties through the years to this effect (Tocher, unpublished). Many of these

parties were familiar with predator loadings at Macraes Flat and have consistently assessed the loadings at Morven Hills to be higher than ambient levels at Macraes Flat (Tocher report, undated). Given that there is unambiguous evidence that predation is the main agent of decline of grand and Otago skinks at Macraes Flat the threat of extirpation by invasive mammals at Morven Hills could be higher than at Macraes Flat. Habitat protection alone at Morven Hills is likely to be insufficient to halt the threat of extinction of these lizards unless accompanied by effective predator control.

MacFarlane (1999) reported captures of 10 cats and 4 ferrets over a 24 day period. A Morven Hills rabbit hunter noted numerous lizards in the cat stomachs including one young cat with 23 McCann's skinks. Ten feral cats were observed near the Otago skinks sites during the MacFarlane (1999) survey days.

Significance of Herpetofauna

Otago skinks are currently classified as Nationally Critical (Hitchmough 2009). They are also conservation dependent as evidence from both monitoring and management to date indicates that populations increase when adequately protected from introduced mammalian predators, but are liable to decline to local extinction when not protected. The remaining western populations, of which the skinks on Morven Hills form a substantial part, are genetically distinct from the larger populations found in the east of their historic range (in the Macraes/Sutton area).

The Otago skink populations at the identified sites on Morven Hills are a significant inherent value, and have greater potential for *in-situ* protection than other western sites currently in Crown ownership.

Table 9: Summary of Otago skink conservation potential (ordered by decreasing site priority)

Site	Historic maxima	Overall skink sighting per hour	Clear Decline	Seen 2011	Potential for predator protection	Potential for response monitoring
G-Mars Upper	medium	high	no	yes	local now wide later	good
G-Mars	high	high	yes	yes	wide later	medium
Hogget Block	medium	high	no	no	wide later	medium
Trig P/ Rocky Hill	high	medium	yes	yes	wide later	medium
Dip Creek	low	medium	no	yes	peripheral benefit of wide later	medium
Farmer's Gully Low	medium	medium	no	yes	peripheral benefit of wide later	poor
Farmer's Gully Mid	low	low	no	no	peripheral benefit of wide later	poor
Big Gully	low	low	no	no	peripheral benefit of wide later	poor
Farmer's Gully Upper	low	low	yes	no	peripheral benefit of wide later	poor
New dip creek	low	high	yes	no	peripheral benefit of wide later	good
Kanuka gully	unknown	low	unknow	yes	wide later	poor

2.6.3 AVIFAUNA:

Previous records:
The Atlas of Bird Distribution in New Zealand (Bull et al. 1985) records the distribution of birds at a 10 000 yard scale for New Zealand. Four 10 000 yard grid squares cover the property. The birds recorded on the property by the atlas are listed in Table 10 below.

Current Survey:
The native birds recorded during the current survey are listed in the Table 5 below. Falcon were heard in the south east of the property in the Davis Block. Falcons are known to make extensive use of areas of kanuka shrubland. In addition to the survey record we are advised that falcon are sometimes seen near the homestead and chicken coop and in the Dip Creek catchment (Richard Snow pers com). Also of interest was the presence of wild emus, one of which had three young. This may be a first instance of wild emus breeding in New Zealand.

Table 10 Bird Species previously noted and Current Survey Results.

Species	Recorded in Current survey	Conservation Status
Black Shag	Yes	At Risk
Black-billed Gull	No	Nationally Endangered
Eastern Falcon	Yes	Nationally Vulnerable
Grey Warbler	Yes	Not threatened
Swamp harrier	Yes	Not threatened
Paradise Shelduck	Yes Breeding	Not threatened
Pied Stilt	No	At Risk
Pipit	Yes	At Risk
S Black Backed Gull	Yes	Not threatened
Pied Oystercatcher	No	At Risk
SI Rifleman	Yes	At Risk
Silvereye	Yes	Not threatened
Spur winged Plover	Yes	Not threatened
Welcome Swallow	Yes	Not threatened

Significance of Avifauna:
The presence of threatened (Miskelly, et. al. 2008) bird species, including the black billed gull and eastern falcon on the property is significant. Other species including the pied stilt, pipit, pied oystercatcher and rifleman are considered to be in the “At Risk” category.

2.6.4 AQUATIC FAUNA:

Previous records:
The New Zealand Freshwater Fish Database was searched for records for Morven Hills PL. There were no records for the property itself, but there were 18 records for creeks which originate within the property boundaries: three for the Pass Burn; three for Dip Creek at the northern end of the property; three for Long Spur Creek and six for Short Spur Creek at the southern edge of the

property. The remaining three records were for the main-stem Lindis River, adjoining SH 8, which runs past the western boundary of the property.

Table 11 Fish Species Recorded from NZFF Database

Locality	Fish
Dip Creek and the Pass burn	longfin eel, brown trout
Long Spur Creek	Clutha flathead galaxias, upland bully
Short Spur Creek	Clutha flathead galaxias
Lindis River	rainbow trout

A total of five species, three native (two of which are threatened) and two introduced, have been recorded from water bodies in country surrounding Morven Hills PL (Table 11).

The majority of the streams on the property flow into the Pass Burn, Dip Creek or Long Spur Creek, all tributaries of the Lindis River (Clutha River catchment), while a small number also flow into the headwaters of Dunstan Creek, a tributary of the Manuherikia River (also part of the Clutha River catchment). One small headwater tributary stream (unnamed) just inside the top boundary at the very northern end of the property (map ref: G40 450 188), flows into Longslip Creek, a tributary of the Ahuriri River (Waitaki River catchment).

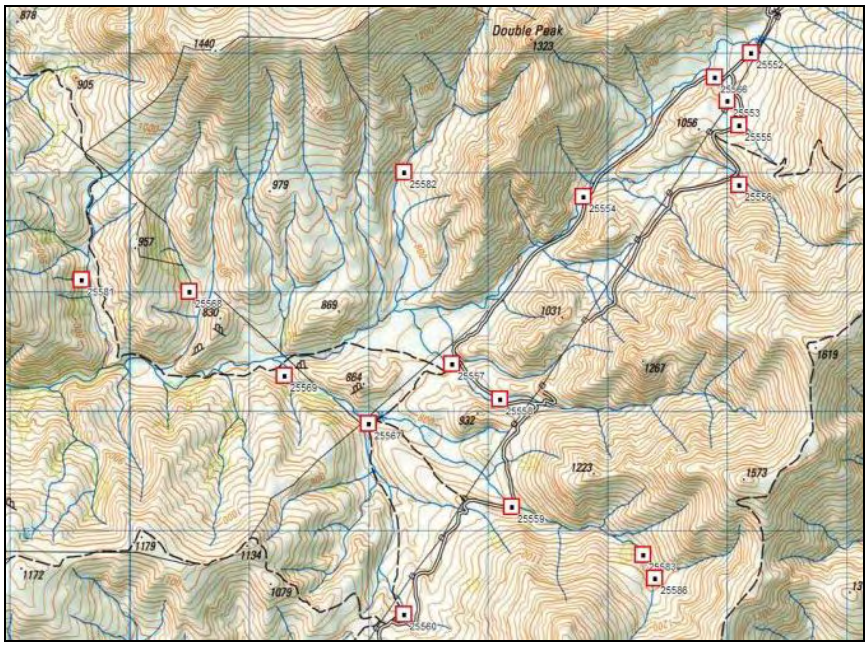

Figure 2. New Zealand Freshwater Fish database (NZFFDB) records with card numbers from Dip Creek, Morven Hills tenure review 2004 (Clutha flathead galaxias card numbers 25552 and 25559).

Recent Surveys:
Two tenure review fish surveys have taken place, the first in January 2004 (Figure 2) and the second on the 12 January 2011.

Sampling during these inspections was carried out with a backpack electric fishing machine, in accordance with the methods described in "*Monitoring Strategy for the Non–Migratory Otago Galaxias*" (Allibone, 1999). The method requires three locations, upper, middle and lower, to be fished on each stream. However, due to the prevailing conditions and access considerations, this was not always possible.

At fishing sites in-stream invertebrates were noted and given an MCI [Macro invertebrate Community Index: Stark (1985)] value when they could be identified according to "*A Photographic Guide to the Freshwater Invertebrates of New Zealand*" (Moore 1997). The MCI is commonly used as an indicator of water quality in New Zealand stony streams.

Forty-six site surveys were undertaken during the initial inspection with two resurveys and a further four new surveys to fill in gaps in 2011. Only two species of fish, one threatened native and one introduced sports fish were found.

In the 2004 survey only two sites contained galaxiids (although the catchment of only one of these was fully contained within the property), 10 were dry when visited, and 11 had no fish. Twenty-two sites contained brown trout only. Two populations of Clutha flathead galaxias were found above culverts with brown trout immediately below. The culverts constituted barriers to the up-stream movement of trout and consequently protect the galaxiids in those streams.

Brown trout were the most ubiquitous species found on the property, being limited in their distribution only by barriers such as waterfalls and culverts. Trout were present at 61% of the sites containing water.

It is most likely that all streams containing trout on this property would have been previously occupied by galaxiids. The two streams still containing galaxiids are remnants of what would have once been an extensive population, both within this locality and the surrounding district.

The Clutha flathead galaxias, *Galaxias* "species D", is part of a cryptic assemblage of non-migratory galaxiids in Central Otago (McDowall 2010). This species of galaxiid can be at times difficult to identify in the field due to high morphological character variability (McDowall 2006a). Molecular analysis has been used to assist with identification when doubt has occurred. Results from molecular studies (McDowall and Hewitt 2004 and references there in) have shown that the galaxiids present on nearby properties (eg: in Short Spur Creek on Shirlmar Station) and throughout the Lindis River catchment were Clutha flathead galaxias. Supported by field observations, it was reasonable to assume that this is the species found on Morven Hills.

Twenty-one invertebrate taxa were identified throughout the surveyed streams. The majority of taxa had high MCI values, suggesting high water quality at the time of survey.

The 2011 survey was undertaken in light of the new conservation status of the Clutha flathead galaxias. The two known Clutha flathead galaxias records in Dip Creek were re-visited. This was to assess the current status of the population and assess the integrity of the barriers since survey work in 2004. Barriers have been essential for the survival of many threatened galaxiid species (Townsend and Crowl 1991, McDowall 2006b). Although it appears galaxiid - salmonid interactions are complex, what is apparent is that where salmonids are abundant in streams, galaxiids tend to disappear or become sparse (McDowall 2006b).

One site which previously only recorded Clutha flathead galaxias present now had brown trout (size range 95 – 254 mm) throughout the entire surveyed reach. Only two Clutha flathead galaxias (sizes 95 and 98 mm) were captured in the stream reach above the road ford. One of the

fish appeared to be recovering from spawning. No evidence of recruitment, in the form of juvenile galaxiid presence, appeared to be occurring in this tributary.

Another section of stream which previously had no species observed was re-fished in the vicinity of the pylon maintenance road ford. Brown trout (size range 90 – 120 mm) and Clutha flathead galaxias (size range 80 – 118 mm) were captured throughout the stream reach above and below the ford. Two Clutha flathead galaxias showed indicative signs of recovery from spawning. There was no evidence, despite searching, of spawning sites or juvenile galaxiids.

The other site resurveyed has a large double culvert. Brown trout (size range 134 – 178 mm) were found occupying the downstream section of the creek below the culvert and Clutha flathead galaxias (size range 51 – 66 mm) throughout the upstream reach of the creek. The culvert appeared to be still providing a barrier to brown trout colonisation of the upper reach of the creek. The observed size range of Clutha flathead galaxias suggests that recruitment was occurring.

Four additional sites were fished on route to fill information gaps from previous survey work. Two sites contained brown trout (size range 40 – 168 mm) and (size range 39 – 138 mm). Two sites had no species present, one site appeared to be ephemeral and the other site had signs of recent disturbance event, e.g. high flow and gravel depositions.

Significance of Aquatic Fauna:

Clutha flathead galaxias:
The conservation status of the Clutha flathead galaxias, *Galaxias* 'species D', has recently been reclassified under new criteria (Department of Conservation 2008) and has qualified as '*Nationally Vulnerable*' due to the ongoing and predicted decline of the total population (Allibone *et al.* 2010.

The recent threat ranking of the Clutha flathead galaxias acknowledges the ongoing and predicted decline of this species. The fragmented populations of Clutha flathead galaxias in Dip Creek appear to be under immediate threat of exclusion by brown trout. One population however was situated above perched road culvert pipes which seemed to be a functional barrier to brown trout invasion. The velocity created by the distance of water drop from the culvert appears to be the mechanism of brown trout exclusion. Therefore the integrity of the culvert was of particular concern with regards to the continued survival of this population of Clutha fathead galaxias.

Morven Hills contains the most north-western representatives of the Clutha Flathead galaxias distribution. The Clutha flathead galaxias shares a common ancestry with the Canterbury galaxias *Galaxias vulgaris*. McDowall (2010) postulated that Otago flathead galaxias stock may have potentially spread north into Canterbury river catchments through the Lindis River headwaters prior to formation of the Canterbury Plains. The surviving Dip Creek populations may be historical remnants of that river capture dispersal event.

2.6.5 PROBLEM ANIMALS:

Rabbits have historically been a problem on this property, particularly at lower altitudes. Over most of the property, numbers are now low except for some of the improved front faces where moderate numbers are present. Considerable money has been expended in recent times with poisoning and helicopter shooting but work will need to be ongoing especially now that rabbit hemorrhagic disease is losing effectiveness.

The relationship between rabbit numbers, predator numbers and their impact on the survival of grand and Otago skinks is well documented (Norbury 2001). Predation of skinks increases markedly after sudden declines in rabbit abundance, because predators remain abundant but switched to feeding on skinks. Although a temporary effect, repeated cycles of intense rabbit control and population recovery may have chronic detrimental effects on skink population viability. Optimal rabbit management for maintaining viable skink populations is likely to require avoidance of large swings in rabbit abundance by maintaining populations at low, stable levels. Hares, possums, ferrets, stoats, weasels, hedgehogs, cats, fallow deer and the occasional red deer and pig are present on the property. Possum control has been undertaken for bovine TB vector control.

Of note are numerous wild turkeys that roost (and defecate) on rock tors, possibly to the detriment of Otago skink habitat. A small number of wild emu are unlikely to be a problem.

2.7 HISTORIC

Introduction:

The original tenure review historic information has been updated with a desktop assessment completed in September 2010 and a field inspection undertaken in February 2011.

Previous archaeological survey work was carried out in 1977, 1990 (Hamel 1990), and 2004 (Bristow).

Pre-contact Maori Sites:
The Lindis Pass was an important Maori route from the Waitaki Valley to the Upper Clutha and Lakes District. The usual route seems to have been up Longslip Creek, down the Pass Burn to the Lindis River and then over Mt Grandview.

A find spot (G40/4, Figure 3) is where Maori artifacts had reportedly been picked up by George Henderson a shepherd on Morven Hills. A small nearby rockshelter was recorded during the site inspection (at GPS 063). The shelter stands out along the valley as being the only outcrop of calcium carbonate visible from the road located on the edge of a raupo swamp.

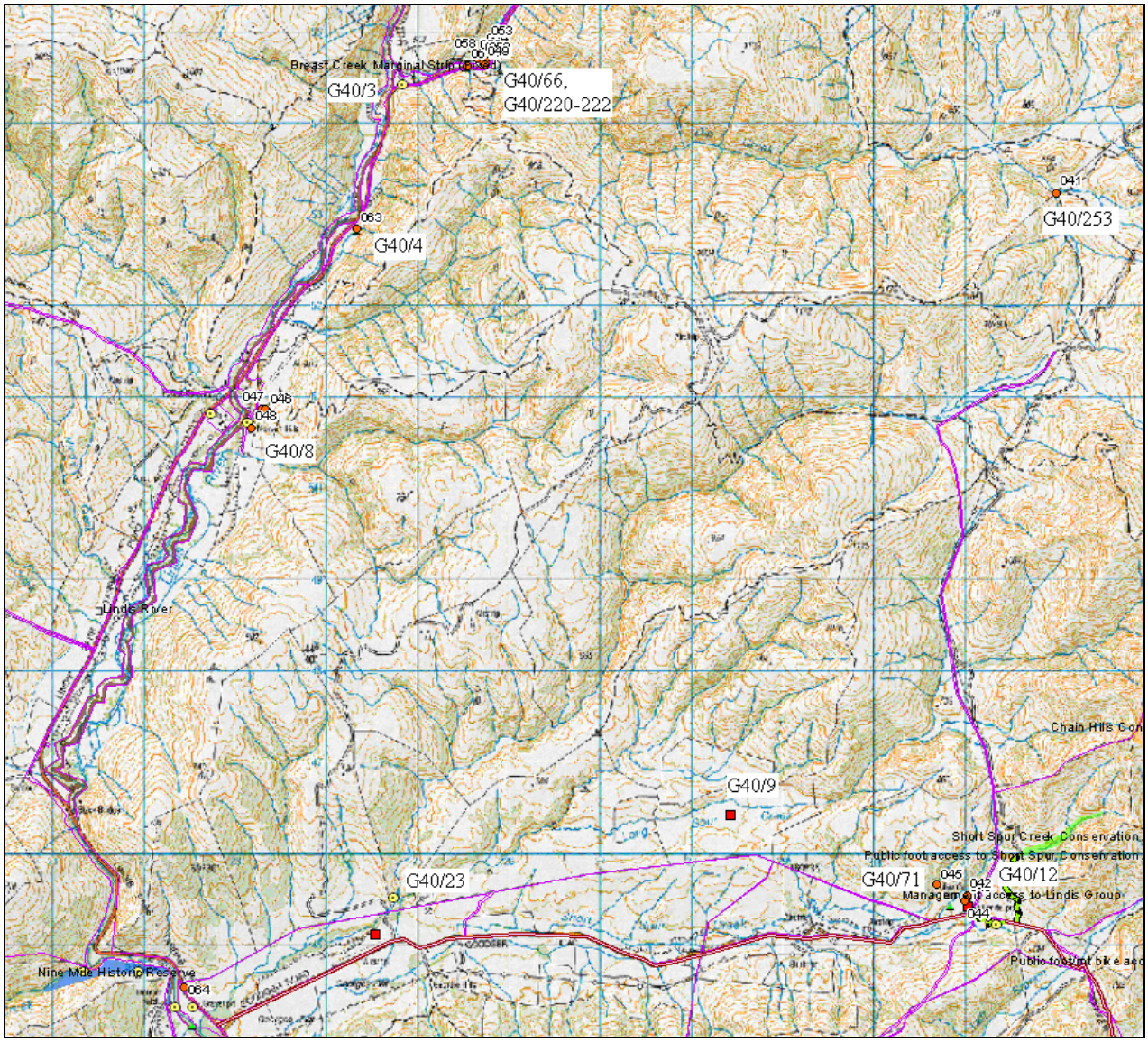

Figure 3. NZAA sites and GPS waypoints of significant archaeological sites.

European history:
For a detailed history of Morven Hills Station and the surrounding area refer to Duff (1978). The original Morven Hills Run was a huge property of approximately 162,000 ha and running 140000 sheep in 1874. T he final break up of Morven Hills took place in 1910 when the current smaller runs in the Tarras – Lindis area were created.

Pastoral Farming:
The Morven Hills lease was taken up by the McLean family in 1856 with Run 235 passing to John McLean (Sinclair 2003). The run was sold in 1874 to Colonel Whitmore for £128,000 and the following year it again sold to Charles Nichols on behalf of Frederick Gonnerman Dalgety and partners (Dalgety & Co Ltd). In 1883 William Burnett was supervisor in charge of Morven Hills followed by John Stronach (also past Chairman of Vincent County Council) as manager a year later. In 1894 Thomas McWhirter became manager to be replaced by Robert Kermode Smith in 1903. Robert Smith was a stud breeder, tree planter, rabbit destroyer, and pioneer irrigator (Pinney 1981: 141 - 148).

Hamel (1990) recorded various sites related to early pastoral farming on Morven Hills; the Morven Hills woolshed (G40/8), Dip Creek dip site and huts (G40/66), Polson's hut (G40/12) and graves (G40/71), and musterer's huts at the head of Dip Creek (G40/253). The location of these NZAA recorded sites is shown in Figure 3.

Gold mining:

Soon after Morven Hills was established a gold rush to the Lindis occurred. Gold had originally been reported in the Lindis River in 1857 by J. T. Thomson the Provincial Surveyor but no interest was shown in this discovery. Early in 1861 a team of road builders recovered gold while fossicking in the river. By the end of April there were approximately 300 miners on the field. Gold returns were patchy and with the onset of winter most of the miners drifted away. Then with the news of the Tuapeka rush (Gabriels Gully), by December 1861 the population of the Lindis gold field was down to one. Throughout the mining period small numbers of miners, including the Chinese, worked the Lindis for gold. The Depression years saw miners again in the Lindis.
Most of the mining activity took place in the Goodgers Flat – Camp Creek area.

The location of gold mining sites within the bounds of the Morven Hills is provided in Figure 3. Gold mining sites are known at: Pass Burn tailings (G40/3), Chimneys Camp (G40/9), and the Long Spur gold working site (G40/23). Middleton (2009) updated the original site record for gold tailings (G40/222, old Site Record S116/5) on the south bank of Dip Creek near its confluence with the Pass Burn.

Historic Heritage Description

The archaeological/historic features are in the following table:

Table 12. Key historic resources on Morven Hills PL.

Description	GPS ID	NZAA No.
Pass Burn tailings		G40/3
Chimneys camp		G40/9
Long Spur mining		G40/23
Sheep dip	040	G40/252
Musterer's Huts	041	G40/253
Polson's Hut	042	G40/12
Enclosure	043	G40/12
Enclosure	044	G40/12
Polsons grave	045	G40/71
Concrete pad	046	G40/252
Plunge dip?	047	
Woolshed	048	G40/8
Reservoir wall	049	G40/66

Description	GPS ID	NZAA No.
Hut site	050	G40/66
Water race	051	G40/66
Sheep dip	052	G40/66
Old road	053	G40/220
Water race A	054	G40/220
Water race B	055	G40/66
Stacked wall	056	G40/66
Stacked stone	057	G40/66
Water race outlet	058	G40/66
Reservoir wall	059	G40/66
Shelter	063	G40/4
Pre-emptive right	064	

<u>Morven Hills Woolshed and surrounds</u> (G40/8)

The Morven Hills Woolshed (see cover photo) is one of the most impressive historic farm buildings in New Zealand. It is a Category I Historic building (Reg. No. 53 dated 2 July 1982: HP 155/1982) and noted within the Central Otago District Plan. This is one of the largest

woolsheds (formerly 34 blade shearing stands) still in use in New Zealand. Built of stone, it is of grander proportions and form than any other woolshed still surviving. It is still well preserved and maintained. The McLean's built the Woolshed about 1873 in the style of 19th century Australian Georgian architecture. It is an excellent example of the scale of operations of a large high country station before most were split up in the early 20th century. The woolshed has been previously described and photographed by Hamel (1990) and Duff (1978). SO 16272 (dated 1865) shows the pre-emptive right C granted to John McLean on Run 253 where the woolshed is located.

An early sheep dip (G40/252) was recorded some 250 m from the Woolshed at the northern extent of the shelter belt (at GPS 040).

Polson's Hut and surrounds (G40/12)
Polson's Hut is well constructed of split and partially dressed schist. The hut is in good condition and a fence has been erected around it to prevent stock damage. The hut was one of the early shepherds' huts on Morven Hills and is associated with one of the sadder tales of the early pastoral history of Central Otago.

John and Christina Polson lived in Polson's hut (GPS 042) from 1867 until about 1870 when they moved to the Morven Hills Homestead to work for the owner Jock Mclean. It was in the depths of winter while residing in the hut that Mrs Polson gave birth to premature twin girls. Unfortunately the isolation and the intense cold meant the twins did not survive. They were buried some distance away with their grave marked by a willow tree.

An earthen walled enclosure is situated close by Polson's hut at GPS 043-044. This enclosure may have functioned as stock yards or as a garden.

Polson's grave site (G40/71)
The Polson's twin's grave site is located in the next gully west of the Polson's hut (at GPS 045). The old willow tree that marks the site has in recent years died and fallen down. Descendents of the Polsons are currently tending the site which now has a new stone plaque set into a concrete base beside the tree. A schist upright is placed behind the new plaque is assumed to be the original plague. It was not noted whether the date of 1869 was scribed onto the plaque as noted in Polson-Genge and Polson (2004: 57).

Dip Creek dip site (G40/66)
Hamel 1990 noted the dip, reservoir, water race, three hut sites, three stone structures, and stone alignments. Many of these features are associated with gold mining.

The Dip Creek Sheep dip and surrounds (G40/66) have been adequately described in Hamel's (1990) and Middleton's (2009) reports. There does not appear to be any reference to the dip having been used to treat parasites with chemicals such as nicotine and arsenic. Duff (1978: 27) suggests the stone dip was used to wash the fleeces prior to being turned out on Camp Hill to dry before shearing. This effectively lightened the wool and allowed for easier transport of the bales by bullock wagon, north over the Lindis Pass. Richard Snow (pers. comm.) remarked that the dip site alongside the Pass Burn has been destroyed by flooding. On inspection stacked stone remains near the confluence of the Pass Burn and Dip Creek look like part of this dip.

Three stacked schist chimneys (G40/66) are located on a terrace above the reservoir/dam (GPS 050). A willow tree is growing amongst the hut sites obscuring them from view and causing collapse of the stacked walls and chimneys. The 1977 site record noted three other structures on this terrace ca. 11 m west of the western chimney noted above. These are no longer evident apart from an area with scattered stone located at the base of the scarp.

A hut described by Duff (1978: 26) with a unique hexagonal chimney was evident at this site prior to being bulldozed out of existence during road construction sometime ca. 1975. The NZAA site record (G40/221) describes the hut as octagonal in shape with a circular stone chimney that was demolished by the Ministry of Works in order to use the stone for a culvert in Dip Creek.

The Dip Creek (G40/220) features related to gold mining located north of the Dip Creek sheep dip have been adequately described in Middleton's (2009: 9) report under site record G40/220. The features include a water race, old road or track, and tailings. Artifacts dating to ca. 1930's depression were found among the tailings.

Musterer's huts head of Dip Creek (G40/253)

Two corrugated musterer's huts and a corrugated clad outhouse (G40/253) are located ca. GPS 041 at the head of Dip Creek (Appendix 5, Plate 17). The earlier hut displayed black Redcliffe brands of corrugated iron on the outside of the cladding dating from 1880's manufacture (Plate 18). Dates of construction are not known but one is more recent. Both are maintained by the Morven Hills lessee. A large rectangle appeared on Google Maps (2010) to the north of the huts that may be a holding paddock although no obvious feature was noted on the ground apart from a rectangular wooden peg. SO 2295 (dated 1938) shows Dip Creek yards in this approximate location.

Pre-emptive right B

The early pastoral pre-emptive right B, 11 acres 2 roods, granted to John McLean (SO 16271 dated 1865 and SO 16270 dated 1873) appears to correlate to the terrace between the State Highway and the Lindis River outside the current Morven Hills PL. This area was not walked over but a view from the highway did not show any obvious features (GPS 064).

Chinese graves (G40/20)

Seven Chinese graves (G40/20) reported by Mr Goodger (pers comm.) at the confluence of Rocky Creek (Long Spur Creek or Short Spur Creek?) and Lindis River. Hamel did not find any trace of the site during a survey in 1990 (page 7). There appears confusion as to the location of Rocky Creek. The NZAA database shows the Chinese graves (G40/20) at the confluence of Lindis River and Long Spur where as the gold mining site (G40/23) is shown further up Long Spur Creek.

Rocky Creek (G40/23)

Site record G40/23 notes Rocky Creek as an area of gold mining in the early 1900-1930's (Mr Goodger pers comm.). A small sluiced area with stacked tailings is located on the true right of Rocky Creek. Hamel's sketch (1990; 8) notes three water races, one a live irrigation race, at the juncture of Long Spur Creek and Rocky Creek. A stone hut is said to be associated with these workings but it was not relocated.

Chimneys camp (G40/9)

The chimneys camp (G40/9) at Long Spur Creek has been described in Hamel's report (1990: 7-8). This site is located on the south side of Long Spur Creek at the western end of the gorge section. When originally recorded in 1972 seven chimneys were reported. In 2004 only 3 were clearly visible and another two are obscured by a dense cover of scrub. Only one other possible chimney was noted. The chimneys (or more accurately, fireplaces) are built of split schist and about 1.5m wide and a metre high.

A search of the area in 2004 yielded the striking surface from a wax vesta matchbox, a fragment from a large cast iron pot, and the neck of glass bottle of early 20th century manufacture.

The 1977 site record form implies that the site was a mining camp with the gold workings located downstream. There is an area of hummocky ground downstream and on the opposite side of the creek which may have been worked for gold, but in an unsystematic manner.

The evidence suggests a group of miners with little experience of mining occupied the site briefly in the early 20th century. Given the possible date and the inexperience at mining the site may have been occupied during the depression when would be miners were subsidised by the Government.

Trig Stations (G40/246 - G40/251)
Six trig stations were noted on the lease during a search of SO plans (QuickMap), Lindis Topo map (Department of Lands and Survey 1980), and the LINZ Geodetic database (Landonline). None of the trigs were visited during the survey therefore no photos or descriptions of current condition are known.

Other features
A lignite seam had been discovered by John Charlton in March 1877 somewhere in the Morven Hills region but it proved to be of very limited extent (Duff 1978: 185). It is likely to be the Geordie Hill seam just outside the south-eastern lease boundary (which was part of the original property).

A Post Office was opened at Morven Hills Homestead ca.1864 (Duff 1978: 108).

There is one last site worthy of mention. This is a length of fencing in the north east corner of the lease. This appears to have been the boundary of the lease in the days of the McLean's. The fence is constructed from 6 hole iron standards and wire cable in place of the usual fencing wire . Preliminary research indicates that the fence may date to the 1870s.

Significance of Historic

Of most historic significance on the Morven Hills PL are sites and features related to the early pastoral history of the run. These include the Woolshed and surrounds (G40/8), two sheep dip sites (G40/66, G40/252), Polson's hut and surrounds (G40/12) and graves (G40/71), and a musterer's hut (G40/253).

The woolshed is part of one of the most significant collections of historic farm buildings in New Zealand.

Notable people involved in the running of the property include John McLean, John Stronach, and Frederick Gonnerman Dalgety.

Polson's hut is associated with a family tragedy which highlights the isolation of early sheep runs. The hut is now fenced from stock damage, and being in good condition and does not require further physical protection.

The Dip Creek dip site is an important site. Dips were a vital part of the early sheep runs for wool washing and also for treatment of the parasite scab. Only two early dip sites have been recorded archaeologically in the southern South Island.

The 19th century surveyor Trig stations (G40/246 - 251) are important features related to land parcel subdivision for the early pastoral runs and for delineating gold mining claims.

All of the historic sites identified during the survey are protected by the archaeological provisions of the Historic Places Act 1993 except for the camp site which may post date 1900.

2.8 PUBLIC RECREATION:

2.8.1 Physical Characteristics:

The recreational potential of Morven Hills derives mostly from its high quality scenic setting, dramatic views, historic associations and the existing track network.

The Lindis Pass Highway is a main highway with significant tourist use. Although the pass itself does not adjoin the property there is about 17km of frontage to this highway. It is seen as part of a scenic corridor associated with the main Christchurch to Queenstown route. Part of this distance fronts to river flats along the Lindis River, with the Lindis Pass end of the property being mainly uninviting steep briar infested hill slopes. The Lindis Pass Scenic Reserve interrupts the boundary, but the boundary touches the road again for a short distance approximately 1km on the Waitaki side of the pass.

The only other formed legal road adjoining Morven Hills is Goodger Road that contacts the boundary near Polson's Hut.

Of interest is the formed and well maintained gravel pylon track that bisects Morven Hills from north of Lindis Pass down to Goodger Road. This track was constructed to service the high voltage transmission line that traverses this route. The southern portion of this track is actually in the adjoining Shirlmar freehold property. There is an alternative track past Polson's Hut that contacts Goodger Road.

The other significant physical feature is Dunstan Creek which is located on the eastern side of the property. Dunstan Creek is a major tributary of the Manuherikia River, which meet on the Maniototo Plain.

The historic features of the property, particularly the woolshed and Polson's hut provide the opportunity for some historic interpretation, although the former has practical difficulties due to its location and the fact that it is still in use.

The Otago DOC Recreation Opportunity Spectrum (Harper:1992), classified recreation opportunities in the Otago region by setting, activity and recreational experience characteristics. The majority of Morven Hills lies in the "*Backcountry Four Wheel Drive In"* zone, which is characterised by a sense of remoteness and a highly natural setting. In this zone, Four Wheel Drive vehicles are identified as giving access to high country tussock grasslands, Block Mountains and more rugged remote areas.

The part of Morven Hills near the Lindis River is zoned *Rural* which recognises a strongly human-modified nature but with open space characteristics of the area. Driving for pleasure, horse riding, walking and picnicking are identified as common activities in such areas. Areas further up SH8 towards the Lindis Pass are zoned as "*Back Country Drive In"*, which is defined as an area that provides a feeling of remoteness.

The open space characteristics of Morven Hills area are also identified in a Federated Mountain Clubs publication "Outdoor Recreation in Otago Volume Two – A Recreation Plan" (Mason, 1989). This document identifies much of the area surrounding Morven Hills as "Open Space" and identifies management priorities such as provision of public access ways through the zone and the maintenance of tussock grassland and native forest settings. It identifies the RAP areas as having particular significance as highly natural areas. The open space character along the Lindis Pass Highway is seen as particularly important both within and outside the landscape protection

corridor identified. It is considered to have unrealised potential and a pressing need for managing the tussock grasslands of the Lindis for landscape appreciation both on and off the highway. It recommends a landscape protection corridor 5km either side of the Lindis Pass and an extension of the Lindis Pass Scenic Reserve.

2.8.2 Legal Access:

Legal access to the property is primarily from SH8. The formed Goodger Road is the other key legal access.

There are three other legal access points all of which are either unformed or not corresponding to formed tracks. However as they are probably unsurveyed this discrepancy could be corrected at the time of a future survey.

One is an unformed road from Goodger Road to the boundary at Beckers farm block. Another starts from Goodger Road near Polson's Hut and continues along the boundary and then into the property in a similar line to the pylon road. This legal road finishes in the middle of the property near the southern headwaters of Dip Creek, but does not correspond to the formed track.

The entire length of the Lindis River has a marginal strip. Also a marginal strip on Dunstan Creek touches the eastern boundary.

2.8.3 Activities:

Many of the activities are considered potential ones rather than being actively undertaken now.

Use is made of the pylon track, and other farm tracks by 4WD clubs and for mountain biking. Much of this route has a remoteness feel and from adjoining farm tracks spectacular views can be gained of the St Bathans Range and the Dunstan Mountains.

If the pylon Road was available for wider public use, the significant distances involved mean that mountain biking is likely to be more popular that walking. Horse riding may also become popular, but possibly only for organised events like the Otago Goldfields Cavalcade.

Hunting for quail and feral animals is sometimes undertaken with permission of the lessee. Rabbit shooting is a reasonably popular activity.

An annual market day has been held at the historic woolshed, which has attracted considerable local interest.

Spare farm accommodation is sometimes rented to holiday makers.

PART 3

OTHER RELEVANT MATTERS & PLANS

3.1 CONSULTATION

The following consultation has taken place:

3.1.1 An NGO early warning meeting was held on the 24/9/03 with interested groups.

3.1.2 The following views were expressed at an NGO report back meeting of 12-5-04.

3.1.3 Additional comments were provided by Mike Floate on behalf of FMC and are attached in 4.1.2, Appendix 9.

3.1.4 The North Otago Branch of the New Zealand Deerstalkers Association provided written comments attached in 4.1.2, Appendix 10.

3.1.5 Additional comments were made at the meetings with NGO's in Alexandra on 21 September 2010.

3.1.6 An NGO meeting took place on 19/4/2011.

3.1.7 A written Submission from Forest and Bird, Central Otago Lakes Branch and are attached in 4.1.2, Appendix 11.

3.1.8 A written submission for Forest and Bird, Dunedin Branch and are attached in 4.1.2, Appendix 12.

3.1.9 A written submission from Federated Mountain Clubs and are attached in 4.1.2, Appendix 13.

The consultation and submissions are summarised as follows:

Point Made	**Group Submitting**
Pylon road access for public very important.	NGO early warning meeting 24/9/03 NGO meeting of 21/ 9/10 Written submission from Forest and Bird, Central Otago Lakes Branch Written submission for Forest and Bird, Dunedin Branch Written submission from Federated Mountain Clubs
Route along crest of Chain Hills and also into Dunstan Creek good access.	NGO early warning meeting 24/9/03
Whole of Dunstan Creek catchment needs to be reserved.	NGO early warning meeting 24/9/03 Written submission for Forest and Bird, Dunedin Branch Written submission from Federated Mountain Clubs
Enlarge the existing Lindis reserve.	NGO early warning meeting 24/9/03

	NGO report back meeting of 12/5/04 Written submission for Forest and Bird, Dunedin Branch Written submission from Federated Mountain Clubs
All Dip Creek has landscape values – northwards Double Hill is a key feature.	NGO early warning meeting 24/9/03 NGO report back meeting of 12/5/04
Highway corridor important – Covenant?	NGO early warning meeting 24/9/03 Written submission from Federated Mountain Clubs
Northern and eastern parts of the property must be high on the agenda.	NGO early warning meeting 24/9/03
Key access into Dunstan Creek – year round access needed.	NGO early warning meeting 24/9/03
Polson's Hut has considerable history.	NGO early warning meeting 24/9/03
Lignite mine nearby.	NGO early warning meeting 24/9/03
There is scope for public recreation along river – may need wider marginal strip.	NGO early warning meeting 24/9/03
Should secure lizard areas regardless of tenure review process as nationally significant.	NGO report back meeting of 12/5/04
Want hunting access to new conservation land and vehicle access.	North Otago Branch of NZDA
That skinks will need to be reassessed by the skink team (GAOS)	NGO meeting of 21/ 9/10
Vegetation and historic values need to be reconfirmed	NGO meeting of 21/ 9/10
NGOs have concerns about the conditions of the Lindis Pass grasslands.	NGO meeting of 21/ 9/10
RAPS A2, A3, B5 should be protected.	NGO meeting of 21/ 9/10 Written submission for Forest and Bird, Dunedin Branch
Upper Dunstan Creek should be a Conservation Areas for recreation.	NGO meeting of 21/ 9/10
There is an issue of sustainability over hawkweed areas.	NGO meeting of 21/ 9/10
Access over Pylon Rd 4WD by permit.	NGO meeting of 19/4/2011 Written submission for Forest and Bird, Dunedin Branch
2 loops needed to link to highway from pylon road	NGO meeting of 19/4/2011 Written submission from Forest and Bird, Central Otago Lakes Branch Written submission for Forest and Bird, Dunedin Branch Written submission from Federated Mountain Clubs
All conservation priorities are secondary to halting decline of grand and Otago skinks on the property.	NGO meeting of 19/4/2011
Retire the high altitude Black Peak and Chain Hills rangelands, include valley floor north of Hummock Block.	Written submission from Forest and Bird, Central Otago Lakes Branch Written submission from Federated Mountain

	Clubs
Create a sustainable management covenant over severely degraded areas.	Written submission from Forest and Bird, Central Otago Lakes
Re-align fence on top of Sledges Hill to include snow tussock plateau and top of stream catchment in Dip Creek Conservation Area.	Written submission from Forest and Bird, Central Otago Lakes Branch
True right of Dip Creek fenced off as conservation area, linked to Lindis and Chain Hills conservation areas by riparian corridor, fenced off from cattle and deer.	Written submission from Forest and Bird, Central Otago Lakes Branch Written submission for Forest and Bird, Dunedin Branch Written submission from Federated Mountain Clubs
Farmers Gully fenced off as conservation area, with public access up to it.	Written submission from Forest and Bird, Central Otago Lakes Branch Written submission for Forest and Bird, Dunedin Branch
4WD track from Dip Creek; short easement could provide public access across the top to Top Airstrip Block and Station Range.	Written submission from Forest and Bird, Central Otago Lakes Branch Written submission from Federated Mountain Clubs
Protection of dryland grey and kanuka shrublands.	Written submission from Forest and Bird, Central Otago Lakes Branch
Protection of dryland turf communities via covenant	Written submission from Forest and Bird, Central Otago Lakes Branch
Protection of the short tussock savannah community on the ridgeline of Wrights and White Rocks blocks via covenant.	Written submission from Forest and Bird, Central Otago Lakes Branch Written submission for Forest and Bird, Dunedin Branch
Protection of wetlands generally, particularly fenced off from cattle and deer.	Written submission from Forest and Bird, Central Otago Lakes Branch. Written submission for Forest and Bird, Dunedin Branch
The Historic sites should be designated as Historic Reserves.	Written submission for Forest and Bird, Dunedin Branch Written submission from Federated Mountain Clubs
We believe that RAP A6 should become a Conservation Area together with the part of G Mars .	Written submission for Forest and Bird, Dunedin Branch. Written submission from Federated Mountain Clubs
Any other sites found to still have endangered skinks should also be protected.	Written submission for Forest and Bird, Dunedin Branch
The natural and landscape values are outstanding and will contribute significantly to the enjoyment of visiting	Written submission from Federated Mountain Clubs
6 RAPs are still worthy of protection by return to full Crown ownership.	Written submission from Federated Mountain Clubs
There is a total of about 7,200 ha of land classified LUC Class VI and should be capable of being managed in a way that is	Written submission from Federated Mountain Clubs

ecologically sustainable so long as maintenance fertilizer is applied to replenish nutrients removed in animal products, and through historical burning.	
6,000ha of LUC Class VII land with low suitability and serious limitations for pastoral use and is most unlikely that this land could be managed in a way that is ecologically sustainable in the long term.	Written submission from Federated Mountain Clubs
There is only about 800ha of land that has been recognized as LUC Class VIII. This land is entirely unsuited to pastoral use, and not capable of being managed in a way that is ecologically sustainable as required by the CPL Act.	Written submission from Federated Mountain Clubs
Morven Hills recreation settings suitable mountain bike riding, tramping, horse trekking and hunting also provide subjects for photography, painting, botanical study and bird watching.	Written submission from Federated Mountain Clubs
Musterers huts in the upper Dip Creek catchment, either with permission from the property owner, or by negotiation through tenure review, public use of these huts would greatly increase the range of options available for recreation.	Written submission from Federated Mountain Clubs
The 'ecosystem service' value of the tall tussock grasslands should not be overlooked.	Written submission from Federated Mountain Clubs
In the Otago CMS objectives Tenure Review presents an important opportunity to advance those objectives.	Written submission from Federated Mountain Clubs

3.2 REGIONAL POLICY STATEMENTS AND PLANS:

Regional Policy Statement

The Regional Policy Statement for Otago provides a policy framework for all of Otago's significant regional resource management issues. It does not contain rules. District Plans shall not be inconsistent with the Regional Policy Statement. In respect of natural values the Regional Policy Statement includes the following policy and method statement:

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

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

In respect of landscape and natural features it includes the following policy and method statement.

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

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

Regional Plans

The whole PL is subject to the *Otago Regional Plan Water* rule which requires resource consent for suction dredge mining.

3.3 DISTRICT PLANS:

The majority of this property is located within the Rural Resource zone of the Central Otago District Plan with the extreme north-eastern tip of the property being within the Rural Scenic zone of Waitaki District. The northern part of the property, to the west of Lindis Pass is identified in the Plan in an Area of Outstanding Landscape Value. Developments including but not limited to earthworks and tree planting require resource consent in this area and the portions of the lease over 900m asl.

Under the relevant provisions Plan resource consents are required for the disturbance of specified areas of tussock grasslands (>10ha) and other indigenous vegetation (>0.5ha). Both these and the relevant landscape provisions do not however apply to land freeholded via tenure. Resource consent is required for excavations or tree planting within specified distances of a water race or irrigation pipeline, and for development work within 10m of any water body.

The Lindis River runs through part of the property, and the stretch of it downstream of the confluence with Breast Creek is subject to a requirement for an esplanade provision upon subdivision.

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

There is one historic site registered in schedule 19.4:

- Item 260 – Morven Hills Station woolshed (NZHPT reg. no. 53 category I)

Modification or disturbance of this site requires resource consent.

The small section of the property within the Waitaki District is identified as in the Waitaki District Plan (Waitaki Plan) as an area of Outstanding Natural Landscape and subsequently provisions of the Waitaki Plan require resource consent for activities such as earthworks within this area. The clearance of specified areas of indigenous vegetation also requires resource consent. The landscape provisions apply regardless of tenure, whilst the indigenous vegetation provisions do not apply to land freeholded via tenure review.

3.4 CONSERVATION MANAGEMENT STRATEGIES AND PLANS

The Otago Conservation Management Strategy has a general objective regarding Central Otago ecosystems.

This is to recognise the distinctive contribution the ecosystems of Central Otago make to the diversity of New Zealand's flora, fauna, ecological communities and processes and to retain representative examples through protection at lower altitudes and more extensive protected areas at higher altitudes.

This objective is to be implemented by the following:

- The protection of representative examples of ecosystems including aquatic ecosystems on privately occupied land will be negotiated using a range of options including acquisition through tenure review, covenants, management agreements and land purchases or exchanges. Attempts to secure buffer zones and ecological linkages between areas will be included in this exercise.

- Survey of areas for the PNA Programme will be completed as access and resources become available and efforts will be made to negotiate formal protection for areas identified as a priority for protection.

- The value of tussock grasslands as a contributor to the character of New Zealand and its landscape and biodiversity will be promoted and retention of tussock grasslands advocated.

Morven Hills is identified in the CMS as part of special place 23 Hawea – Lindis.

The values noted include the presence of Otago and grand skinks, the nationally significant landscape of the Lindis Pass and the historic buildings on Morven Hills.

The proposals for implementation include the use of tenure review to:

- *Protect landscape qualities in the area particularly those of the visual catchments visible from highways.*
- *Protection on a broad scale will be sought for the Otago portion of the Lindis Pass scenic corridor as a priority.*
- *The species recovery plan for Otago skinks and grand skinks will be implemented.*
- *The department will encourage the New Zealand Historic Places Trust to take responsibility for assisting the owner with the protection and maintenance of the Morven Hills Station historic stone farm buildings.*

3.5 NEW ZEALAND BIODIVERSITY STRATEGY

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

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

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

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

3.6 PROTECTING OUR PLACES

In April 2007 the Ministry for the Environment produced a new policy document titled 'Protecting Our Places' which was jointly launched by the Minister of Conservation and the Minister for the Environment. This publication introduces four national priorities for protecting rare and threatened native biodiversity on private land. The national priorities identify the types of ecosystems and habitats most in need of protection.

The policy statement supports the government's pledge to maintain and preserve New Zealand's natural heritage. This began in 1992 when New Zealand signed the United Nations Convention on Biodiversity; followed in 2000 with the release of the New Zealand Biodiversity Strategy.

The four national priorities for biodiversity protection are listed below. They are based on the most up to date scientific research available.

National Priority 1:
To protect indigenous vegetation associated with land environments, (defined by Land Environments of New Zealand at Level IV), that have 20 percent or less remaining in indigenous cover.

National Priority 2:
To protect indigenous vegetation associated with sand dunes and wetlands; ecosystem types that have become uncommon due to human activity.

National Priority 3:
To protect indigenous vegetation associated with 'originally rare' terrestrial ecosystem types not already covered by priorities 1 and 2.

National Priority 4:
To protect habitats of acutely and chronically threatened indigenous species.

3.5 ECOLOGICAL SUSTAINABILITY AND CARBON STORAGE

Sustainability and Ecosystem Services

The Land Use Capability (LUC) system is a nationally consistent land classification system based on physical sustainability that has been used in New Zealand to help achieve sustainable land development and management since 1952. The LUC system has two key components. Firstly, Land Resource Inventory (LRI) is compiled as an assessment of physical factors considered to be critical for long-term land use and management. Secondly, the inventory is used for LUC classification, whereby land is categorised into eight classes according to its long-term capability to sustain one or more productive uses (Lynn et al. 2009).

Analysis of LUC for Morven Hills reveals that most of the property falls in class 6, 7 & 8 with small areas of class 3 & 4 lands restricted to the valley floors around Goodger Road and the main Lindis Valley. The higher altitude areas including the Chain Hills are class 7 lands with the highest and steepest land falling into class 8. Class 8 lands have severe to extreme physical limitations or hazards which make it unsuitable for arable, pastoral, or commercial forestry use. Erosion control, water management and conservation of flora and fauna are the main uses of this land (Lynn et al. 2009). Class 7 lands have severe physical limitations and consequently are high risk lands requiring active management to achieve sustainable production. These classes have a subclass 'e' which indicates that erodibility is the main kind of physical limitation or hazard to use that has been identified.

Sustainability

The PL contributes a number of "ecosystem services" which are significant to Otago from social, infrastructural and economic perspectives. Constanza et al (1997) define ecosystem services as flows of materials, energy, and information from natural capital stocks which combine with manufactured and human capital services to produce human welfare." They identify 17 "services". Morven Hills clearly contributes to five of these services excluding those of a recreation and cultural nature which are described elsewhere.

(i) Gas Regulation:

One hectare of mixed grassland/shrubland stores about 42 tonnes of carbon versus approximately 2t for unimproved grassland (Carswell et al 2008).

The property 14207ha ha predominantly clothed in short tussock and degraded tall tussock lands. The shrubland component to this property is mainly confined to gully systems in the lower altitudes and comprises about 1000 ha of light to medium native/exotic shrub. In the absence of burning and grazing the property reverted to native and exotic shrublands could in time be expected to store some (40 x say 9000ha [9886 ha area under 1000m, less say 886 ha area already in shrublands] 360000 tonnes of carbon. If it reached a climax forest vegetation it could store (100t x 9886 ha) = say 1 million tonnes of carbon although this timeframe may be many hundreds of years.

Currently a tonne of carbon is worth about $10 - $30 US. This makes carbon sequestration potentially valuable in the long term.

The following research provides insight into the potential benefits available on Morven Hills.

McIntosh et al. (1994) reported that at low rainfall a reduction in soil carbon of 1.7 t ha^{-1} under grazing without fertilizer over a 15 year period. This contrasted with gains of a similar magnitude in soil carbon on the same property in both unfertilised and fertilised situations in the absence of grazing. Thus pastoral lands transferring to conservation land will have varying soil carbon trajectories depending on management history.

Table 8. Some potential opportunities for carbon sequestration on conservation land.

Present vegetation	Present carbon in above-ground biomass (t ha^{-1})	Potential vegetation	Potential carbon in biomass (t ha^{-1})	Time (years)	Carbon sequestration rate (t $ha^{-1}yr^{-1}$)
Severely modified short grassland – dry	1	*Pinus radiata*[1]	140	30	4.7
Severely modified short grassland – moist	1	Mountain beech	140	50	2.8
Severely modified short grassland – moist	1	Manuka–kanuka shrubland	120	35	3.4
Severely modified short grassland – moist	1	*Pinus ponderosa*	97	15	6.5
Manuka–kanuka shrubland	120	Mountain beech	140	50	0.4

[1] Stems only, calculated from volume increment (Ledgard & Belton 1985)

(ii) Climate Regulation:

Carbon storage in expanding shrublands, forest, tall tussock grasslands and consequential increased soil organic matter makes a modest contribution to ameliorating the current anthropogenic induced rise in atmospheric carbon dioxide levels.

(iii) Water Regulation/Regulation of hydrological flows:

Most of Morven Hills lies in the Lindis catchment. The Lindis River is situated in Central Otago and has a catchment area of 1,055 km2, flowing into the Clutha River/Mata-Au. About 1360ha is in the Dunstan Creek catchment a tributary of the Manuherikia River which in turn flows into the Clutha River/Mata-Au.

The upper Lindis Catchment receives substantial rainfall during winter and spring; however the lower Lindis Catchment is one of the driest areas in New Zealand with very little rainfall throughout the summer months. Flows in the Lindis River are generally high during spring due to rainfall and snow-melt, but are greatly reduced during summer.

The future development and prosperity of Otago depends on water. However, much of Otago has long been recognised as a water-short area. In many cases, irrigation, particularly in these drier areas, is critical to the continued well-being of the people and communities who rely on the primary production it supports. The Lindis River has a significant trout spawning and juvenile habitat and there are also several disjointed populations of the Clutha flathead galaxiid in many of the tributaries. Primary allocation is severely over allocated.

Water quality

The Lindis River meets all guideline compliance values and is ranked 17th in Otago for water quality (of 77 water bodies). The river's water quality is classified as Very Good, meaning that the median values for all six tested variables comply with guideline values. The two tested sites on the Lindis River have Macroinvertebrate Community Index (MCI) scores of 104 and 119, which are an indication of good water quality.

Hydrological Flows
To enable the best flow regime for the future the following research provides some insights:

Waugh (2005) notes that;

- snow-tussock catchments have less variable flows than degraded tussock, oversown tussock or improved pasture
- snow-tussock catchments have flows than are are steadier on a monthly basis and are less variable in the summer- autumn period.
- To maximise water yield it is necessary to maintain a tall, unmodified tussock vegetation over the headwater catchments. This is best achieved by completely destocking these areas, preventing fires of any kind and controlling wilding pine tree growth (Waugh 2005).

Mark and Rowley (1969) demonstrated that undisturbed snow tussocks produced a greater water yield than either a sward of blue tussock or snow tussocks which have been recently defoliated by clipping or burning. Retirement of grazed areas with the view to allowing natural regeneration of snow tussock grasslands provides the potential for increased water yield.

Fahey and Jackson (1991a) note "Evaporation from tussock grasslands has important implications for water-resource management. The strong physiological control of transpiration by tall tussock produces low rates of water use in summer and contributes to the well sustained stream flow".

Fahey and Jackson [1991 (b)] in the Landcare reports to DCC provide some indication of the influence of depleted tussock cover on summer water yield. The estimate that restoration of the tussock cover to nil depletion and vigorous growth in these areas [water producing headwaters] could lead to… "Yield would increase by 52% and 48% at the Deep Creek and Deep Stream water intakes for the three summer months in the driest year".

If this is extrapolated to Morven Hills with say 10,000 ha of depleted tussock, then it makes up about 10% of the 1059 sq km in the Lindis catchment.

If we could double the water yield on this depleted tussock through destocking, it could increase water yield in the catchment by 10%. Based on these assumptions, this would make a significant difference to the water yield particularly during the dry period of the year by providing a more stable flow.

An important aspect of the current hydrology of the lower Lindis River is the sudden reduction in surface flows once irrigation commences in the middle reaches.

(iv) Food and Raw Materials

The water yield from Morven Hills contributes to the irrigation water takes in both the Lindis and Dunstan Creeks. This water is used for the production of crops and livestock. It also contributes to the available water for the 2 Clutha hydro electric dams. These actions contribute to the Ecosystem Service described as Food and Raw Materials (Waugh 2005).

(v) Economic Benefits of Water from Morven Hills

With its dry climate and low water availability, the Lindis catchment is dominated by sheep and beef farming, with deer and crop farming also prominent, and has seen a recent increase in viticulture in the lower catchment.

Pastoral farming
The reliance of pastoral farming; including sheep (also merino wool), beef, deer and crops; and horticulture; including flowers and vegetables; on water for irrigation is very important and without water growth, production and economic viability become vulnerable to drought events.

Other commercial
. Viticulture – supporting upwards of 14 wineries within the Tarras / Bendigo area

Irrigation - Consented surface water takes
There are 31 surface water takes from the Lindis River and its tributaries. The catchment is severely over-allocated with an overall consented instantaneous primary water take of 3.96 m^3/s . This is an over-allocation of the mean annual low flow of 0.70 m^3/s which effectively dries out the river in most summers.

Summary

While the issues presented show the estimated value/contribution of ecosystem services derived from Morven Hills, it is difficult to quantify the impact of current pastoral practices on these values. However it is known that low summer flows could quite quickly increase under a nil stocking regime (Waugh 2005).

There is significant opportunity to increase carbon sequestration by about 360,000 t by moving from depleted short tussock to tall tussock. In the long term a further increase of 640,000 t would be possible with succession in the long term to shrubland and then forest on land below the natural tree line. Realistically this may only be an option for the areas of the property of lower pastoral production.

Morven Hills could make a significant contribution to providing ecosystem services (especially water harvesting and carbon sequestration) for the Upper Clutha region.

PART 4

ATTACHMENTS

4.1 ADDITIONAL INFORMATION

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4.1.2 APPENDICES

Appendix 1 **Lindis Ecological District PNAP Report – RAP A2**

Appendix 2 **Lindis Ecological District PNAP Report – RAP A3**

Appendix 3 **Lindis Ecological District PNAP Report – RAP A4**

Appendix 4 **Lindis Ecological District PNAP Report – RAP A5**

Appendix 5 **Lindis Ecological District PNAP Report – RAP A6**

Appendix 6 **Lindis Ecological District PNAP Report – RAP B5**

Appendix 7 **Soil Sites of Significance**

Appendix 8 **List of Vascular Plants**

Appendix 9 **Federated Mountain Clubs Submission 2005**

Appendix 10 **North Otago Deerstalkers Submission 2005**

Appendix 11 **Submission from Forest and Bird, Central Otago Lakes Branch 2011**

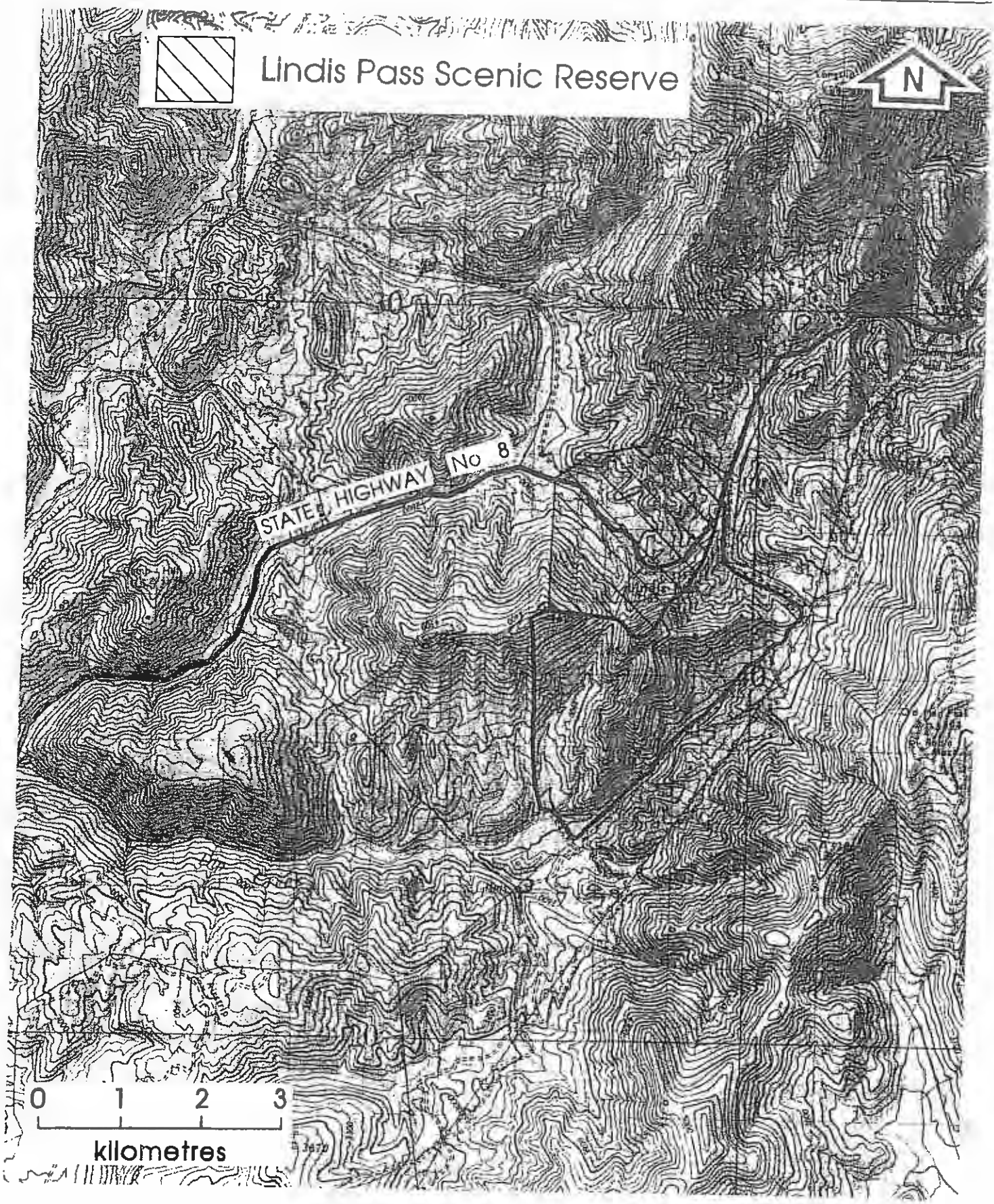
Appendix 12 **Submission for Forest and Bird, Dunedin Branch 2011**

Appendix 13 **Submission from Federated Mountain Clubs 2011**

APPENDIX 1

LINDIS ECOLOGICAL DISTRICT PNAP REPORT – RAP A2

Lindis A2 : DOUBLE PEAK



GR CENTRE : NZMS 1 S116 388249

AREA : 650 hectares

ALTITUDINAL RANGE : 760m - 1430m

Lindis A2: DOUBLE PEAK

LANDFORM

A complex of ridges and small steep valleys south of the Lindis Pass Scenic Reserve draining into the northern branch of Dip Creek. Most upper slopes and ridges and some lower slopes are smooth colluvial surfaces characteristic of the Lindis Pass area. Valleys and fluves have been incised into these slopes during a later period of down-cutting which is also expressed by terraced alluvial surfaces especially at the southern corner of the priority area.

Small slumps on some shady slopes are variations from the standard pattern in the Pass land system. Sunny faces, particularly the western aspects of Double Peak have suffered locally severe sheetwash erosion.

Soils are predominantly Kaikoura steepland yellow-brown earths.

VEGETATION

Narrow-leaved snow tussockland is extensive on shady faces and is particularly dense in the head of Dip Creek. Common associated species in this community are alpine fescue, Pimelea oreophila, Acaena caesiiglauca, Wahlenbergia albomarginata and Gaultheria depressa. Small areas of slim snow tussockland extend down from the highest altitudes on shady faces.

Fescue tussockland predominates on sunny slopes. It includes considerable sweet vernal, Elymus rectisetus, Deyeuxia avenoides and other native and exotic herbs typical of of this community. Snow tussock is usually scattered becoming denser with increasing altitude.

Red tussockland is found in pockets on young, damp alluvial surfaces in the upper reaches of Dip Creek. Abundant clover is present with Schoenus pauciflorus, Carex coriacea, Maori onion and other species typical of damp areas at low or mid altitudes.

Scattered patches of matagouri shrubland occur near Dip Creek in the lower reaches of the priority area, with minor briar and Olearia odorata. Such shrubland is more extensive further downstream.

Steep rocky ribs adjacent to Dip Creek harbour a diverse shrubland including, as less common species, native broom, Gaultheria crassa, Helichrysum selago, Brachyglottis haastii, Olearia cymbifolia and Celmisia densiflora

FLORA

Apart from the species noted above in shrubland refuges, flora is typical of the eastern Lindis district.

DISCUSSION

Protection of this area would supplement the Lindis Pass Scenic Reserve, adding a significant area of good and excellent quality snow tussockland to that within the reserve. Although sharing the same highest peaks with the reserve, the priority area has a much greater effective altitudinal range because of

the predominance of shady faces. (Maximum altitude, however, is 150 m less than in Lindis A1 and A3, with which the priority area shares several features.) Snow tussockland density and diversity is considerably superior to that within the reserve.

The red tussockland in Dip Creek, though of small area, is the best of the few patches remaining in the fault trough from Longslip Creek around the western margin of the Chain land system, where red tussockland was probably once a characteristic feature of the extensive alluvial surfaces.

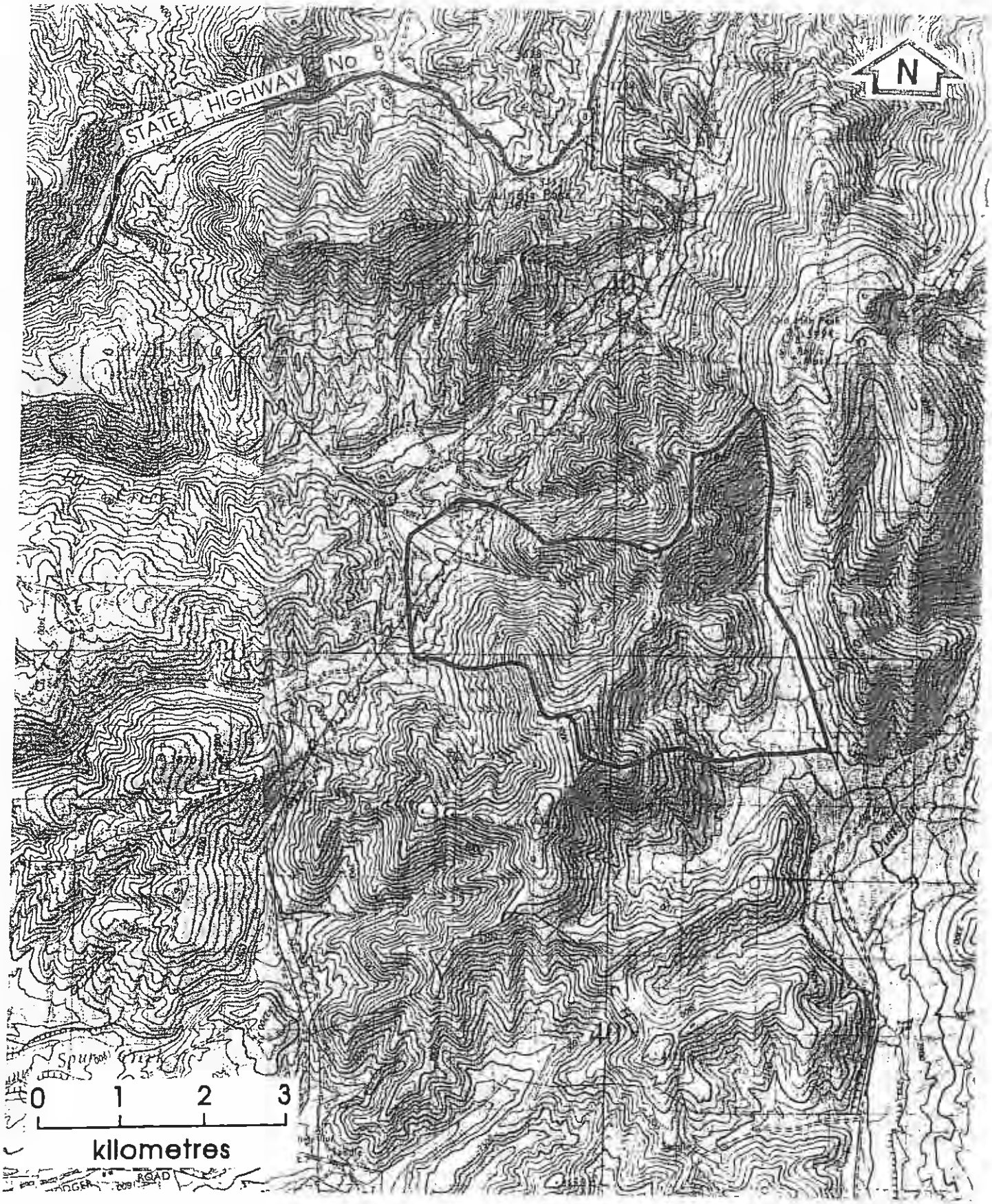
CRITERIA SUMMARY

Representativeness	- H -	A range of tussocklands typical of the eastern Lindis district.
Diversity	- M -	Four major tussockland communities plus small areas of shrubland.
Naturalness	- M -	Tussockland of variable quality with high concentrations of exotics at lower altitudes. Snow tussock seriously depleted or removed from sunny faces.
Special Features	- H -	Red tussockland now special, also patches of very high quality snow tussockland.
Viability	- H -	All communities are viable, though diverse shrubland refuges very small.
Buffering	- M -	Surrounding vegetation is tussockland of varying quality. Poor catchment boundaries in part.
Threat	- M -	Fire, accelerated erosion on sunny faces.
Landform	- H -	Typical of the irregular, narrow-ridged, semi-schist terrain of the Pass land system, though without a complete catchment basis.

APPENDIX 2

LINDIS ECOLOGICAL DISTRICT PNAP REPORT – RAP A3

Lindis A3 : CHAIN HILLS



GR CENTRE : NZMS 1 S116 400203

AREA : 1230 hectares

ALTITUDINAL RANGE 790m - 1610m

Lindis A3: CHAIN HILLS

LANDFORM

A west-east transect across the northern end of the Chain Hills. The western flank is dissected by the southern branch of Dip Creek and the eastern flank by Dunstan Creek tributaries. As a consequence of a higher erosional base-level in Dunstan Creek relative to that in Dip Creek, the eastern slopes are gentler and less deeply incised than those to the west.

The rock is semi-schist, (textural zone 2) and characteristically smooth colluvial slopes predominate with slight effects of solifuction and other periglacial phenomena at higher altitudes. Localised slumps are very distinctive, and some at least appear to have been generated during earthshift forming an en echelon set of north-trending recent fault traces (eg, at GR S116 410208).

Patches of stable talus are widespread, particularly on the steeper slopes in the west and on slump margins. Some of these patches appear to be expanding by sheetwash erosion at their upper edges, and bare soil with incipient sheetwash is common on mid-altitude sunny faces.

Recent alluvial surfaces and low terraces are prominent in the lower valleys on both sides of the Chain Hills and are particularly extensive in Dunstan Creek. A narrow strip of an older fan surface is preserved 70 m above the Dip Creek branch.

Alpine soils cap the main ridge crest, with Kaikoura yellow-brown earths on steepland sites elsewhere.

VEGETATION

Narrow-leaved snow tussockland is the predominant vegetation of the area, extending from the valley floors to the crest of the Chain Hills, although restricted to sunny slopes at high altitude. Condition is variable from good to poor, the latter particularly on mid-altitude sunny slopes where bare soil may predominate over vegetation cover.

Slim snow tussockland is found along the summit of the Chain Hills and extends down to 1100 m on shady aspects. This community generally has a relatively low species diversity but with very few exotics.

The alluvial terraces and lower hillslopes on the western side are dominated by fescue tussocklands, with abundant Hieracium pilosella, Raoulia subsericea, sweet vernal and Acaena caesiiglauca in depleted areas.

Silver tussock is scattered in minor fluves within the fescue tussockland and is locally dominant on alluvial surfaces.

Red tussock associated with Schoenus pauciflorus, alpine fescue, blue tussock, Bulbinella angustifolia, Ranunculus gracilipes, and frequent exotic species dominates moist areas on young alluvial soils in the lower valleys. These areas are very small (hundreds of square metres) in Dip Creek but cover several hectares in the western branch of Dunstan Creek, where however most "red" tussocks are probably hybrids with narrow-leaved snow tussock. Narrow-leaved tussockland is extensive on the older alluvial surfaces in Dunstan Creek, at an altitude 150-200 m higher than the corresponding surfaces in Dip Creek where snow tussock is now scattered and patchy.

Mixed shrublands on talus or boulderfields between 900-1100 m on the western slopes are dominated by matagouri, Coprosma propinqua and Aristotelia fruticosa with Corokia cotoneaster, Olearia odorata, Hymenanthera*alpina and Muehlenbeckia complexa. Coprosma intertexta and Hebe subalpina are locally common. Celery pine is prominent on one sparsely vegetated boulderfield in the SW of the priority area. About 20 plants between 1.5 and 2.5 m tall are associated with other species typical of these shrublands. The celery pine is in the centre of the boulderfield whereas some other shrubland patches are concentrated around the margin of boulderfifelds where they appear to be expanding onto more favourable soils from the fire refuge provided by the coarse talus.

FLORA

Localised occurrences of Swainsona novae-zelandiae in alpine narrow-leaved snow tussockland, and Coprosma intertexta and celery pine in shrubland, are noteworthy.

DISCUSSION

This transect across the Chain Hills provides good altitudinal sequences with a full representation of aspects and slope variation related to the contrasting base level between the eastern and western sides. Recent fault traces, and slump modification of the regular colluvial slopes characteristic of the Chain land system, are distinctive features.

The priority area includes a full range of tussocklands including red tussockland, a minor but formerly characteristic feature of the eastern Lindis district. Except for slim snow tussockland and the higher altitude narrow-leaved snow tussockland, tussocklands are considerably modified and show limited species diversity. Even the modified low altitude tussocklands in the west however are among the better examples of their type in the district, and show a wide variation in a small area of diverse landforms. Electricity pylons and associated tracking have a visual impact on this area. The western boundary of the priority area is placed where modification, centred on the station huts, becomes excessive. Snow and red tussocklands on alluvial surfaces in the east are the most extensive in the district.

The priority area abuts the eastern boundary of the Lindis Ecological District with the higher greywacke mountains of the St Bathans Ecological District, in which extensive talus slopes and summit fellfields are characteristic. The potential for a protected area straddling the district boundary should be considered when the St Bathans district is surveyed.

Localised talus patches are characteristic of the semi-schist of the eastern Lindis district, transitional between the schist of the Central Otago region and the greywacke of the Mackenzie and Waitaki Ecological Regions. Celery pine on talus fire refuges in this priority area is unusual in the Lindis district and can be regarded as an outlier of the more widespread occurrences of the Ahuriri district (Espie et al. 1984).

* Melicytus alpinus

CRITERIA SUMMARY

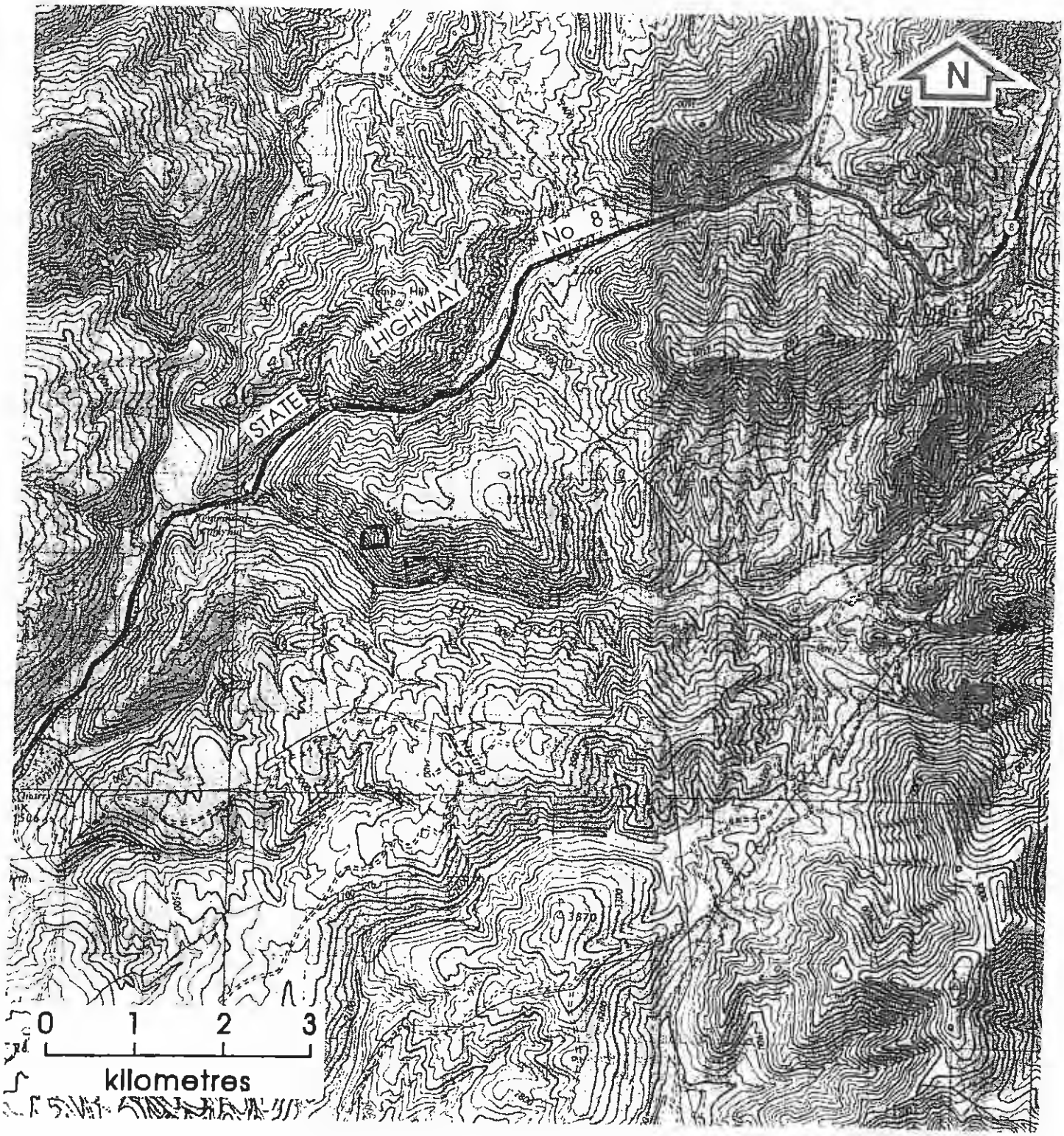
Representativeness	- H -	Typical of the eastern Lindis district.
Diversity	- H -	Dominated by snow tussocklands, but good range of associated communities.
Naturalness	- M -	High in shrublands and slim snow tussockland, low in fescue and silver tussocklands.
Special Features	- H -	Several unusual species present, red tussockland, recent fault traces.
Viability	- H -	No young celery pine seen, but other shrublands and tussocklands generally viable.
Buffering	- M -	Generally follows catchment boundaries. The eastern boundary is fenced, but poor buffering in west.
Threat	- M -	Exotic infestation and oversowing in west, sunny steeplands susceptible to further depletion and accelerated erosion.
Landform	- H -	Excellent representation of all features of the Chain land system.

APPENDIX 3

LINDIS ECOLOGICAL DISTRICT PNAP REPORT – RAP A4

Lindis A4 : DIP CREEK-BEECH

Lindis A5 : DIP CREEK-TOTARA



	DIP CREEK - BEECH	DIP CREEK - TOTARA
GR CENTRE	: NZMS 1 S116 317233	: NZMS 1 S116 323228
AREA	: 10 hectares	: 20 hectares
ALTITUDINAL RANGE	: 670m - 880m	: 610m - 850m

Lindis A4: DIP CREEK - BEECH

LANDFORM

A small area centred on a gully on the very steep derivative slope of southwest aspect in the gorge of Dip Creek.

VEGETATION

A 1 ha stand of mountain beech with a very open canopy occupies the western side of the gully. Associated native species, which include Coprosma propinqua, C. parviflora and Aristotelia fruticosa, are few and of minor cover. Gooseberry is more abundant, and the ground tier is dominated by exotic species including Hieracium lachenalii.

Surrounding the stand is mixed dryland vegetation on colluvial slopes and rock outcrops, dominated by exotic grasses and herbs, with shrublands including abundant briar in fluves.

FLORA

Except for mountain beech, typical of this area.

DISCUSSION

This small ragged mountain beech forest remnant is identified as a priority for protection because it is the southeasternmost driest outlier of the beech forest remnants characteristic of the northwestern Lindis district, which themselves are outliers of the continuous beech forest nearer the main divide. The steep rocky surrounds and sheltered gully site have protected it from fire and wind to date, but the stand remains vulnerable. A small buffer zone with the potential to regenerate to forest is included in the priority area.

Native birds noted were greywarbler, silvereye and harrier.

CRITERIA SUMMARY

Representativeness	- M -	Mountain beech remnant characteristic of NW Lindis district.
Diversity	- L -	Limited by small size.
Naturalness	- L -	Grassland and shrubland - exotics dominant.
Special Features	- H -	Mountain beech at SE limit.
Viability	- H -	Beech regeneration adequate, mainly around margins of stand. Likely that other species of forest community already lost.
Buffering	- M -	Natural buffering adequate to date, but remains vulnerable because of small size.
Threat	- M -	Fire, wind throw, domination by exotics.
Landform	- L -	Small fragment of derivative slope, unrepresentative of range of landforms in Georges land system.

APPENDIX 4

LINDIS ECOLOGICAL DISTRICT PNAP REPORT – RAP A5

Lindis A5: DIP CREEK - TOTARA

LANDFORM

A small area of derivative slopes of southerly aspect in the gorge of Dip Creek. Steep colluvial slopes are broken by rocky ribs and gullies. A 2 ha talus cone has formed adjacent to the main stream at the mouth of the largest gully.

VEGETATION

The talus core adjacent Dip Creek supports an open Hall's totara treeland with Olearia odorata, matagouri and Coprosma propinqua. Another boulderfield near the upper margin of the priority area has a low diversity mixed shrubland with several large Hebe subalpina, and frequent O. odorata, C. propinqua and Hymenanthera alpina.

A dense matagouri-briar scrub of low diversity occupies the streamsides, and similar shrubland extends up the lower slopes, particularly in fluves. Depleted fescue tussockland and mixed dryland vegetation with abundant exotic species occupies the remaining area, with a low cover of narrow-leaved snow tussock near the upper margin of the area.

FLORA

Except for Hall's totara, typical of central Lindis district.

DISCUSSION

This is the easternmost and driest (650 mm annual rainfall) site of Hall's totara in the Lindis district. Regeneration appears adequate in these relatively harsh conditions, and this stand and a few isolated trees nearby may provide a seed source for colonisation of the remainder of the priority area and beyond. Talus is a minor and generally uncharacteristic feature of the Lindis district as a whole. This is the only example of totara on a talus fire refuge in the district - elsewhere totara is generally centred on rock outcrops particularly in gorges (Lindis A8).

Other communities are strongly modified but include considerable diversity in a small area, have some representative significance, and provide additional buffering for the totara treeland.

CRITERIA SUMMARY

Representativeness	- M -	Typical communities of restricted altitudinal and aspect range.
Diversity	- M -	Good range of woody and herbaceous communities considering small area.
Naturalness	- M -	Moderate in totara treeland, generally low elsewhere, abundant briar and other exotics.
Special Features	- H -	Hall's totara on talus cone.
Viability	- H -	Totara shows adequate or vigorous regeneration, other communities viable.

Buffering	- M -	Steep derivative slopes and talus provide some natural buffering to significant communities.
Threat	- M -	Fire, further domination by briar and other exotics.
Landform	- L -	Lower half only of gorge wall, and poor overall representation of Georges land system.

APPENDIX 5

LINDIS ECOLOGICAL DISTRICT PNAP REPORT – RAP A6

Lindis A6: MORVEN HILLS

LANDFORM

The middle and upper reaches of a small tributary of the Lindis River. Broad gently undulating ridges around the upper catchment are characteristic of the Georges land system, and derived from the warped Tertiary erosion surface or peneplain. To the west, streams become more incised into schist dipping 10-15°E. The valleys are asymmetric. On west and northwest aspects smooth colluvial slopes are interrupted by buttress outcrops and steep derivative slopes, whereas opposite faces are generally smooth (and locally ripply) colluvial slopes.

Soils are predominantly yellow-grey (Arrow) dry-subhygrous earths, with yellow-brown (Dunstan) hygrous earths at higher altitude.

VEGETATION

Narrow-leaved snow tussockland occupies shady slopes at mid-altitude and extends onto the broad ridges or "peneplain" above 900 m. It is rather depleted of native species in the ground tier where clover and other exotics are generally predominant.

Fescue tussockland is extensive on the sunnier faces at mid-altitude and on all aspects at lower altitudes. Sweet vernal may be codominant and clover is abundant. On dry ridge crests and deflated sites fescue is sparse or absent, and the sparse vegetation is dominated by scabweed, sorrel, haresfoot trefoil, Raoulia parkii, Leucopogon fraseri and blue tussock.

Large derivative slopes on sunny aspects support open kanuka shrubland with a very minor understorey which may include Coprosma propinqua, matagouri, native broom and Leucopogon colensoi. A sparse ground cover is dominated by exotic species with some native herbs. Native grasses herbs and subshrubs are more prominent on associated rock outcrops. Kanuka shrubs are scattered in adjacent fescue tussockland.

Matagouri-dominated shrubland occurs below the derivative slopes on rubblefields and smooth colluvial slopes, and in fluves and riparian sites on both sunny and shady slopes where it is often associated with Olearia odorata, briar, Coprosma propinqua and occasional koromiko.

A small swampy alluvial site by the main stream supports a modified community dominated by Carex secta, C. coriacea and silver tussock.

FLORA

Typical of central Lindis district.

DISCUSSION

This is a compact area including all the major indigenous ecological features of the Georges land system. It is notable for the good representation of the combination of narrow-leaved snow tussockland with the two main shrubland types, kanuka and matagouri (- Coprosma). It includes a section of the original snow tussockland cover at the lowest altitude remaining on the warped "peneplain" surface.

The catchment has been modified by intensive oversowing and topdressing, but retains sufficient cover and diversity of native species that it could probably return to a substantially natural condition if appropriately managed. Tussocklands and other non-woody vegetation in the Georges land system are generally of much lower naturalness and do not retain this potential.

The rare Otago skink (Leiolopisma otagense) has been recorded from kanuka shrubland here. Another population of this large skink is known from 5 km southeast in similar kanuka shrubland centred on GR 329175. In keeping with the botanical emphasis (or bias) of this survey, the Lindis A6 area is identified as a priority area in preference to the southeastern area, on the basis of its clearly superior representation of the vegetation and landforms of the Georges land system. However further investigation of the populations and ecology of the Otago skink at these two sites might indicate that the southeastern area has a higher overall priority for protection.

CRITERIA SUMMARY

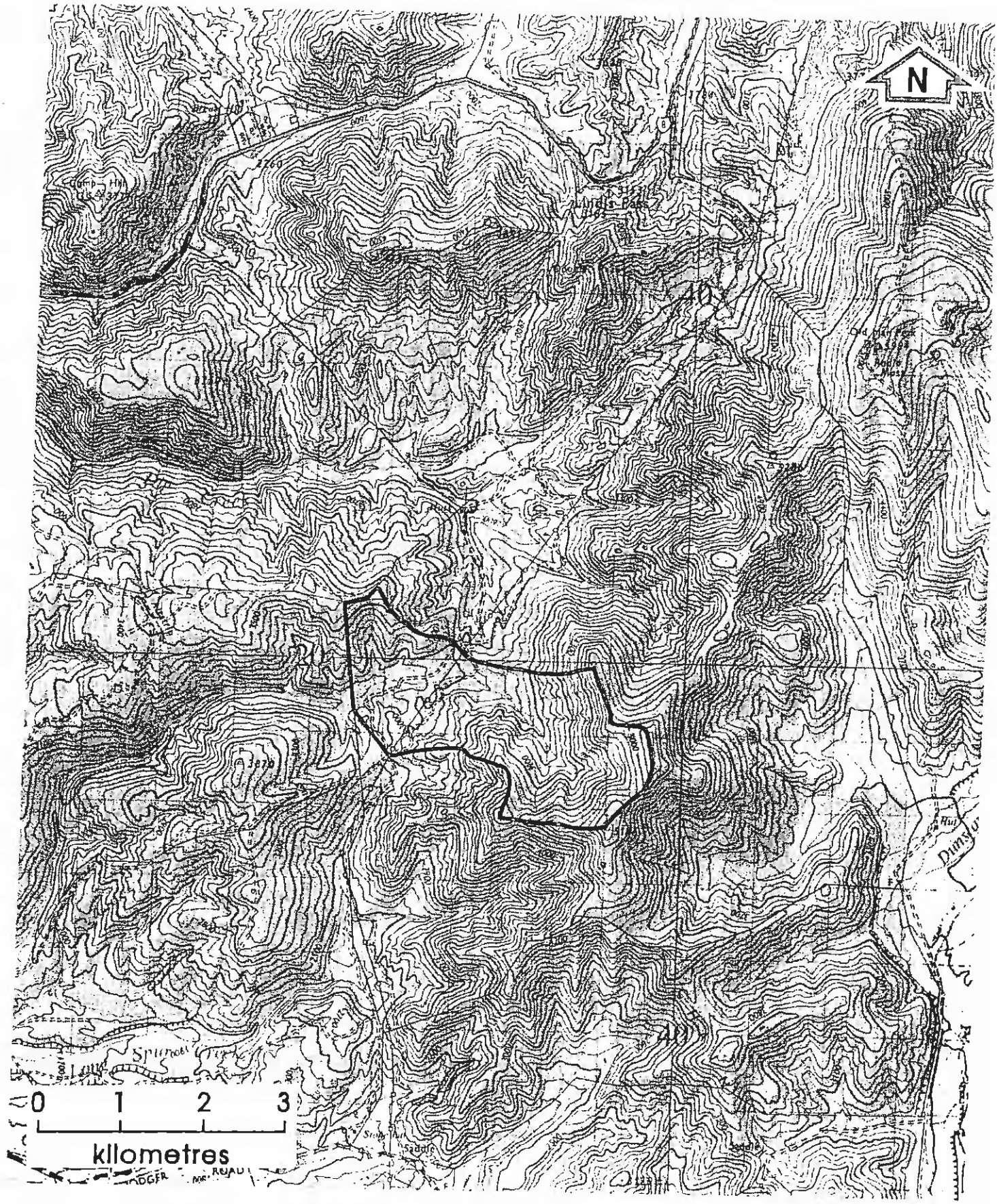
Representativeness	- H -	Good representation of important communities.
Diversity	- H -	Several types of tussockland and shrubland.
Naturalness	- M -	MOderate or high in canopy but generally low in the ground tier of tussocklands and shrublands.
Special Features	- H -	Otago skink habitat; low altitude snow tussockland.
Viability	- H -	Especially in shrublands, but some tussockland ground species may be at risk from continued oversowing.
Buffering	- M -	Derivative slopes and other shrublands buffer kanuka community; generally good catchment boundaries except with exotic grassland and briar concentration downstream.
Threat	- M -	Fire, oversowing.
Landform	- H -	Representative small catchment incised into plateau surface characteristic of Georges land system.

APPENDIX 6

LINDIS ECOLOGICAL DISTRICT PNAP REPORT – RAP B5

Lindis B5 : WEST CHAIN HILLS

MAP 5



GR CENTRE : NZMS 1 S116 376913

AREA : 540 hectares

ALTITUDINAL RANGE : 830m - 1650m

Lindis B5: WEST CHAIN HILLS

LANDFORM

The upper catchment of the northern branch of Long Spur Creek on the western flank of the Chain Hills and lower hills to the west. Steep smooth colluvial slopes predominate in the east, with common talus patches. Alluvial fans extend onto the valley floor and merge with valley-fill alluvium 200-300 m wide, reaching the western edge of the priority area. The valley is here flanked by a complex of small ridges in the south, and a dissected partially slumped hill slope to the north formed on schist.

Alpine steepland soils cap the main ridge rest, with hygrous yellow-brown earths elsewhere - Kaikoura soils or greywacke - semi-schist in the east, Dunstan soils on schist in the northwest.

VEGETATION

Slim snow tussockland is present at the top of the catchment on shady aspects. Cover values are relatively low due to the stony substrate but few exotic species are present. Narrow-leaved snow tussockland of moderate or good quality on shady aspects but depleted on sunny aspects, extends from the west of Chain Hills down onto the alluvial flats.

Three small talus patches on the shady side of the valley at about 1100 m are locally dominated by a prostrate form of celery pine, together with Coprosma species, Hymenanthera alpina, and Pimelea traversii.

The sunny side of the valley and adjacent ridges at lower altitudes carry a depleted fescue tussockland. Silver tussock is locally co-dominant on fertile, moist soils.

The broad alluvial flats have a complex vegetation mosaic including several areas of red tussock, associated in the dampest areas with Bulbinella angustifolia, Schoenus pauciflorus, Juncus effusus, J.articulatus, Carex sinclairii and Pernettya nana often with clover and frequent exotic grasses.

FLORA

Apart from celery pine, flora is typical.

DISCUSSION

The major part of this priority area is analogous to the western side of Lindis A3 (Chain Hills) immediately to the north. These two catchments on the western flank of the Chain land system are a closely matched pair.

The mid-upper altitude tussockland in this southern catchment is in somewhat poorer condition, particularly on the sunny aspect which is more depleted with lesser snow tussock and total vegetation cover and abundant golden spaniard in parts. This face has also been further damaged by a 4WD track. However at lower altitudes in the trough between the Chain and Georges land systems, the vegetation in this priority area (B5) is superior, though still substantially modified. Exotic weed and pasture species are generally in lesser

abundance, snow tussock extends onto the alluvial flats, and red and fescue tussocklands are more extensive and in better condition.

This priority area straddles the boundary to the Georges land system and includes significant representation of subalpine narrow-leaved snow tussockland of moderate quality on the contrasting soils and landform pattern to the west. Westward extension of Lindis A3 to similarly cover the transition to Georges land system would be less appropriate because of the lower naturalness there.

CRITERIA SUMMARY

Representativeness	- H -	Altitudinal sequence of major tussockland types, typical of eastern Lindis district.
Diversity	- M -	Snow tussockland dominates, with small examples of other communities.
Naturalness	- M -	Generally few exotics relative to altitude, snow tussockland on sunny faces depleted and suffers from sheetwash erosion.
Special Features	- M -	Celery pine, red and snow tussockland on alluvial surfaces.
Viability	- H -	Stable communities, with possible exception of tussocklands on sunny faces.
Buffering	- H -	Good natural catchment boundaries and fence in west, surrounded by similar vegetation.
Threat	- M -	Oversowing and topdressing in west, weed infestation, further depletion on sunny faces.
Landform	- H -	Good representation of Chain land system (though only steeper western flank) and sufficient of Georges land system to show the contrast.

APPENDIX 7

SOIL SITES OF SIGNIFICANCE

(303) Crescent Island Scenic Reserve

REGIONAL/CITY COUNCIL(S): Otago **ECOLOGICAL DISTRICTS(S):** 66–02 Wanaka
LOCALITY and GRID REFERENCE: island in Lake Wanaka F40 972150
AREA(ha): 117 **ALTITUDE(m):** 277-490 **RAINFALL(mm):** 640
TOPOGRAPHY: roche moutonee island with steep colluvial slopes, some bluffs **PARENT MATERIAL:** schist colluvium and till **VEGETATION:** broadleaved forest; introduced grassland with bracken and kanuka; kanuka forest
SOILS: yellow–grey earths (Arrow)
IMPORTANCE: 3 **SIGNIFICANCE:** (i) yellow–grey earths with open native forest vegetation is now mostly gone in the area (ii) good example of strong aspect controls on soil processes.
VULNERABILITY: 3 **MODIFICATIONS/THREATS:** probably has been grazed and burned
TENURE: scenic reserve **OWNER/MANAGER:** Department of Conservation
CONTACT PERSON: Peter McIntosh **DATE OF INFORMATION:** April 1990
NOTE: Also known as Rabbit Island.
REFERENCES: Department of Lands and Survey (1984) Allen (1978) McCaskill (1975b)

(304) Ben Lomond Scenic Reserve

REGIONAL/CITY COUNCIL(S): Otago **ECOLOGICAL DISTRICTS(S):** 66–04 Shotover
LOCALITY and GRID REFERENCE: 4 km NW of Queenstown, southern slopes of Ben Lomond E41 642687
AREA(ha): 151 **ALTITUDE(m):** 400-1730 **RAINFALL(mm):** 849
TOPOGRAPHY: steep colluvial and bedrock mountain slopes and tops **PARENT MATERIAL:** schist and derived colluvium **VEGETATION:** snow tussock grassland; Dracophyllum–snow tussock grassland; Dracophyllum–broadleaved scrub; beech forest
SOILS: upland yellow–brown earths (Dunstan)
IMPORTANCE: 3 **SIGNIFICANCE:** (i) a good altitude sequences of yellow–brown earths from under forest to subalpine shrubland
VULNERABILITY: 3
TENURE: scenic reserve **OWNER/MANAGER:** Department of Conservation
CONTACT PERSON: Peter McIntosh **DATE OF INFORMATION:** April 1990
REFERENCES: Department of Lands and Survey (1984) Allen (1978) McCaskill (1975b)

(305) Chain Hills

REGIONAL/CITY COUNCIL(S): Otago **ECOLOGICAL DISTRICTS(S):** 67–01 Lindis
LOCALITY and GRID REFERENCE: 5 km S of Lindis Pass G40 448134
AREA(ha): 1230 **ALTITUDE(m):** 790-1610 **RAINFALL(mm):** 600-800
TOPOGRAPHY: steep colluvial mountain slopes; solifluction landforms; talus patches; low terraces **PARENT MATERIAL:** semi–schist and derived colluvium and alluvium **VEGETATION:** snow tussock grassland; short tussock grassland; red tussock grassland; matagouri–broadleaved shrubland; podocarp shrubland
SOILS: upland yellow–brown earths (Kaikoura), alpine steepland soils, etc. (Alpine)
IMPORTANCE: 3 **SIGNIFICANCE:** (i) contains Kaikoura soils with a moderate range of relatively unmodified vegetation types.
VULNERABILITY: 2 **MODIFICATIONS/THREATS:** many exotics at lower altitudes
TENURE: pastoral lease, recommended area for protection **OWNER/MANAGER:** Morven Hills Station
CONTACT PERSON: Peter McIntosh **DATE OF INFORMATION:** May 1990
REFERENCES: Ward et al. (1987)

(306) Dip Creek Beech

REGIONAL/CITY COUNCIL(S): Otago **ECOLOGICAL DISTRICTS(S):** 67–01 Lindis
LOCALITY and GRID REFERENCE: 10 km SW of Lindis Pass G40 371160
AREA(ha): 10 **ALTITUDE(m):** 670-880 **RAINFALL(mm):** 650
TOPOGRAPHY: steep colluvial gully slopes **PARENT MATERIAL:** schist and derived colluvium **VEGETATION:** beech forest
SOILS: yellow–grey earths (Arrow)
IMPORTANCE: 2 **SIGNIFICANCE:** (i) one of the few remaining remnants of yellow–grey earths with mountain beech forest cover in New Zealand. This site is also significant because the mountain beech is at its driest limits.
VULNERABILITY: 2 **MODIFICATIONS/THREATS:** threatened by fire and domination by exotics
TENURE: recommended area for protection, pastoral lease **OWNER/MANAGER:** Morven Hills Station
CONTACT PERSON: Trevor Webb **DATE OF INFORMATION:** December 1987
REFERENCES: Ward et al. (1987)

(307) Dip Creek Totara

REGIONAL/CITY COUNCIL(S): Otago **ECOLOGICAL DISTRICTS(S):** 67–01 Lindis
LOCALITY and GRID REFERENCE: 10 km SW of Lindis Pass G40 377153
AREA(ha): 20 **ALTITUDE(m):** 610-850 **RAINFALL(mm):** 600
TOPOGRAPHY: steep colluvial slopes broken by rocky ribs and gullies; talus cone **PARENT MATERIAL:** schist and derived colluvium **VEGETATION:** podocarp treeland with matagouri; broadleaved scrub; short tussock–introduced grassland
SOILS: yellow–grey earths (Arrow)
IMPORTANCE: 2 **SIGNIFICANCE:** (i) driest site in the district – notable for the Arrow soils under original vegetation cover (although modified).
VULNERABILITY: 2 **MODIFICATIONS/THREATS:** abundant briar and other exotics; threatened by fire
TENURE: pastoral lease, recommended area for protection **OWNER/MANAGER:** Morven Hills Station
CONTACT PERSON: Peter McIntosh **DATE OF INFORMATION:** December 1987
REFERENCES: Ward et al. (1987)

(308) Double Peak

REGIONAL/CITY COUNCIL(S): Otago **ECOLOGICAL DISTRICTS(S):** 67–01 Lindis
LOCALITY and GRID REFERENCE: 2 km S of Lindis Pass G40 436175
AREA(ha): 650 **ALTITUDE(m):** 760-1430 **RAINFALL(mm):** 600-800
TOPOGRAPHY: steep colluvial mountain slopes and tops **PARENT MATERIAL:** semi–schist and derived colluvium
VEGETATION: snow tussock grassland; short tussock grassland; red tussock grassland; matagouri shrubland; rockland
SOILS: upland yellow–brown earths (Kaikoura)
IMPORTANCE: 3 **SIGNIFICANCE:** (i) one of the few remaining snow tussocklands in Lindis Ecological District that has not been extensively modified by oversowing and topdressing. This site is more diverse than adjacent Lindis Pass Scenic Reserve.
VULNERABILITY: 2 **MODIFICATIONS/THREATS:** tussockland depleted on sunny faces; threatened by further fire and erosion
TENURE: pastoral lease, recommended area for protection **OWNER/MANAGER:** Morven Hills Station
CONTACT PERSON: Peter McIntosh **DATE OF INFORMATION:** May 1990
REFERENCES: Ward et al. (1987)

(309) East Camp Creek

REGIONAL/CITY COUNCIL(S): Otago **ECOLOGICAL DISTRICTS(S):** 67–01 Lindis
LOCALITY and GRID REFERENCE: 20 km N of Tarras G40 256083
AREA(ha): 710 **ALTITUDE(m):** 550-1160 **RAINFALL(mm):** 600-800
TOPOGRAPHY: steep colluvial and bedrock mountain slopes; valley asymetry (bedrock controlled); narrow alluvial terraces **PARENT MATERIAL:** semi–schist and derived colluvium and alluvium **VEGETATION:** snow tussock grassland; short tussock grassland; kanuka shrubland; rockland; matagouri shrubland; cushion–herbfield
SOILS: upland yellow–brown earths (Dunstan), yellow–grey earths (Arrow)
IMPORTANCE: 3 **SIGNIFICANCE:** (i) large area of soils with kanuka shrubland (which was formerly much more extensive) and also relatively unmodified snow tussockland at low altitudes.
VULNERABILITY: 2
TENURE: pastoral lease, recommended area for protection **OWNER/MANAGER:** Bargour Station, Glenfoyle Station
CONTACT PERSON: Peter McIntosh **DATE OF INFORMATION:** May 1987
REFERENCES: Ward et al. (1987)

(310) Lagoon Creek

REGIONAL/CITY COUNCIL(S): Otago **ECOLOGICAL DISTRICTS(S):** 67–01 Lindis
LOCALITY and GRID REFERENCE: 4 km SE of Hawea Flat G40 191090
AREA(ha): 20 **ALTITUDE(m):** 490-700 **RAINFALL(mm):** 600-800
TOPOGRAPHY: steep bedrock and colluvial slopes **PARENT MATERIAL:** semi–schist and derived colluvium
VEGETATION: matagouri–broadleaved–sweet brier shrubland
SOILS: yellow–grey earths (Arrow)
IMPORTANCE: 3 **SIGNIFICANCE:** (i) the yellow–grey earth – kanuka shrubland association was formerly much more extensive (though still a minor association).
VULNERABILITY: 2 **MODIFICATIONS/THREATS:** many exotic ground cover species; threatened by fire
TENURE: recommended area for protection (scientific reserve) **OWNER/MANAGER:** Department of Conservation
CONTACT PERSON: Peter McIntosh **DATE OF INFORMATION:** May 1990
REFERENCES: Ward et al. (1987)

APPENDIX 8

Morven Hills Pastoral Lease

Lessees R & A Snow – Central Grid Reference NZMS 260 Map G40 380130
Checklist of vascular plants compiled from visits 26-30 January 2004 & 21-22 Dec 2010
B. D. Rance & J. W. Barkla

Habitat

T	Tussockland
S	Shrubland/forest
R	Rock outcrop
Ru	Rubblefield
C	Cushionfield and sunny depleted slopes
W	Wetlands
F	Fellfield

Abundance

a	abundant
f	frequent
c	common
o	occasional
u	uncommon
l	local

Site

W	Western hill country south of Dip Creek
C	Chain Hills and land north of Dip Creek

* exotic species

	Habitat	Abundance	Site
Ferns and fern allies			
Asplenium flabellifolium	R	o	W,C
Asplenium richardii	R	o	W,C
Asplenium trichomanes	R	u	W
Blechnum penna-marina	T,S	o	W,C
Cheilanthes sieberi	R	o	W
Cystopteris tasmanica	R	u	W
Grammitis patagonica	R	u	C
Grammitis poepiggiana	R	u	C
Hypolepis millefolium	Ru	o	W,C
Lycopodium fastigiatum	T	c	W,C
Lycopodium scariosum	T	o	C
Ophioglossum coriaceum	T	o	C
Pellaea calidirupium	R	u	C
Polystichum vestitum	S	o	W,G
Pteridium esculentum	S	o	W,C

Gymnosperm trees and shrubs			
Phyllocladus alpinus	Ru	lo	C
Podocarpus cunninghamii	S	lc	C
Dicotyledonous trees and shrubs			
Acrothamnus colensoi	T,Ru	o	W,C
Arisotelia fruticosa	S	c	W,C
*Buddleja davidii	T	u	W
Carmichaelia australis?	T	o	C
Carmichaelia crassicaulis subsp. racemosum	T	o	C
Carmichaelia petriei	T,S	c	W,C
Carmichaelia vexillata	***T***	***o(lc)***	***W, C***
Chionohebe densiflora	F	c	C
Coprosma atropurpurea	W	c	C
Coprosma brunnea	Ru	u	W
Coprosma cheesemanii	T,s	o	C
Coprosma dumosa	Ru	o(lc)	C
Coprosma intertexta	S	o	W,C ?
Coprosma petriei	T,C	o	W
Coprosma propinqua	S	f	W,C
Coprosma tayloriae	S	u	W
Coriaria plumosa	S	o	C
Coriaria sarmentosa	S	o	W
Corokia cotoneaster	Ru	u	C
Discaria toumatou	S,T	a	W,C
Dracophyllum longifolium	T	l	C
Dracophyllum muscoides	F	o	C
Dracophyllum pronum	T	c(lf)	C
Dracophyllum rosmarinifolium	T	u	C
Gaultheria antipoda	R	o	W,C
Gaultheria crassa	T,R	o	C
Gaultheria depressa var. novae-zelandiae	T	f	W,C
Gaultheria parvula	W	c	C
Hebe buchananii	R	o	W,C
Hebe epacridea	F	u	C
Hebe pauciramosa	W	u	C
Hebe pimelioides subsp. faucicola	R	u	C
Hebe rakaiensis	Ru	u	C
Hebe salicifolia	S	o	W,C
Helichrysum intermedium	R	o	W,C
Helichrysum lanceolatum	R	u	W
Kelleria dieffenbachii	T	c	C
Kelleria villosa	T	o	C
Kunzea ericoides	S,L	c(la)	W
Leptospermum scoparium	T	l	C
Leucopogon fraseri	T,C	a	W,C
*Lupinus arborea	S	o	W

Melicytus aff. alpinus	T,S	c	W,C
Muehlenbeckia axillaris	T,C	o	W,C
Myrsine divaricata	S,R	l	W
Myrsine nummularia	R,Ru	o	W,C
Nothofagus solandri. var. cliffortioides	S	o(lf)	C
Olearia bullata	***T***	***o***	***C***
Olearia cymbifolia	R	o	C
Olearia fimbriata	S	o	W
Olearia lineata	S	l	C
Olearia odorata	S	c	W,C
Ozothamnus vauvilliersii	T	o	C
Parahebe decora	T	u	W
Pentachondra pumila	T	o(lc)	C
Pimelea oreophila	T	c	W,C
Pimelea sericeovillosa	T	u	W
Pimelea traversii	R	o	W
*Pinus radiata	T	o	C
*Ribes uva-crispa	S	o	W,G
*Rosa rubiginosa	S,T	f	W,C
*Salix fragilis	T	o	W
Sophora microphylla	S	u	W
Climbers & vines			
Carmichaelia kirkii	***S***	***o***	***W, C***
Clematis marata	S	o	W,C
Muehlenbeckia australis	S	o(lc)	W
Muehlenbeckia complexa	S	f	W,C
Parsonsia capsularis	S	c	W,C
Rubus schmidelioides	S	f	W,C
*Solanum dulcamara	S	o	W
Dicotyledonous herbs			
*Acaena agnipila	T	o	W,C
Acaena anserinifolia	S	o	W,C
Acaena buchananii	T,C	c	W,C
Acaena caesiiglauca	T	c	W,C
Acaena fissistipula	T	o	C
Acaena inermis	T	o	W,C
Acaena saccaticupula	F,W	o	C
*Achillea millefolium	T	o	W
Aciphylla aurea	T	o(lf)	W,C
Aciphylla montana var. montana	T,R	o	C
Anaphalioides bellidioides	W,R	o	C
Anisotome aromatica	T	o	C
Anisotome aromatica var. flabellifolia	T	o	W,C
Anisotome brevistylis	R	o	C
Anisotome cauticola	R	o	C
*Aphanes arvensis	C	o	W
Brachyglottis haastii	R,T	c	W,C

Brachyscome sinclairii	T	o	W,C
Cardamine bilobata	***R***	***o***	***C***
Celmisia angustifolia	R	u	C
Celmisia densiflora	T	o	C
Celmisia gracilenta	T	c	W,C
Celmisia “gracilenta rhizomatous”	W	o(lf)	C
Celmisia laricifolia	T,R,F	o	C
Celmisia lyallii	T,R	o	C
Celmisia prorepens	T	o	C
*Centaurium erythraea	T	o	W
*Cerastium fontanum	T	o	W
Chaerophyllum “bog”	W	o	C
Chaerophyllum colensoi var. colensoi	T	o	W
Chaerophyllum ramosum	S	o	W,C
Chaerophyllum novae-zelandiae	C	o	W
*Cirsium arvense	T	o	W,C
*Cirsium vulgare	T	o	W
Colobanthus acicularis	R	l	C
Colobanthus apetalus	W	c	C
Colobanthus brevisepalus	C	o	W
Colobanthus buchananii	R	o	C
Colobanthus strictus	R	o	W
*Conium maculatum	S	o	W
Craspedia aff. lanata	Ru	u	C
Craspedia sp. (stream side, yellow flower)	W	o	C
Crassula sieberiana	R	o	C
*Crepis capillaris	W	o	W
*Dianthus armeria	Ru	o	C
Dichondra brevifolia	W	lc	W
Dichondra repens	S	o	W
Dolichoglottis lyallii	W	o	C
*Echium vulgare	T	o	W
Einadia allanii	R	o	W
Epilobium atriplicifolium	T	o	C
Epilobium billardiereanum	W	o	C
Epilobium brunnescens	W	c	C
Epilobium chionanthum	W	o	W
Epilobium hectorii?	T	o	C
Epilobium komarovianum	W	c	W,C
Epilobium melanocaulon	T	u	W
Epilobium palidiflorum?	W	u	C
Epilobium pubens	R	o	W
Epilobium tasmanicum	T	o	C
Euchiton audax	T	o	C
Euchiton laterale?	W	o	C
Euchiton paludosum	W	o	W
Euchiton polylepis	W	o	C
Euchiton traversii	T	o	C
Euchiton sp. (pale)	W	o(lc)	W
*Galium aparine	S	o	W
Galium perpusillum	W	o	C

Galium propinquum/trilobum	S	o	W
Gentianella amabilis	W	o(lc)	C
Gentianella corymbifera	T	u	C
Geranium brevicaule	T,C	w	C
Geum leiospermum	T	o	C
Gonocarpus aggregatus	W	o	C
Gonocarpus micranthus	W	o	C
Helichrysum filicaule	T	o	C
*Hieracium lepidulum	T,S	f	W,C
Hydrocotyle hydrophila	W	lf	W
Hydrocotyle moschata	S	o	C
Hydrocotyle novae-zelandiae var. montana	W	c	W,C
Hydrocotyle sulcata	W	o	C
*Hypericum perforatum	C	o	C
*Hypochaeris radicata	T	o	W,C
*Jacobaea vulgaris	T	o	W
Kirkianella novae-zelandiae	C	o	C
Lagenifera barkeri	W	o(lc)	C
Lagenifera cuneata	T	o	C
Leptinella pectinata	F,R,T	o	C
Leptinella perpusilla	T	o	C
Leptinella serrulata	***C***	***o***	***W***
*Leucanthemum vulgare	T	o	W
Leucogenes grandiceps	R	o	C
Leptinella squalida subsp. mediana	W	o	C
*Linum cartharticum	T	c	W,C
Lobelia angulata	W	c	W,C
Lobelia ionantha	W	u	C
Lobelia linnaeoides	T	(lc)	C
*Lupinus polyphyllus	W	o	W
Mentha cuninghamii	W	o	W
*Mimulus moschatus	W	o	W
Montia fontana	W	o	W,C
Montigena novae-zelandiae	***T***	***o***	***C***
*Mycelis muralis	S	o	W
*Myosotis arvensis	W	o	W,C
Myosotis australis	F	u	C
*Myosotis laxa subsp. caespitosa	W	o	C
Myosotis drucei	F	o	C
Myosotis traversii var. cantabrica	F	u	C
Myriophyllum triphyllum	W	o	C
Nertera balfouriana	W	c(lf)	c
Nertera depressa	W	o	C
Ourisia caespitosa	R,T	o	C
Oxalis exilis	C,S	c	W
Pachycladon cheesemanii	R	o	W,C
Phyllachne colensoi	T	o	C
* Pilosella officinarum	T	a	W,C
*Pilosella praealta	T	c	W,C
Plantago novae-zelandiae	W	o	C

Plantago spathulata	C	u	C
Plantago triandra	W	o	C
Potamogeton cheesemanii	W	o	C
Potentilla anserinoides	W	o(lc)	W
*Prunella vulgaris	T	o	W
Pseudognaphalium luteo-album	R	o	W
Psychrophila obtusa	W	c	C
Ranunculus cheesemanii	W	o	C
Ranunculus foliosus	W	o	W,C
Ranunculus glabrifolius	W	o	W,C
Ranunculus gracilipes	W	c	C
Ranunculus maculatus	W	o	W,C
Ranunculus multiscapus	T	o	C
Ranunculus royi	W	o	W
Raoulia australis	C	o	W
Raoulia beauverdii	C	o	W
Raoulia grandiflora	F,T	c	C
Raoulia hectorii	F	c	C
Raoulia hookerii	T	u	C
Raoulia parkii	C,T	o	W,C
Raoulia subsericea	T	c	W,C
Raoulia tenuicaulis	T	o	C
*Rumex acetosella	T	f	W,C
Rumex flexuosus	W	o	W,C
*Sagina procumbens	W	o	W,C
Schizeilema haastii var. cyanopetalum	R	o	W
Schizeilema hydrocotyleoides	T,F	o	C
Schizeilema nitens	W	o	C
Scleranthus brockiei	T	o	W,C
Scleranthus uniflorus	T,C	o	W,C
Senecio quadridentatus	R	o	W
Senecio wairauensis	S	u	W,C
Stackhousia minima	T	o	C
*Stellaria alsine?	W	o	W
Stellaria gracilenta	R,C	c	W,C
*Taraxacum officinale	T	c	W,C
*Trifolium arvense	C,T	f	W,C
*Trifolium pratense	T	o	W
*Trifolium repens	W,T	c	W,C
Urtica aspera	***S***	***o***	***W, C***
*Verbascum thapsus	C	o	W,C
*Vicia sativa	S	o	W
Viola cunninghamii	W	o	W,C
Vittadinia australis	C	o	W,C
Wahlenbergia albomarginata	T	c	W,C
Wahlenbergia rupestris	R	c	W,C
Grasses			
*Agrostis capillaris	T	c	W,C
Agrostis meulleriana	F	o	C

*Aira caryophyllea subsp. carophyllea	C	o	W
*Anthoxanthum odoratum	T	a	W,C
Austroderia richardii	W	u	W
Chionochloa macra	T	a	C
Chionochloa rigida	T	a	W,C
Chionochloa rubra	T	o(lc)	C
*Cynosorus cristatus	T	o	W
*Dactylis glomerata	T	o	W
Deyeuxia avenoides	T	o	C
Dichelachne crinita	R	o	W,C
*Elymus scaber?	T	c	W,C
Festuca madida	W	o	C
Festuca matthewsii	T	c(lf)	C
Festuca novae-zelandiae	T	a	W,C
*Festuca sp.	W,T	c	W,C
*Glyceria declinata?	W	o	W
*Holcus lanatus	W,T	c	W,C
Koeleria novozelandica	R	c	W,C
Lachnagrostis sp.	W	o	C
*Phleum pratense	T	o	W
Poa breviglumis	R	o	C
Poa cita	T	o	W,C
Poa colensoi	T	f	C
Poa lindsayi	T	o	C
Poa maniototo	C,T	c	W,C
*Poa pratense	T	o	W
Rytidosperma australe	W	o(lc)	C
Rytidosperma buchananii	W	o	C
Rytidosperma gracile	T	o	W
Rytidosperma pumilum	T,C	o	W,C
Rytidosperma setifolium	F,R	o	C
Rytidosperma unarede	R	o	W
Rytidosperma sp (dryland)	C	o	W
Trisetum tenellum	W	o	C
Sedges			
Carex acicularis?	W	o(lc)	C
Carex breviculmis	T,C	c	W,C
Carex buchananii	W	o	
Carex colensoi?	T	o	W
Carex coriacea	W	lf	W,C
Carex diandra	W	lf	W,C
Carex dipsacea?	W	o(l)	W
Carex flagellifera	W	o(l)	W
Carex flaviformis	W	o(l)	W
Carex gaudichaudiana	W	o(lc)	W
Carex inopinata	***R***	***o***	***W***
Carex inversa	W	lc	W
Carex kaloides	W	lc	W,C
Carex maorica	W	o(l)	W
Carex muelleri	T	c	C

*Carex ovalis	W	o(lc)	W,C
Carex petriei	W	o	C
Carex resectans	C	c	W
Carex secta	W	o	W,C
Carex sinclairii	W	lc	W
Eleocharis acuta	W	lc	W,C
Isolepis aucklandica	W	o	C
Isolepis calagenis?	W	lc	W
Oreobolus pectinatus	W	lc	C
Schoenus pauciflorus	W	o(lf)	W,C
Uncinia divaricata	W	lc	C
Orchids			
Microtis oligantha	W	o(l)	C
Microtis unifolia	T	o	W,C
Nematoceros macranthum?	W	o	C
Prasophyllum colensoi	T	c	C
Thelymitra longifolia	T	o	C
Rushes			
Juncus antarcticus	W	o(l)	C
*Juncus articulatus	W	c	W,C
Juncus australis?	W	o	W
*Juncus effusus	W,T	o	W,C
Juncus novae-zelandiae	W	o	W,C
Juncus pusillus	W	lc	W,C
Luzula banksiana var. migrata	R	c	W,C
Luzula leptophylla	W	o	C
Luzula pumila	F	o	C
Luzula rufa var. rufa	T	o	W,C
Luzula traversii?	R	o	C
Luzula ulophylla	C	o	W
Other moncots			
Bulbinella angustifolia	T,W	o	W,C
Triglochin palustris	***W***	***lc***	***W***
Typha orientalis	W	lc	W

APPENDIX 9

FEDERATED MOUNTAIN CLUBS SUBMISSION

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

CONS	
A.M.	
C.R.M.	
B.S.M.	
T.S.M.	
H.R.A.	
H.C.T.R.M.	
K.A.M.	
OTHER	

Debbie
Copy Rob - Rees Valley
- mike Harding
Tim - morven Hills

1 June 2004

Tony Perrett
High Country Tenure Review Manager
Department of Conservation
PO Box 5244
DUNEDIN

Dear Tony

Re FMC Report on Recreation and Related Significant Inherent Values On Rees Valley Station, and Notes on Morven Hills

FMC has been preparing Reports on the recreational and conservation values of properties which were introduced as new entrants to the Tenure Review process at an 'Early Warning' meeting in September 2003 These Reports are a more detailed account of the recreational and related significant inherent values than was given in the earlier brief Notes.

FMC have conducted inspections of some of these properties, and where this has not been permitted by the runholder(s) we have usually carried out an academic study of the property from the literature, from past field experience where appropriate, and from maps and any other information available to us. We wish to thank the Crown contractors for their efforts to make the appropriate access arrangements with lessees where this was possible, to facilitate these inspections. In other cases, where access has been denied, it is unfortunate that Reports have had to be written without the benefit of detailed on-site information. This year the situation has been compounded by the late appointment by LINZ, of the Crown's contractors for each pastoral lease. This has shortened by several months the time available for ENGOs to conduct on-site inspections of pastoral leases under review.

We now enclose our Report on Rees Valley Station which is the next Report of the series for the 2003 – 2004 round. While access to Morven Hills was not actually denied, it was not granted either. As we feel we do not know the property well enough to add more detail to the notes already provided by FMC, we enclose a copy of the September 2003 Notes for your information.

The Rees Valley Report and the Morven Hills Notes are offered as the FMC contributions to the statutory consultation process undertaken by the Department. We hope that the Report and Notes will be helpful to you in developing tenure review proposals for these properties. We look forward to commenting on the Preliminary Proposals in due course.

Yours sincerely

Michael Floate.

Dr Michael J S Floate
FMC High Country Tenure Review Co-ordinator, Otago/Southland

Cc Ken Taylor
DTZ New Zealand Ltd.
PO Box 27
ALEXANDRA

Name of Property: Morven Hills Po 359
Location: Lindis Pass
Maps: G40, S116 (NW SW)
Adjoining Leases: Geordie Hill and Shirlmar (S); Breast Hill/Forest Range Mt Thomas (NW); Dalrachney (N) and Dunstan Downs (NE).
Area: 14,199 ha
Altitude range: from 400m at the Black Bridge over the Lindis River (SH 8) to1,600m on the North Dunstans.
Current recreation usage: Very little due to access problems and locks on the 'Hydro Road'.
Land Use Capability: The property is bisected by the 'Hydro Road' or pylon line from SH 8 (N of the Lindis Pass) to a point near Polsons Hut by Goodger Road. To the east of the pylon line the North Dunstans rise to 1,600m and are dominated by LUC Class VIII and VIIe Dunstan Steepland (HCYBE soils. **(Class VIII about 200 ha, Class VIIe about 3,000,ha).** There is also a narrow fringe of lower country on sunny faces below about 1,000m, parallel to the pylon line, characterised by Arrow Steepland and Blackstone Hill (YGE) soils classified **LUC VI, covering about 800 ha.**
To the west of the pylon line there is much more lower country (below 1,000m) with only isolated hills (eg around Trig P and Double Peak rising significantly above 1,000m. Much of this part of the property **(approx. 6,000 ha) is characterised by LUC Class VI** Arrow Steepland and Blackstone Hill (YGE soils) and smaller areas of Dunstan Steepland and Carrick Hill (HCYBE) soils. In the north there are small areas **(approx 200 ha) of LUC Class VIII** Dunstan Steepland on high sunny faces overlooking Lindis Pass; and there are also about **300ha of LUC Class VIII** land with Arrow Steepland on dry rocky sunny faces up to 1,000m overlooking SH 8 and to the east of the homestead. The remainder of the land is classified **LUC Class VIIe (approx. 3,500 ha)** characterised by Carrick Hill and Dunstan Steepland HCYBE soils on the higher ground and Arrow Soils on the lower country.
Conservation land recommended: All Class VIII and VIIe land in the N of Morven Hills and east of the 'Hydro Road'. The northern part would be an extension of the existing Lindis Pass Scenic Reserve. There may be some important native shrublands in the western (and lower) part of the property which could be protected under covenant (needs field checking).....otherwise some 10,000 ha may be capable of ecologically sustainable pastoral use and therefore suitable for freeholding. This might be achieved by utilising existing fencelines, from SH 8 oppposite Camp Hill to the ford at Map Ref. G40 420.149, and thence south to the locked gate near Polsons Hut. Approx 4,000 ha of new conservation/recreation land. Because of its importance as a tourist corridor, and because of the well known and much photographed and painted Lindis Pass, the Lindis Pass landscapes (visible from SH 8) should be protected under a Landscape Protection Covenant, against the adverse effects of inappropriate land use.
Access Requirements: (i) Marginal strips on all qualifying waterways. (ii) From the locked gate near SH 8 by the Lindis Scenic Reserve to the other locked gate near Polsons Hut at Goodger Road. Note that part of this road is marked as legal road, despite the locked gate. (iii) foot access to Polsons Hut and the Twin's Grave from Goodger Road....note that legal access has been provided over Goodger Road through the 'Lindis Group' of tenure reviews. (iv) a scenic diversion for MTB use off SH 8 south of Dip Creek to a point near, and N of the Morven Hills homestead. (v) Foot, MTB, and horse access (and 4WD with landowner consent to Old Man Peak (on Dunstan Downs pastoral lease); via two alternative routes which could be used to make a round trip when access to Old Man Peak becomes available. Note that most of these routes are within the area recommended as new conservation land, so legal easements may not be needed. (vi) There should also be a link to the Chain Hills and to the new conservation area on Shirlmar.

APPENDIX 10

NORTH OTAGO DEERSTALKERS SUBMISSION

P/L 14-04-

New Zealand Deerstalkers` Association

Incorporated

North Otago Branch, 67 Wansbeck St,
OAMARU.

16 May, 2004

Department of Conservation
Attn: Tony Perrett
P.O.Box 5244
Dunedin

RE: Tenure review of Otago property

ar Mr. Perrett,

On behalf of the North Otago Deerstalkers Association we would like to make a submission on the lowing properties under land tenure review.
The properties of interest are: Mt Dasher, Pisgah Downs, Carrick, Shag valley, Balmoral, Herron, Cluden, Morven hills, Walter peak and Rees valley.

We would like access to the above properties for recreational hunting when the land reverts to conservation estate. As well as providing important recreational opportunities for hunters to enjoy the mountains and wild game animals, we will be keeping the population under control with out the use of poisons.

We would also need vehicle access where formed tracks exist due to the distances needed to be covered to hunt effectively. Foot access is not adequate due to the extra time required to travel to a hunting area, particularly for the weekend hunter.

Our club members have hunted some of the properties under review for many years. We have had an excellent relationship with the farmers and have provided wild animal control.

NZ Deerstalkers Association members have the added benefits of a $5 million public liability insurance c r which includes fire suppression cover in the unlikely event of disaster.

We would like to wish you well for the land tenure process and would like to continue contact.

Yours Sincerely

Nick Sim
President
North Otago Deerstalkers Association

CONS	
A.M.	
C.R.M.	
B.S.M.	
T.S.M.	
H.R.A.	
H.C.T.R.M.	✓
K.A.M.	
OTHER	

APPENDIX 11

SUBMISSION FROM FOREST AND BIRD, CENTRAL OTAGO LAKES BRANCH

Central Otago-Lakes Branch
Forest and Bird
4 Stonebrook Drive
Wanaka 9305

FOREST & BIRD

Royal Forest and Bird Protection Society of New Zealand Inc

24 April 2011

Tim Whittaker
Department of Conservation
Central Otago Area Office
PO Box 176
ALEXANDRA 9320

Dear Tim

Preliminary Report - Conservation and Recreation Values of Morven Hills Pastoral Lease

Morven Hills pastoral lease has re-entered the tenure review programme, as introduced to members of our branch attending the interested stakeholders meeting in Clyde in spring, 2010.

We inspected the property on 24 January 2011, primarily from 4WD vehicle accessing the property from the south along the main ridge track to the airstrip, with a brief foray northwest to look into Dip Creek, before returning to the ridge track. We crossed Dip Creek on the Ewe Block and travelled northwest over the Sledges Hill saddle to the highway, from where we drove north around the pass to the Pylon Track. We followed the Pylon Track to the south boundary and exited the property via Goodger Road. This route gave us a good overview of the property.

A number of our members are broadly familiar with the area, including those who are also members of the Lindis Pass Conservation Group which carries out conservation activities in the Lindis Pass Scenic Reserve adjoining Morven Hills.

Richard Snow, the lessee, met us at the start of our journey and dropped in on us by helicopter in Dip Creek. It is worth noting that his use of the 4WD tracks on the property is somewhat less now because most work is done by helicopter. Consequently the tracks are not as well maintained as in the past.

We submit this preliminary report outlining our views on the conservation, landscape and recreation values of Morven Hills. We are well informed by the Conservation Resources Report, which is very detailed.
We would be pleased if you would take our comments into account when compiling the conservation resources report and in making your recommendations to LINZ on the tenure review proposal for this property.

Our report is supported by three maps/images and a collection of captioned photographs.

Overview

Morven Hills directly adjoins the Lindis Pass Reserve and wider Lindis Conservation Area. It contains landforms and ecosystems that are part of the landscapes of these areas including high altitude peaks and range lands.
The east side of the lease contains a large portion of Dunstan Creek valley - a large tussock grassland valley that is remote and relatively unmodified, retaining a high level of landscape integrity. Parts of the enclosing ranges are already conservation area, through the tenure reviews of Killermont and Dunstan Peaks/Twinburn pastoral leases.

Other key elements of interest are the Otago and Grand skink populations and their habitats - and other skink and gecko species; the relict beech and totara forest in Dip Creek; and the Pylon Track - a valuable off-highway recreation link between Goodger Road and the Lindis Pass.

The property generally comprises threatened ecosystems (or Land Environments) and has widespread presence of lowland dryland shrublands and wetlands.

In the sections to follow we comment on specific aspects of Morven Hills pastoral lease.

1 High Altitude Lands (Chain Hills and Lindis/Black Hill peaks)

A large part of Morven Hills is over 1000m altitude. Such areas cannot be sustainably grazed and tend to be overwhelmingly dominated by Class VII (often VIIe) and VIII lands which are well recognised as being unsuited to pastoral use. Fertiliser application at a level required to replace nutrients lost through grazing is uneconomic and impractical. Continued grazing has and will continue to cause gradual decline in ecosystem health.

Generally all land greater than 1000m in altitude should be retired as conservation land, so that without grazing pressure the tall tussock cover can gradually regain vitality. Healthy tall tussock serves an important water capture and storage role for downstream uses. There are also areas of *Chionochloa macra* (slim snow tussock) in reasonable condition on the tops. Such cover is now scarce due to preferential grazing pressure.

Faces with a southerly aspect are probably of low productivity down to 800-900m altitude and should also be retired.
Land over 1000m and over 900m on colder shadier faces is shown on the attached map.

The high altitude areas also tend to embody the highest natural landscape values and some of the most distinctive natural landscape character areas; high recreation values; and are generally the most ecologically intact areas on the property.

Areas that should be managed for conservation of the natural values (namely tall tussock and subalpine ecosystems) include the whole of the Chain Hills/Dunstan Range on both sides; and the tops north of Dip Creek (plateau top on true right of Dip Creek; Black Hill and Double Peak).

Existing fencing would enable all of the Dunstan Creek to be retired. The Bluecliffs, Black Hill and Sledges Hill/Ewe blocks all contain areas of lower altitude land, some of which is greatly modified and dominated by exotic pasture which could probably be grazed under

a sustainable regime. These could be fenced off as freehold. On Bluecliffs the 1000m contour largely coincides with the Pylon Track.

There are more isolated broad ridge top areas above 1000m on the lower hill country west of the Chain Hills and south of Dip Creek. Where these areas adjoin lower altitude areas of high ecological value, protection of these areas as part of the continuum from valley floor to tops should also be considered. Most of the colder shadier faces on the true right of the stream running through Top Airstrip are 800-900m and higher and are probably of low productivity, better suited to conservation management. Retention of this area as conservation land would be easy as it is already fenced as a block (Top Airstrip).

It is recognised that simply fencing along the 1000m contour can be both impractical and result in undesirable visual and ecological fragmentation. Important montane ecosystems often adjoin, and in places there are relatively intact valley floor-to-alpine tops ecological and visual sequences which are worthy of protection.
It is also relevant to consider using existing fence lines from a practical cost-saving perspective. However existing fence lines are not always well aligned with natural landform and vegetation patterns and, with a contrast in vegetation cover evolving, undesirable visual contrasts (affecting visual coherence or unity) and ecological "truncation" can occur, affecting the overall integrity of the landscape.

We attach a map and two annotated Google-based images suggesting where appropriate fence lines demarcating future conservation areas might be, taking into account other significant inherent values discussed in the sections below.
Fence lines would ultimately need to be "micro sited" to avoid creating sheep camps that would create strong and unnatural visual contrasts.

2 Lindis Pass Conservation Area Extension

The Morven Hills tenure review is a once only opportunity to extend the Lindis Pass conservation area to include adjoining important areas of natural mountain landscape and a wide range of ecosystems. Relatively intact ecosystem sequences on a landscape scale including broad scale east to west transitions as well as shady versus sunny aspects could be included and protected. This would enhance the overall value of the Lindis Pass conservation area and enable more robust ecological processes to occur (such as ability to adapt with environmental changes and enabling species to move around in the landscape between habitats over time enhancing survival).

The review enables the former RAP A2 to be incorporated seamlessly with the conservation area. The small isolated RAPs A4 and A5 around the beech and totara remnants could also be incorporated. By doing so, the likelihood of expansion of these remnants is significantly increased with removal of any grazing pressure.

Recreational values would also be enhanced, with ability for round trips and exploration along the high tops.

A future south boundary to the Lindis Pass conservation area should relate well to landform and allow intact valley floor to tops ecological sequences. Long smooth landforms should not be bisected by fence lines and contrasts in vegetation. Larger rocky bluff systems and talus should also be included.

A suggested boundary is shown on the attached map and images. This is broadly consistent with the area identified as having significant vegetation and invertebrate values in the CRR but allows for the lower more modified slopes to be fenced off as grazing land. The existing fence between Sledges Hill and the Black Peak blocks could be used but it is likely to promote an unnatural line and pattern in what is currently a natural looking landscape with a high level of integrity.

The long smooth landforms on the southeast sector of Black Hill including points 979 and 869 need to be included in a future conservation area to retain the integrity of a natural looking mountain landscape.
Dip Creek and its wetlands should be included in conservation area also (refer map and annotated Google image).
It is envisaged a riparian corridor would be fenced off to protect the stream and wetlands from stock - especially cattle - as well as providing a public access link.

3 Chain Hills conservation area incorporating former RAPs A3 and B5

The retiring of the Chain Hills in their entirety would enable the creation of a new Chain Hills conservation area incorporating the former RAPs B5 and A3 as well as similar adjoining areas. Full ecological and landform sequences would be protected and allowed to recover in the absence of grazing, importantly valley floor tall tussock on the west side and extensive wetlands on the east side could be included.

This conservation area would extend naturally into the Dunstan Range which is expected to be retired in the tenure review of Dunstan Downs pastoral lease and thus continue round to connect to the Wether Range and St Bathans Range.

It is possible some lower altitude land could be fenced off on Davis block for grazing (see map); alternatively a covenant could be placed over the entire block for the purposes of protecting and enabling recovery of the native vegetation (snow tussock, gully shrublands).

4 Degraded Lands - Bluecliffs Block

Between the Chain Hills and Double Peak on the Bluecliffs block is a small isolated ridge rising to around 1000m altitude. The pylon line and an access track runs along the east side of it, the track roughly following the 1000m contour along the base of the Chain Hills generally. The main Pylon Track runs along Dip Creek on the northwest side of these small hills.
The small range is extremely degraded with very sparse to non-existent tall tussock cover and widespread hieracium. It is suggested that this area be placed under a sustainable management covenant similar to that for Lake Hawea station, with clearly defined targets with respect to achieving a robust cover of vegetation, preferably tall tussock. This should be achieved through careful grazing and fertiliser application. If this target cannot be achieved then it should revert to conservation area.

The area should be fenced from the envisaged Chain Hills conservation area with the new fence following the existing pylon track, thus avoiding creating a new line in the landscape. The southern part of this area could include the valley floor of RAP A3, adjoining the northeast end of the Dip face ridge. Alternatively if A3 is desired as

conservation area the boundary could cut across to the hut at the track junction (GR533 320 - see attached map), to retain landscape integrity. South of that, towards the Hummock Block, there is better snow tussock cover on valley floors which is of relatively high value - there are not many areas left now with snow tussock on valley floors around 800-900m altitude. These areas are also important to the overall intactness of ecological patterns and landscape integrity.

5 Dip Creek (Pass Burn, Dip Face and Ewe blocks)

Dip Creek contains important shrublands and remnants of beech and totara forest. The latter are on the true right, which is a steep and rugged valley side. Our view is that this side of the the creek is best managed as conservation land, with removal of any grazing pressure to allow these eastern-most remnants to expand undisturbed. The full sequence from riparian shrublands to snow tussock tops could also be protected.

An envisaged conservation area would extend from the bridge/SH8 to the leading spur joining to the 4WD track about 4km upstream (see attached map). This is coincidental with the area mapped as having both significant vegetation and invertebrate values in the CRR.

The mid to upper valley floor wetlands - including an impressively large Carex wetland where the 4WD track crosses - and stream corridor should be fenced off from stock. This could form a narrow connection of conservation land (providing also for public access) to the envisaged Lindis conservation area described above.

To complete the ecological sequence the plateau of Sledges Hill with its snow tussock cover should ideally be part of the future conservation area. This would require realignment of the fence however.
If it is not fenced, continued use and possibly more intensive use for Merino grazing will result in the conversion of the snow tussock here to dense exotic pasture due to sheep camping (nutrient transfer).

The true left of Dip Creek is dry, very degraded tussock land with extensive areas devoid of tussock or shrub vegetation, instead dominated by hieracium. There are grey shrublands and kanuka in patches and concentrated in gullies.
A sustainable management covenant would be ideal placed over this block as well, with its purpose being grazing and land management to encourage return of woody cover and improvement in tussock cover.

6 Farmers Gully

The CRR clearly indicates the significant value of the Farmers Gully upper catchment, which is also a RAP A6. There is a good opportunity here to secure a variety of different vegetation communities from valley floor to snow tussock tops including threatened Land Environments. Relief from grazing pressure would allow full recovery of woody vegetation (apart from the snow tussock tops).
As this area is already fenced on three sides it would be a relatively easy matter to fence across the lower boundary of this area.

Public foot access to the area could be possible via the 4WD track from Dip Creek Road bridge (refer attached map).

7 Shrublands (montane zone)

There is riparian grey shrubland, patches of kanuka and rocky outcrop shrub commnities throughout the lower hill country, including a large area of regenerating kanuka on a western face on Station Range block.
These are important for natural landscape character and visual values as well as representing threatened dryland and woody communities, and providing habitat for diverse populations of native invertebrates. They coincide with rocky lizard habitat. Dryland turf comunities are often associated with the rocky areas, situated on the ridge crests above. They include rare and uncommon species such as *Leptinella serrulata* and *Acaena buchananii*. It is important as many areas as possible are protected, especially where they contain threatened and at risk species such as *Carmichaelia kirkii*, *Olearia fimbriata, Carex opinata* and *Coprosma intertexta* (detailed in the CRR).

Where there are larger areas dominated by woody cover, fencing off areas could be contemplated especially where the terrain is rugged and of little grazing value; there is good potential for expansion of the woody cover; and a range of communities can be included from valley floor wetlands and riparian communities through shrublands and rocky outcrop associations topped by dryland turfs up to snow tussock tops.
This may be possible through the Station Range, Manuka Gullies, Rocky Hill and Hummocks blocks as shown on the attached map.

Combined with the suggested Chain Hills conservation area, and considering where land above 1000m is (or 900m on colder faces), the extension of the conservation area over all of the Rocky Hills and Top Airstrip blocks and the northern part of Station Range is recommended. This would greatly enhance the overall value of the conservation area by including a wider variety of interconnected ecosystems and enabling ecological processes to carry on at a landscape scale. A notable area of wet seepages on the east end of Rocky Hill would be included. It would also enable the public to access the area, which would be of considerable interest. A short link via an access easement along the airstrip track would enable public access into Farmers Gully, which would also be best as a fenced off conservation area. From there the public could return to the highway at Dip Creek via the 4WD track.

In a broad sense this approach seem to make sense, as the proposed hill country conservation areas would separate the main working area of the property - the lower more productive hill country - from the two more sensitive areas recommended for a sustainable management agreement. These would only be grazed in spring most likely, and possibly a short spell mid or late summer to autumn. Public access into and between the areas should not present an issue for on going farming operations providing access is well marked.

Elsewhere a covenant could be placed over freehold grazing blocks for the purposes of preventing any substantial clearance of native shrublands or invasion of weeds. Grazing may in fact be beneficial to maintaining the dryland turf communities. Exclusion areas would need to be identified and mapped. Photo points could also be set up.

8 Dryland communities

Dryland turf communities occur throughout the lower hill country, typically around and above rock outcrops on tops of ridges. Grazing is likely to be beneficial in maintaining a turf.
Consideration might be given to including key areas of these under the above mentioned covenant (s) aimed at managing grazing and pests to ensure the continued survival of these special and threatened communities.

9 Short Tussock Community

There is a distinctive reasonably healthy short tussock community across a rolling plateau on Ileans block and extending into Wrights block and north into White Rocks (refer map). The area contains scattered Olearia shrubs and also Maori Onion. It has a distinctive savannah appearance.
It would be desirable to ensure this area retains its character. This could be achieved via covenant which prevents any cultivation or tree planting, and requires a certain grazing and pest management level to retain the tussock cover.

10 Wetlands (montane zone)

There are numerous small wetlands of varying size and shape and type throughout the lower hill country both in the main gully floors and on rolling plateau areas. All wetlands are important and deserving of protection.

It would be ideal if all wetlands are recognized and protected. Those that are under greater stock pressure should be fenced off. Cattle and deer should be prevented from accessing all wetlands and stream margins.
Light or extensive sheep grazing may cause only minor degradation and may not require fencing off.

It is suggested an inventory of wetlands and riparian margins be taken over the lower hill country and a covenant be established setting out where fencing is required and/or where cattle and deer need to be excluded from grazing blocks, to avoid the need for fencing.

An alternative is some kind of agreement that requires an ecological management plan be carried out by an approved ecological expert. The plan would be completed within a specified time frame and be submitted to DOC for peer review and approval. The legal agreement would require compliance with the recommendations and conditions set out in the plan. Management of the shrublands could come under the same plan, as could management of remaining tall tussock areas which are important upper catchments for water quality and quantity.

11 Recreation Values

Pylon Track
The establishment of public foot, mountain bike and horseback access along the Pylon Track is an obvious desired outcome, giving a much needed off road link between Lindis

Pass and Goodger Road. From here trips can be made east into the Dunstan Valley; or west through the Lindis Conservation Area involving no or relatively little highway travel. The track also provides easy access to the envisaged conservation areas including the Top Airstrip and Station Range area with links via the suggested easement to Farmers Gully and Dip Creek/SH8.
Vehicle access would also be desirable, and feasible, given the track is maintained for service access to the pylons.

Chain Hills and Lindis Peaks (Black Hill) Loop
It would be of value to enable mountain bike and foot access along the existing 4WD track between SH8 north of Sledges Hill round to the Pylon Track. Together with the Pylon Track this would enable an interesting loop from the Lindis Pass reserve seeing both the front (north) and back (south) sides of Black Hill and Double Peak. This would be preferable to a return trip via the Pylon Track and enables easy access from the saddle between Sledges Hill and Black Peak at the 900m contour to the 'back' faces.

Link between envisaged Lindis and Chain Hills Conservation Areas
A link between the envisaged Lindis Pass Conservation Area and a Chain Hills conservation area would be desirable by way of easement across the recommended SMC area in the upper Dip Creek valley floor. This would be a short easement probably about 600m long crossing the flat valley floor alongside a small stream to reach the Pylon Track and thus the envisaged conservation area of Chain Hills (refer map).

Dip Creek
Public foot access up Dip Creek would be possible if it were conservation area (true right only). Public foot access should be able to continue up Dip Creek until it reaches the envisaged Lindis conservation area or the easement on the 4WD track described above. Public access into Dip Creek would be desired for visiting the beech and totara remnants and generally exploring the steep terrain, rock outcrops, riparian areas and shrublands.

Loop Track
The existing 4WD track between Goodger Road and the airstrips would make an excellent loop track for walking or mountain biking or horse riding starting and finishing on Goodger Road taking in a lot of country including visits to conservation land, when combined with the Pylon Track. This would enhance the overall recreation potential in the Chain Hills area.

SUMMARY

In summary our comments on Morven Hills are:

- Retire the high altitude Black Peak and Chain Hills rangelands and amalgamate with existing Lindis Pass conservation area; include valley floor north of Hummock Block to protect the wetlands and tall tussock communities on those lands
- Create a Sustainable Management Covenant for the severely degraded small hill range and valley floor flats on Bluecliffs Block
- Re-align fence on top of Sledges Hill to include snow tussock plateau and top of stream catchment in Dip Creek conservation area

- True left of Dip Ceek put under a Sustainable Management Covenan to address severe degradation
- True right of Dip Creek fenced off as conservation area, linked to Lindis and Chain Hills conservation areas by a riparian corridor, fenced off from cattle and deer
- Farmers Gully fenced off as conservation area. With public access up the (but not necessarily extensively grazing sheep)
- 4WD track from Dip Creek; short easement could provide public access across the top to Top Airstrip and Station Range.
- Protection of dryland lowland grey and kanuka shrublands; Top Airstrip, Station Range, Rocky Hill and parts of Manuka Gullies and Hummocks block fenced off as conservation area to allow regeneration of shrublands; elsewhere via covenant preventing burning, spraying or mechanical removal, and invasion of weeds.
- Protection of dryland turf communities via covenant (noting grazing is probably necessary to sustain them)
- Protection of the short tussock savannah community on the ridgeline of Wrights and White Rocks blocks via covenant
- Protection of wetlands generally, particularly fencing off from cattle and deer
- Public access of all kinds along the Pylon Track
- Public foot and MTB access between SH8 and Dip Creek via Sledges Hilll saddle track, to link up with the Pylon Track
- Ensure public access link via easement between Dip Creek and the Chain Hills
- Public foot access into/up Dip Creek
- Public access around a loop off Goodger Road via the Airstrip and Pylon Tracks

We very much appreciate this opportunity to have input to the Morven Hills tenure review process, and hope our comments will be of assistance to you.

We look forward to seeing the proposal when it is put out for public comment,

Signed:

Denise Bruns
Secretary
Central Otago-Lakes Branch
Forest and Bird

April 2011

PHOTO PAGES

Morven Hills Pastoral Lease
Preliminary Report forTenure Review

COL F&B
April 2011

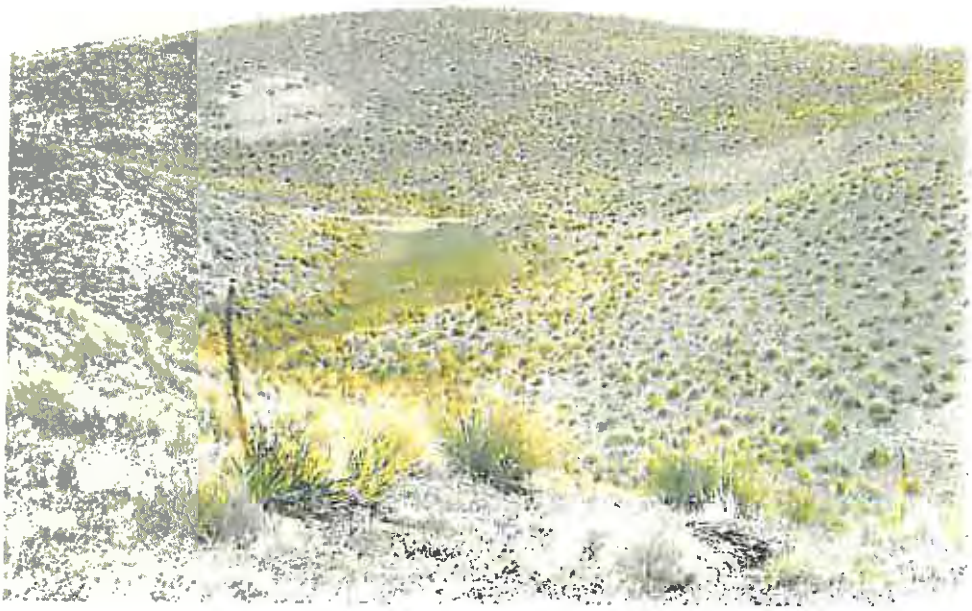
The following four photos were taken on the Ilean and Wrights blocks. They show the short tussock grassland with scattered olearia shrubs, creating an appealing savannah landscape character. It is desirable to retain this landscape character, protecting it from cultivation, excessive AOSTD and grazing, and tree planting. The aim of a covenant would be to maintain a healthy robust short tussock cover and as great a diversity of native inter tussock species as possible

1

Large carex wetland in middle reaches of Dip Creek, where track crosses on to the Ewe Block. This should be fenced off from cattle and deer. (view is looking north)

View looking up Dip Creek from same position as above. Valley floor riparian margins and small wetlands should be fenced from cattle and deer. The valley floor could provide an easy public access route to the northern Chain Hills beyond.

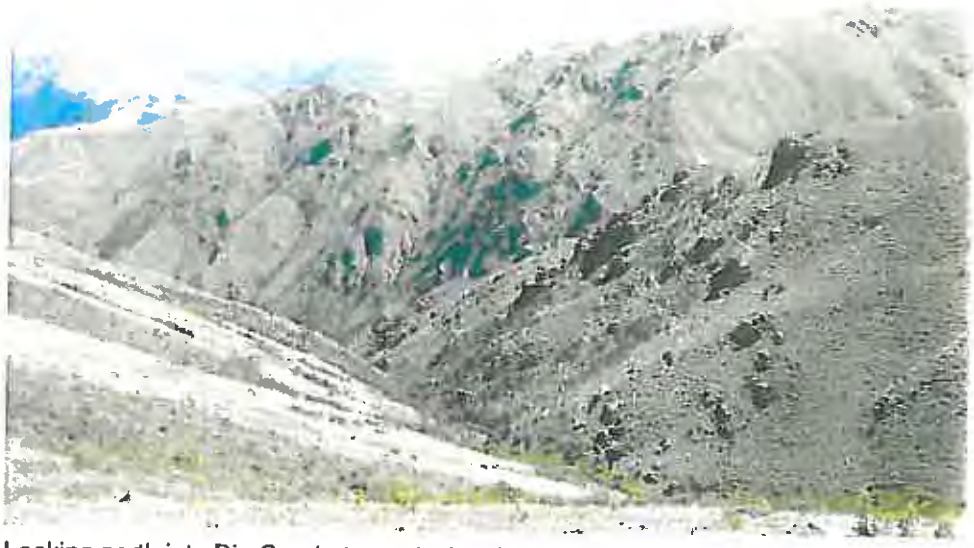
Reasonably large carex wetland at south end of Hummocks block, viewed from the Pylon Track. This wetland should be fenced off from stock, ideally in conjunction with the adjoining dry shrubland for maximum habitat value.



High altitude wetlands have high values and should be protected in a healthy tall tussock matrix to ensure their survival (location near the Airstrip)

The two photos below show the severely degraded upper Dip Creek tussock lands. This area needs careful management over a long period to recover any semblance of its natural cover and resilience. A Sustainable Management Covenant is envisaged.

View looking south to Dip Face block from the track on Sledges Hill saddle. The degradation on this land is also severe and a Sustainable Management Covenant would be appropriate here too.



Looking north into Dip Creek, towards the site of the beech and totara remnants. The entire true right from valley floor (including an effective riparian corridor) to the tall tussock summit of Sledges Hill should be retired for conservation purposes and public enjoyment.

Looking into the top end of the lower Dip Creek section, on the southeast side of Sledges Hill, with Black Hill beyond. The envisaged boundary between grazing land and conservation land would run down the crest of the steep talus strewn slope of Dip Creek.

View towards Black Hill from the Pylon Track. The overall integrity of landform, the higher levels of naturalness, and the distinctive landscape character of the Lindis Pass landforms is apparent. The majority of this land should be managed for conservation purposes, to retain the landscape integrity and give the tall tussock better opportunity to recover.

Striking landscape on the southeast side of Double Peak, as viewed from the Pylon Track.
This is colder high altitude land under snow tussock which should be managed for conservation purposes.

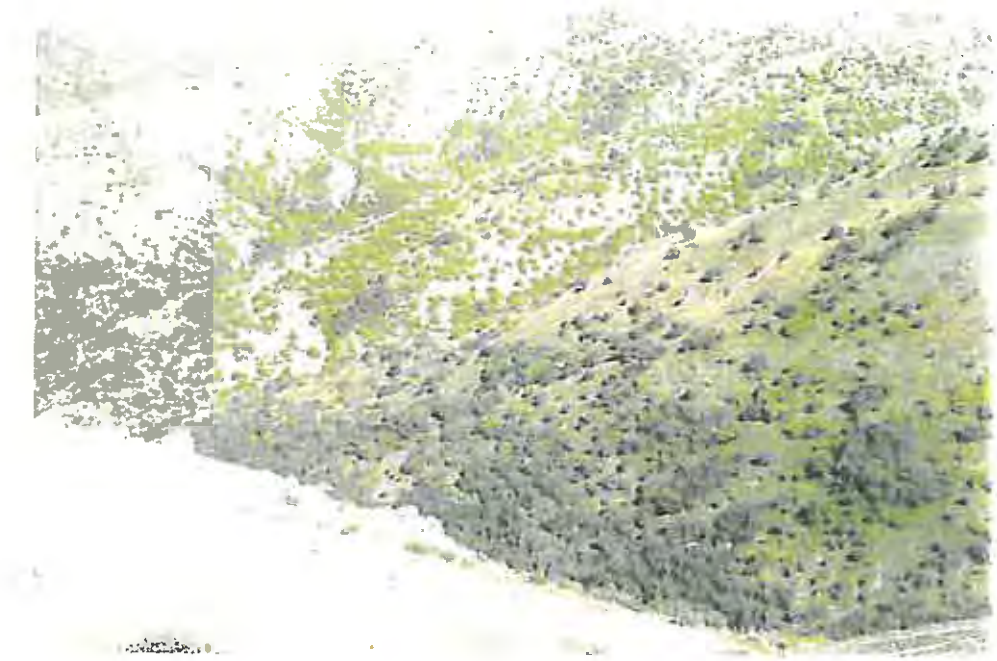
Landscape with high natural landscape values and containing low altitude tall tussock and valley floor wetlands. This area on the southeast side of Top Airstrip Block adjunct to the Chain Hills should be managed for conservation purposes alongside the Hills, adding value through protection of valley floor to mountain top ecosystem sequences, and at a landscape scale.

Looking at the east end of the Rocky Hills block, there are dense native shrublands and wetland seeps in the same gully towards the middle of the photo, as well as a reasonable cover of tall tussock on the basin floor contiguous with that on the Airstrip Block. This area should be part of the conservation area.

The Chain Hills on their mid to lower slopes have a poorer tussock cover but support grey shrublands especially on areas of talus and rock outcrop. View looking south down the Pylon Track route, with Hummock Block on the right.

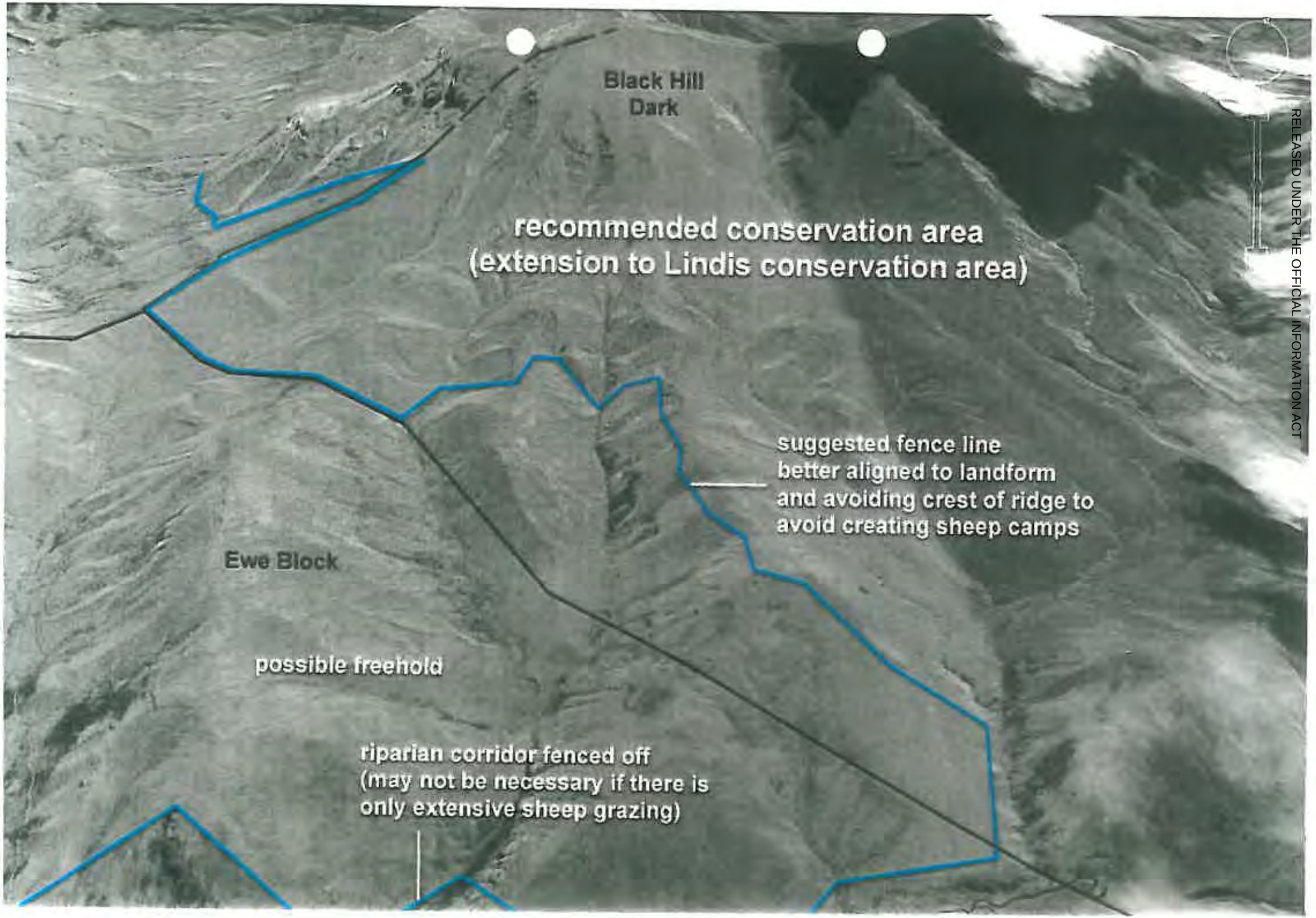
View looking north along pylon track from point just on north boundary of Davie Block. Landscape overall has high level of integrity and although sparse in many places, a homogenous snow tussock cover. This should be protected for its visual qualities as well as lower altitude tall tussock ecosystem (now rare)

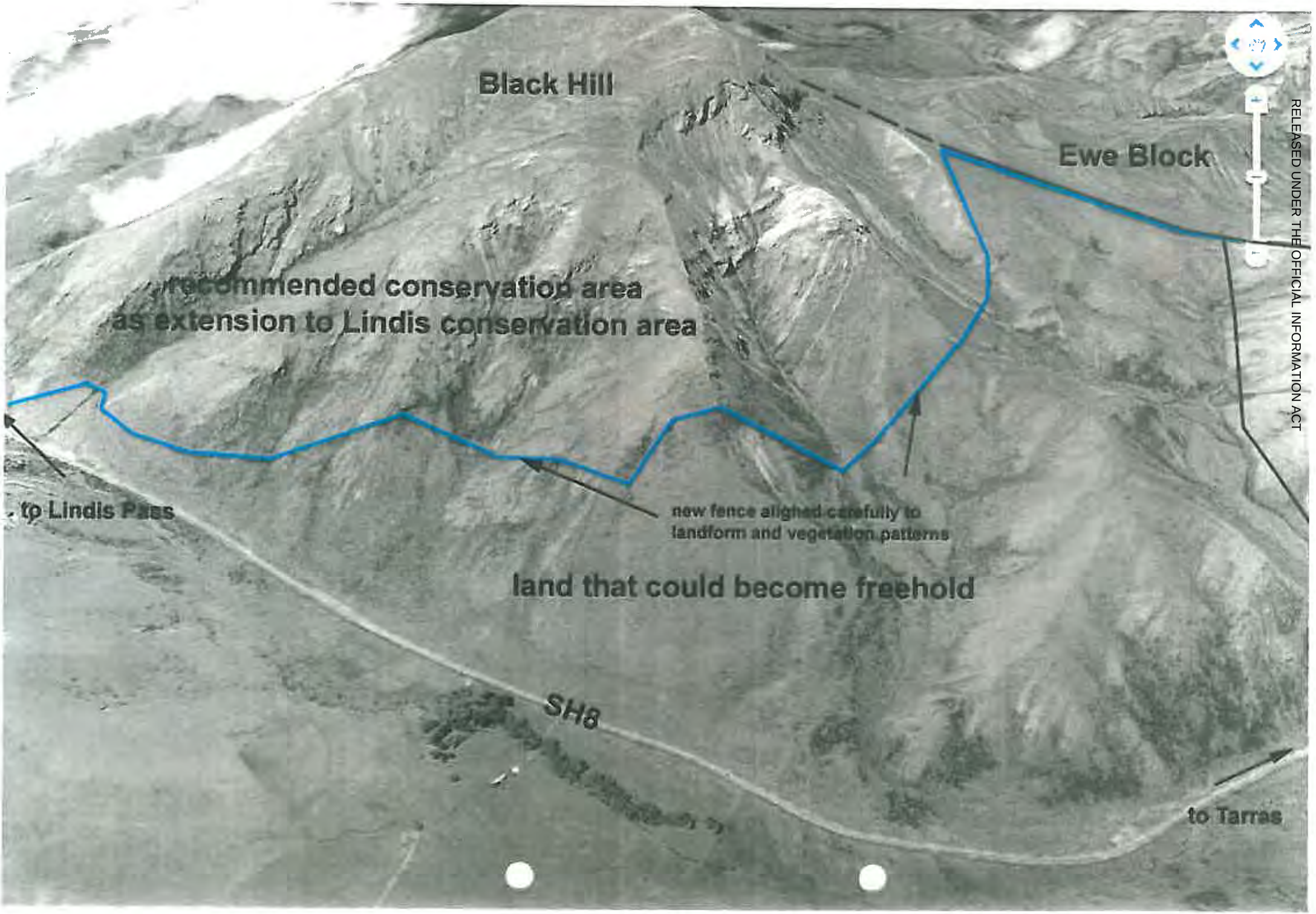
Examples of large patches of grey shrublands on the Chain Hills which are important for their ecological values and their contribution to landscape character and natural appearance.



There are many patches of grey shrubland through the lower more modified country towards the Lindis River. It would be desirable to ensure these shrublands are protected and managed under freehold status so that they are sustained as a viable network of native cover.

Reasonable cover of Tall tussock on the southeast face of G Mars block. This imparts high natural landscape value, and low altitude tall tussock ecosystems are now rare. This area is over the ridge from Farmers Gully which is recommended for full protection as conservation area. It is desirable to maintain this cover and landscape character.





APPENDIX 12

SUBMISSION FOR FOREST AND BIRD, DUNEDIN BRANCH 2011

Forest & Bird
GIVING NATURE A VOICE
Dunedin Branch

MORVEN HILLS

Preliminary Report on the Conservation, Recreation and Historic Values and Recommendations for the Outcome of Tenure Review.

This submission is written on behalf of the **Dunedin Branch of the Royal Forest and Bird Protection Society** which has approximately 1000 members with strong interests in botany and natural history in general and in the High Country. Many of the members enjoy active recreation in the back country and are very aware of the need to ensure the protection of natural values, vegetation and landscape, historical sites and to improve public access through the tenure review process.

In making these recommendations we are mindful of the fact that under the CPLA Section 24 (b), significant inherent values must be protected by the creation of protective mechanisms (e.g. covenants) with a preference to return to full Crown ownership and control.

This submission is made on the basis of an inspection trip in January 2011 and a visit to the historic woolshed with the Goldfields Trust some years ago

We have also consulted the Conservation Resources Report (CRR) done in 2005, the reports on the six Recommended Areas for Protection (RAPs) that lie within the lease and the Conservation Management Strategy (CMS) for Otago.

Introduction

As described in the CRR, the Morven Hills Lease of approximately 14207 ha is situated on the Lindis Pass Road, SH8, and is bounded by SH8, the Lindis Pass Scenic Reserve to the north and west, Dunstan Creek to the east and Geordie Hills and Shirlmar to the south.

The Protected National Areas Programme Survey Report for the Lindis Ecological district identified six areas within Morven Hills for protection; RAPA2 Double Peak, now the Lindis Pass Scenic Reserve, RAPA3 Chain Hills, RAPA4 Dip Creek – Beech, RAPA5 Dip Creek – Totara, RAPA6 Morven Hills, RAPB5 West Chain Hills.

While much of the least is badly degraded partly as a consequence of rabbit infestation over the years many significant inherent values, landscape and ecological are still present within the lease.

Significant inherent values which should be protected.

The CRR of 2005 identified 3 landscape units.

Landscape Unit 1 (LU1) Georges

LU1includes the narrow alluvial flats adjacent to the Lindis River and the narrow band of alluvial surface adjoining Goodger Road. It also takes in the broad upland platform extending to Dip Creek in the north and a further 8-9km to the east.

The unit as a whole has been extensively modified by pastoral activities including oversowing and topdressing.

The faces visible from the Lindis Road near Black Bridge and south of Dip Creek are steep and have extensive rock outcrops. Scattered native shrubland is present in the gullies.

The landscape visible from the SH, smooth undulating ridges and incised gullies, is typical of the Lindis Pass and adds to the enjoyment of the Scenic Drive through to the Pass.

There are some important wetlands scattered through out the unit which need to be afforded some degree of protection, possibly after a survey to classify their importance.

RAP A6, (Farmers Block) the middle and upper reaches of a small tributary of the Lindis River is at the NW of LU1. It is contained by the Farmers Block. The values within RAP A6 are described in the PNAP report as having a good representiveness of important communities. The report notes that the catchment has been "modified by oversowing and topdressing but retains sufficient cover and diversity of native species that it could probably return to a substantially natural condition if appropriately managed'. The landform is said to be 'a representative small catchment incised into plateau, surface characteristic of the Georges land system'. We note that A6 has been an important skink habitat in the past but sadly this may no longer be so.

We believe that RAP A6 should become a Conservation Area together with the part of G Mars which has been identified as having endangered skinks.

Any other sites found to still have endangered skinks should also be protected.

We noted a number of gullies with patches of shrubland as we drove the 4WD track between the airstrips on Wrights and G Mars and we understand that several new sites for threatened Olearia fimbriata have now been found.

Consideration should be given to affording some form of protection by covenants for the most important shrubby areas in the gullies in the middle block, visible from the track beyond the airstrip on the Wrights block (Figure 1).

Overall, we would have no objection to freeholding of most of LU1 **with the exception of Farmers Gully, the part of G Mars block identified as endangered skink habitat and Dip Face and Pass Burn blocks which contain RAP A4, A5** which will be discussed under LU2. The soils in the LU1 area are designated as Class VI, capable of being managed in a way that is ecologically sustainable.

The historic buildings seem already to be protected under the Historic Places Trust designations, including the magnificent woolshed which is still in use.

Landscape Unit 2 (LU2) – Lindis

We could not better the landscape description in the 2005 CRR: '*The large LU2 forms a very distinctive landscape with characteristics analogous with the Lindis Pass Landscape. It is the land north of Dip Creek including the Pass Burn faces, Double Peak and area surrounding the Lindis Pass Scenic Reserve. The unit also takes in the back basins from the crest of the Chain Hills and alluvial valley floor between the Chain Hills and Dip Creek. The boundary with LU1 (Georges) overlaps LU2, as part is within the visual catchment of the Lindis Unit'.*
The dominant characteristics of the unit are smooth colluvial landforms, often no rock outcrop sand dominant tussock cover extending from high altitude to valley floor with varying degrees of integrity. The steep south facing slopes below Double Peak form a complex of ridges and small steep valleys that drain into the north branch of Dip Creek with terraces and alluvial surfaces on the lower slopes. Red tussock and associated plant communities occur in moist alluvial surfaces within upper Dip Creek. The southern face of Dip Creek gorge contains steep colluvial slopes and includes a tiny remnant of Hall's totara and associated shrubland.
Large exposed cliffs within upper Dip Creek, known as Blue Cliffs are a prominent feature at the base of the southern flank of Double Peak.
The Chain Hills faces are characteristically smooth colluvial slopes with a complex of distinctive low hills, knobs, and narrow sharp ridges and spurs. These extend down onto alluvial fans and merge with the valley floor. The hills and ridge formations provide a contrast with the gentle sloping fans and valley floor. The tussock mantle appears 'draped' over the bones of the smooth,

flowing and undulating landform.
Other features characteristic of the steeper slopes of the Chain Hills are localised rock bands, slumping and as some sheet erosion. Above 900 m patches of talus and boulderfields occur associated with mixed shrublands. The talus patches reflect the transition from schist to greywacke and are very prominent on the St Bathans Range in the adjoining catchment to the east. Tussock remains the dominant vegetation throughout LU2 but is highly variable in condition. Tall tussock occurs from ridge to valley floor, but is severely depleted on sunny faces, lower slopes and on the valley floor. Lower hill slopes and alluvial terraces are dominated by short tussock with some inter tussock species, hawkweed and exotic pasture species. Shrubland (predominantly matagouri) is also a significant component of the vegetation pattern on the valley floor with some mixed shrubland that has survived fire and grazing.

There are a number of RAPs within LU2; RAP A2 Double Peak, the western half of RAP A3 Chain Hills, RAP A4 Dip Creek – Beech and RAP A5 Dip Creek – Totara (both on the boundary with LU1), and RAP B5 West Chain Hills.

The visual and scenic values are high with varying degrees of intactness, high aesthetic factors through the visually striking and impressive landforms and the dominant tussock cover. It is a continuation of the iconic Lindis Pass landscape and is vulnerable to landuse changes which could adversely effect the landscape values

RAP A2 in the Black Hill blocks seems to have retained the values mentioned in the PNAP report and we believe that the **Black Hill dark and light blocks should be added to the Lindis Conservation area.** The Back Hill Dark block provides a good altitudinal sequence and includes a stream and associated wetlands present in the valley floor. Steep rock faces border the stream at places. Golden speargrass, matagouri and bouldery talus are plentiful on the slopes above the stream.

While the Dunstan Creek side of RAP A3 still has significant inherent values as stated in the PNAP report, sadly this is not so for the western section of the RAP in the Bluecliffs block, Similarly RAP B5 in the Bluecliffs block has deteriorated. The high Bluecliffs land to the east of the Pylon Track is very degraded and while as Class VIII and VIIIe land it is not capable of sustained pastoral activity and should therefore be returned to the Crown as a Conservation Area, it would take many years for any recovery to occur and continuing plant pest and rabbit control would be needed.

As stated in the CRR in lower Dip Creek '*Contiguous riparian shrublands extend along the course of Dip Creek from its confluence with the Pass Burn, for over three km upstream, with extensions up several tributaries. In parts they are of such density and stature as to be almost impenetrable. Common shrubs include matagouri, mingimingi, Olearia odorata, mountain wineberry and koromiko. Some large matagouri have reached tree proportions. The rare scrambling shrub Carmichaelia kirkii is present sporadically along the length of the shrubland belt. Other lianes are very common and include Parsonsia sp, Muehlenbeckia complexa, and Rubus schmidelioides. Shrub weeds are minor and restricted to briar, gooseberry and in the lowest reaches, elderberry. Similar shrublands are also present in a less contiguous manner on the steep shady slopes on the true right of Dip Creek in damp gullies and in and around bouldery colluvium. The drier lower valley slopes on the true left (Pass Burn Face farm block) have considerable regenerating kanuka along with matagouri and briar'.*

The RAPs in Dip Creek at the western end of the property, RAP A4 Dip Creek – Beech and RAP A5 Dip Creek – Totara, still retain the values noted in the PNAP reports and should become a small Conservation Area with public access available along Dip Creek which should have a realistic riparian strip laid off to protect the wetlands and associated shrublands all the way along the Creek.

There is an existing track at the RAP A2 end of Dip Creek which could also be utilised as an easement for foot and non motorised access.

Landscape Unit 3 (LU3) Dunstan

We were unable to inspect this area but it is well described in the CRR
'*This unit forms a separate catchment on the eastern flank of the Chain Hills that falls within Dunstan Creek in the headwaters of the Upper Manuherikia River. Its natural characteristics are similar to LU2 in respect of the smooth colluvial mountain slopes and dominance of tussock from valley floor to ridge crest. At high altitude, there are slight effects of periglacial features as well as patches of talus. Tall tussock is generally continuous and in better condition than on the western flank of the Chain Hills, particularly at lower altitudes. There is a visible distinction between sunny faces and shady faces with sunny faces showing signs of snow tussock depletion. Hawkweed is also widespread. The openness and scale of the tussock landscape is important.*
The valley floor forms a tributary at the head of Dunstan Creek and includes alluvial valley floor wetlands of high natural character'.

LU3 is part of the Dunstan creek and Upper Manuherikia catchment and landscape and ecological values are high. It is vulnerable to ecologic degradation. It includes the eastern part of RAP A3 which still retains the values described in the PNAP report. This face of the Chain Hills retains intact vegetation sequences from valley floor narrow-leaved snow tussockland up the hill slope into slim snow tussockland and onto the ridge crest summit of the Chain Hills. It also has extensive and diverse wetland communities. It would be an area attractive to both trampers and botanical trampers with foot access up to the ridge crest from the Pylon Road near the SE corner of RAP A2 and perhaps, resulting from other reviews, along Dunstan creek itself.

The whole of LU3 Dunstan should be returned to full crown ownership and control as a Conservation Area

Public access for recreation

It would be highly desirable to have foot and mountain bike access along the whole length of the Pylon Road and perhaps 4WD as well during the summer with the keys to be available on request from DOC. It would also be desirable to have foot and mountain bike access along the existing 4WD track between SH8 north of Sledges Hill round to the Pylon Track.

Historic Sites –

There are a number of historic sites on the lease, well described in the CRR. These include the historic woolshed, the Sheep Dip site located between SH8, the Pass Burn and Dip Creek, gold workings at the junction of the Pass Burn and the Lindis River , a Camp site on the south side of Long Spur Creek at the western end of the gorge, a length of fencing that may date to the 1870s in the NE corner of the lease and Polson's Hut.

All sites except the camp site and the fence are protected under the Historic Places Act, but in addition we suggest that they should be designated as Historic Reserves and fenced off where appropriate. Polson's Hut is already fenced off and probably requires no further protection

Summary of recommendations

1. **Within LU1 there are some important wetlands scattered through out the unit which need to be afforded some degree of protection, possibly after a survey to classify their importance.**
2. **We believe that RAP A6 should become a Conservation Area together with the part of G Mars which has been identified as having endangered skinks**

3. **Overall, we would have no objection to freeholding of much of LU1 with the exception of Farmers Gully, the part of G Mars block identified as endangered skink habitat and Dip Face and Pass Burn blocks which contain RAP A4, A5 .**
4. **Any other sites found to still have endangered skinks should also be protected. Consideration should be given to affording some form of protection to the most important shrubby areas in incised gullies visible for the track beyond the airstrip on the Wrights block.**
5. **Black Hill Dark and Light blocks, which include RAP A2 should be added to the Lindis Conservation area. NB. The Back Hill Dark block provides a good altitudinal sequence down to a stream and associated wetlands present in the valley floor.**
6. **The RAPs in Dip Creek at the western end of the property, RAP A4 Dip Creek – Beech and RAP A5 Dip Creek – Totara, still retain the values noted in the PNAP reports and should become a small Conservation Area with public access available along Dip Creek which should have a realistic riparian strip laid off to protect the wetlands and associated shrublands all the way along the Creek.**
7. **There is an existing track at the RAP A2 end of Dip Creek which could also be utilised as an easement for foot and non motorised access.**
8. **The whole of LU3 Dunstan, the eastern side of the Chain Hills, should be returned to full crown ownership and control as a Conservation Area**
9. **It would be highly desirable to have foot and mountain bike access along the whole length of the Pylon Road and perhaps 4WD as well during the summer with the keys to be available on request from DOC. It would also be desirable to have foot and mountain bike access along the existing 4WD track between SH8 north of Sledges Hill round to the Pylon Track.**
10. **The Historic sites should be designated as Historic Reserves to allow protection worthy of their heritage values.**

We wish to thank the lessee, Richard Snow for allowing us to inspect the lease and for discussions with us.

Janet Ledingham

For the Dunedin Branch of Forest and Bird
PO Box 5793, Dunedin 9010

May, 2011

Figures

Figure 1. Examples of gullies containing shrublands which should be considered for some form of protection by covenant.

Figure 2. Dip Creek looking upstream from near the point where it is crossed by a 4WD track. The creek, associated wetlands and riparian margins need some form of protection.

Figure 3. Wetland for protection adjoining Dip Creek near the crossing point.

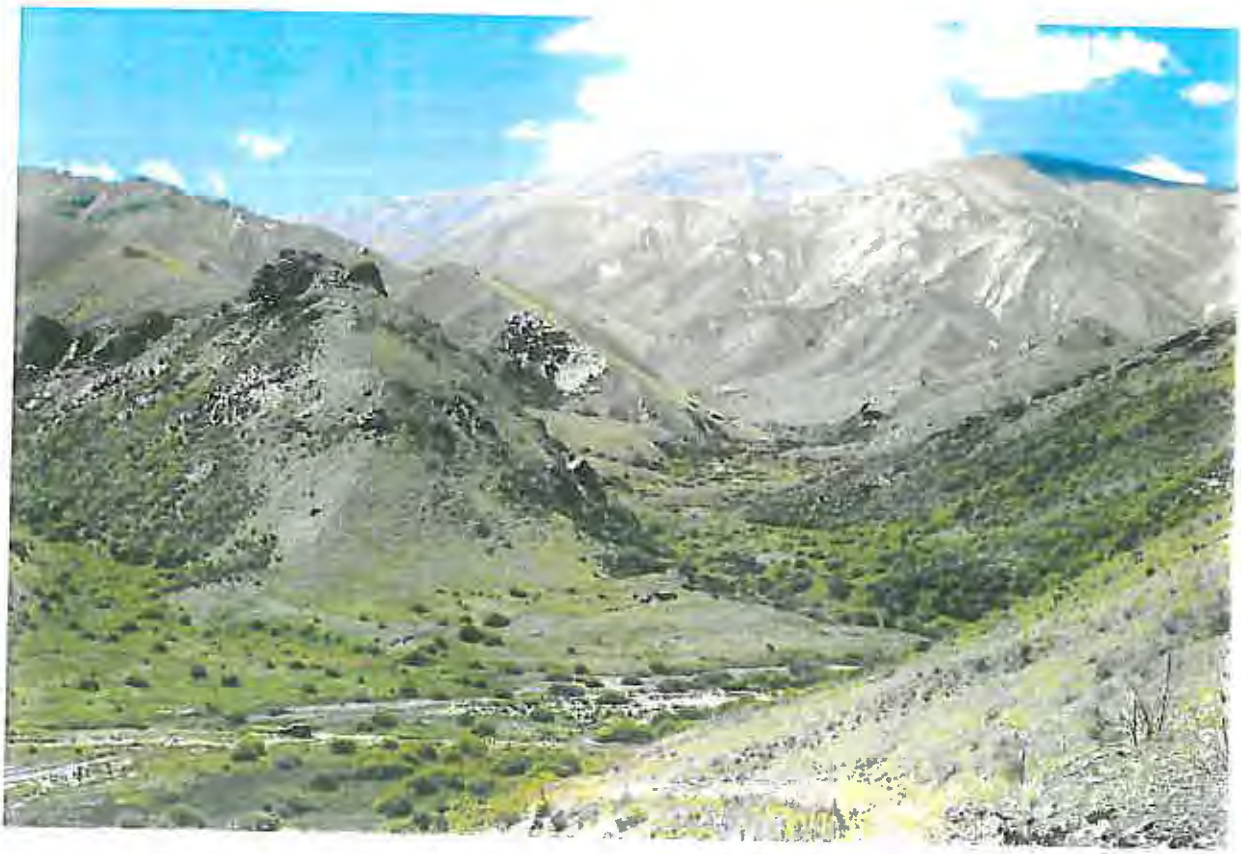


Figure 4. A further view of Dip Creek looking upstream. Note cattle grazing in the middle foreground. Part of an ideal route for walkers through to the Lindis Pass area.

APPENDIX 13

SUBMISSION FROM FEDERATED MOUNTAIN CLUBS 2011

PRELIMINARY REPORT ON THE RECREATIONAL, LANDSCAPE, HISTORIC AND OTHER CONSERVATION VALUES OF, AND RECOMMENDATIONS FOR THE OUTCOMES OF TENURE REVIEW ON MORVEN HILLS

A Report for FMC based on Field Inspection and other research to assist in the Crown Pastoral Lease Tenure Review Process

May 2011

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INTRODUCTION

This report has been prepared following the Early Warning Meeting in September 2010 at which the properties entering the tenure review process in 2010 were introduced. An inspection of the property was carried out by the author of this report in January 2011, with the kind permission and co-operation of the runholder, Richard Snow. This report is based on that inspection and other material listed below. The report is offered as a contribution to the statutory consultation process undertaken by the Department of Conservation.

The purpose of the report is to identify those features, resources and characteristics of this pastoral lease property which are relevant to tenure review and are important from a recreation and conservation perspective. The report will include an examination of the key issues and why they are considered important. The rationale underlying decisions related to the Crown Pastoral Land Act, future land tenure, protection of natural and historic values, and public access will be discussed. The final section of the report will deal with these issues and the recommended outcomes for the tenure review of Morven Hills from a recreation and conservation perspective.

Morven Hills (Po 359) is a large pastoral lease covering just over 14,000ha adjacent to Lindis Pass. The homestead is located on State Highway 8, some 32 km north of Tarras. The property extends from about 500m near the junction of SH8 and Goodger Road to more than 1,600m at the northern end of the Chain Hills, close to Old Man Peak on the Dunstan Range. It is bounded by Shirlmar and Geordie Hills runs to the south, SH 8 and the Lindis Pass Scenic Reserve to the west and north, and by the West Branch of Dunstan Creek (in Dunstan Downs pastoral lease) to the east.

The Pastoral Lease originally entered the tenure review process in 2002 but was subsequently withdrawn before restarting the review again in 2010. A Conservation Resources Report (CRR) was prepared in 2005. That Report stated that *"The recreational potential of Morven Hills derives mostly from its high quality scenic setting, dramatic views and historic associations"*. It is noteworthy that the CRR refers to the recreational potential, rather than its current usage, because access has not always been available despite a power line service road (the Pylon Road) running for more than 15km through the property from SH8 north of Lindis Pass to Goodger Road on the Shirlmar property. This road is closed with locked gates at both ends.

This report focuses on those features of Morven Hills which are important for public recreational interests. It should be noted that while some of this interest focuses on access, which is important, the natural, landscape and historic values and of the place have a fundamental impact on the recreational value of the property and greatly influence the quality of recreational experience enjoyed. It is for this reason that reference is made to these values in this report. The natural and landscape values are outstanding on Morven Hills and will contribute significantly to the enjoyment of visiting this high country run.

No less that 6 Recommended Areas for Protection (RAPs) were recognised during the Protected Natural Area Programme (PNAP) survey of Morven Hills conducted in the 1980s. Many of these areas retain their highly significant inherent values and are worthy of protection by return to full Crown ownership.

Much of the mid altitude country has been developed and is heavily modified by grazing and invasion of weeds such as Hieracium and Briar. There are nevertheless areas of significant inherent natural value and many recreational opportunities to enable people to enjoy those values.

METHODS OF SURVEY AND ASSESSMENT

This report is based on the author's January 2011 field inspection and, in part on information gathered from other sources. These include studies of topographical and Land Use Capability (LUC) maps, consultation with recreational user groups and a knowledge of the landscapes seen from the State Highway 8, Goodger Road and the Chain Hills.

A study of "Outdoor Recreation in Otago" was undertaken by Mason (1989) and published by FMC. Reference is made to this Recreation Plan for Otago below. The Conservation Management Strategy for Otago (1998) and the CRR (2005) have also been used as sources of reference.

GENERAL DESCRIPTION OF MORVEN HILLS 1. LANDSCAPES

Morven Hills pastoral lease (Po 359) covers some 14,000ha and rises from about 500m near the junction of Goodger Road and SH 8, to more than 1,600m in the NE corner of the property at the northern end of the Chain Hills.

There is a good description of the property in the CRR prepared by DOC staff in 2005. That Report identifies 3 landscape units on the property and these will form a useful framework for the current FMC Report. LU 1 covers the lower and mid altitude country in the southern and western parts of Morven Hills, while LU 2 occupies the steeper and higher and more rugged land in the northern and eastern parts of the property, except for the Dunstan face which is identified separately as LU 3.

LU 1 Georges

The majority of LU 1 consists of a broad upland plateau (an old tilted peneplain) rising from about 500m to over 1,100m to the east. It also includes narrow strips of alluvial land beside the Lindis River and Long Spur Creek. The edges of the plateau are sometimes steep, as in the Lindis gorge and are characterized by extensive rock outcrops and spurs. This is an important scenic landscape feature on the tourist highway (SH 8) between Christchurch and Queenstown. Briar, scattered shrubland and depleted short tussock grassland are the dominant vegetation types. The sloping plateau surface is heavily modified through pastoral use and is of relatively low recreation and conservation value. Vegetation on the undulating ridges and spurs includes depleted short tussock, exotic grasses and weeds, particularly Hieracium, and remnants of shrubland including Matagouri and Olearia. Vegetation grades into snow tussock as altitude increases above about 900m. Manuka, Kanuka, grey shrubland and Briar form distinctive vegetation patterns in the upper reaches of incised, rocky gullies which make an important contribution to diversity in an otherwise rather repetitive landscape.

The intactness and significance of the LU 1 landscape was assessed as low while other landscape characteristics, including legibility and aesthetic factors were assessed as medium.

In summary, the plateau landform with smooth undulating ridges and incised gullies is visually interesting and reasonably distinctive, but not striking.

LU 2 Lindis

The more rugged, and generally higher landscape unit LU 2 forms a distinctive landscape with charactreistics related to the Lindis Pass itself. It consists of the land north of Dip Creek including the rugged Pass Burn faces, and Double Peak with the highest peaks reaching above 1,400m. This unit also includes the western faces of the Chain Hills and the lower and undulating country between the Chain Hills and Dip Creek occupied by the electricity transmission line and prominent pylons, generally known as the "Pylon Road"

The dominant characteristics of the unit are colluvial landforms, often without rock outcrops but including extensive areas of eroded bare land especially on the faces below the crest of the Chain Hills.

These patches of talus and boulder fields reflect the west to east transition from schist to the greywacke so characteristic of the St Bathans Range. Dominant vegetation consists of tussock grassland with varying degrees of remaining integrity, extending from high altitude (generally about 1,600m along the Dunstan Crest) to valley floor averaging around 800m. Tussock cover is highly variable in condition – tall tussock occurs from ridge to valley floor but is severely depleted on sunny faces, lower slopes and the valley floor. Shrubland, particularly Matagouri, is a significant component of the vegetation on the valley floor with some mixed shrubland that has survived fire and grazing. The steep south facing slopes below Double Peak form a complex of ridges and small steep valleys which drain into Dip Creek. Red tussock and associated plant communities occur in moist areas in the upper Dip Creek catchment.

Large exposed cliffs (known as the Blue Cliffs) are a prominent feature at the base of the southern flank of Double Peak. The Pass Burn faces from Dip Creek to the Lindis Pass Scenic Reserve are generally north facing. Tussock is diminished on the lower slopes while mixed Briar and native shrubland occur within intervening valleys. Large slumps and sheet erosion are features on the upper slopes.

The legibility, aesthetic factors and significance of LU 2 have been assessed as high (cf LU 1) although its intactness is only medium.

In summary, the Lindis Unit contains very high visual values derived from the distinctive landform patterns and dominant tussock cover from valley floor to ridgeline. The characteristics are similar to the Lindis Pass landscape which is widely recognized as an outstanding NZ iconic landscape.

LU 3 Dunstan Creek

That part of the Dunstan Creek catchment which occupies the eastern flank of the northern Chain Hills is described as Landscape Unit LU 3. Dunstan Creek catchment is part of the Manuherikia drainage system. Natural characteristics of colluvial mountain slopes and dominant tussock are similar to those within LU 2. At high altitude there are some periglacial features and patches of talus consisting mainly of greywacke rock fragments.

Tall tussock is generally continuous and in better condition than on the western flank of the Chain Hills, particularly at lower altitude. There is a visible distinction between sunny and shady faces with the former showing signs of snow tussock depletion. The openness and scale of the tussock landscape is important and complements the remoteness of the Upper Dunstan Creek area (See Fig…….).

Within LU 3 intactness, legibility, aesthetic factors and significance are all classed as high, while vulnerability to ecological degradation is also considered high.

Significance of Landscape Values

Landscape values have been considered in 3 landscape Categories:-
Category 1: Dunstan Creek, Pass Burn faces north of Dip Creek, and the south side of Double Peak and adjoining tussock basins taking in all of LU 2.
Category 2: Shrublands and associated rocky outcrops in deeply incised gullies.
Category 3: The Lindis Pass visual corridor

GENERAL DESCRIPTION OF MORVEN HILLS 2. SOILS AND LAND USE CAPABILITY

The soils within each of the Landscape Units described above are described and discussed in this section. They are grouped in terms of their LUC classification

LUC Class VI land with medium suitability for pastoral use, and which should be capable of being managed in a way that is ecologically sustainable so long as maintenance fertilizer is applied to replenish nutrients removed in animal products (meat and wool).

There is a total of about 7,200 ha of land classified LUC Class VI (including a small area of Class IV land) on Morven Hills. Most of this land (some 4,500ha) is situated in the mid altitude part of the property especially within LU 1, although about 2,400ha occurs in the lower altitude basins and valleys within LU 2, together with a very small area (~300ha) at the lowest altitude within LU 3.

The soils in this class include alluvial soils on valley floors, Yellow Grey Earth Arrow and some Blackstone Hill soils in the mid altitude zone, and very limited areas of High Country Yellow Brown Earth Carrick and Carrick Hill soils at higher altitudes.

Because it is probable that such soils are capable of being managed in a way that is ecologically sustainable, so long as maintenance fertilizer is applied to replenish nutrients removed in meat and wool, they may be suitable for freeholding unless there are overriding conservation interests such as the recognition of Recommended Areas for Protection (RAP's) for example – Lindis RAP 4 and Lindis RAP 5 in Dip Creek and RAP A6 in Farmers Gully.

LUC Class VIIe land with low suitability, and serious limitations for pastoral use. It is most unlikely that this land could be managed in a way that is ecologically sustainable in the long term.

There is a total of some 6,000ha of LUC Class VII land on Morven Hills. Most of this land is classed VIIe where erosion is an actual or potential threat or limitation. This class of land occurs in all three Landscape Units with some 600ha of mainly Arrow soils in River Face block, 1,600ha of Arrow, Carrick and High Country Yellow Brown Earth Dunstan Steepland soils in the Dip Creek catchment. There is also about 200ha of Arrow soils on steep faces within a narrow unnamed catchment running SW from the Top Airstrip block. The largest areas of Class VIIe land are characterized by Dunstan Steepland soils as follows: about 3,000ha in LU2 and LU 3 on both faces of the Chain Hills and some 600ha in Black Hill Sunny and Dark blocks in LU 2.

By definition Class VIIe soils have serious limitations for pastoral use and have problems related to actual or potential erosion. Not only do such soils have limitations for pastoral use but they also only produce small pasture growth responses to applied fertilizer because of climatic limitations on growth potential. This means that it is usually not economic to replenish the nutrients removed in animal products, so nutrient reserves will eventually be run down and vegetation cover depleted so there are real problems in managing the land in a way that promotes ecological sustainability, as required by the Crown Pastoral Land Act (CPLA) 1998. It is therefore, unlikely that such land will be suitable for freeholding and instead it will be important to consider its recreational, conservation and significant inherent natural values.

The higher altitude tussock grasslands can make a significant contribution to water harvesting, The augmentation of natural rainfall by entrapment of water, especially mist and drizzle, by tussock foliage has been shown to be an important 'ecosystem service' value.

LUC Class VIII land which is entirely unsuited to pastoral use, and not capable of being managed in a way that is ecologically sustainable.

Somewhat surprisingly in view of the eroded appearance of much of the highest land on Morven Hills, there is only about 800ha of land that has been recognized as LUC Class VIII. This Classification (Class VIIIe) is due to existing and potential erosion which is visually obvious on the higher parts of the western faces of the Chain Hills

Within the Blue Slip block and Farmers Gully there are about 200ha and 100ha respectively of Class VIIIe Arrow soils. In Black Hill Sunny and on Double Peak there are about 100ha of Dunstan Steepland soils in Class VIIIe on each block. The largest area of Class VIIIe land (some 300ha), characterized by Dunstan Steepland soils occurs, not surprisingly, in the Blue Cliffs block towards the NE boundary of the property.

All this land is entirely unsuited for pastoral use, and cannot be managed in a way which is ecologically sustainable, as required by the CPLA. As an alternative, its recreation and significant inherent natural values should be considered.

RECREATIONAL ACTIVITIES AND POTENTIAL

Despite the existence of a good formed track traversing NE to SW across Morven Hills, relatively little recreational use has been made of this property in the past. In part this has been because of pastoral lease tenure and the need to obtain permission for access. Public access to the Pylon Road is barred by locked gates at both ends, and permission is required to use the track. With the property under tenure review, that situation may be changing in the future and it is therefore appropriate to consider both existing and potential recreational use of Morven Hills.

Morven Hills has been host to occasional commercial 4WD trips and fundraising 4WD excursions. The Otago Goldfields Cavalcades have also been granted permission to use Morven Hills in the past. Private use has been very limited and only a few mountain bike parties have used the Pylon Road from SH8 near Lindis Pass to Shirlmar Station and Goodger Road .

Increasing popularity of mountain bike (MTB) recreation is widening the scope of recreational opportunities where longer journeys on foot were impractical for day trips. There is not only increasing recreational use of MTBs but there is recent interest in creating new cycleways and new opportunities for back country MTB travel. The extensive track network, the appealing landscapes and wide vistas on Morven Hills are likely to become more popular for MTB travel or possibly horse trekking if access is provided through tenure review. The main Pylon Road would provide an excellent MTB route with a remoteness quality despite the ever present pylons and power cables. In a curious way these are almost absorbed into the landscape, perhaps because this is so vast. This would provide a trip of about 15km between the dominating Chain Hills with their peaks stretching up to the ridgeline at about 1,600m, and the mid altitude country described here in the Lindis and Georges Landscape Units.

There are musterers huts in the upper Dip Creek catchment, some 7km in from the locked gate at the northern end. With permission from the property owner, or by negotiation through tenure review, public use of these huts would greatly increase the range of options available for recreation and especially for trampers. For example, a through trip (day walk) might include the northern section of the Pylon Road and a traverse of the Dip Creek gorge with an exit to the SH 8 in the Pass Burn section of the highway. A longer trip, suitable for MTB travel would also include the northern part of the Pylon Track to the huts and thence returning to the Pylon Track before climbing to the top airstrip and finally exiting to SH8 at Dip Creek. .

There is potential for a challenging but rewarding tramping trip involving two traverses of the Chain Hills and the possibility of camping in the remote Dunstan Creek catchment. There is an alluvial flat near the confluence of the two main branches of the Dunstan Creek, with a number of small streams flowing down off the eastern slopes of the Chain hills which should provide good choices for camping areas at less than 1,000m in a remote but relatively sheltered spot.

Hunting, with permission from the runholder, is an existing recreational activity on Morven Hills, with Fallow Deer, occasional Red Deer, and Quail being the main targets.

Although mountain bike riding is likely to be the most popular recreational use of Morven Hills in the future, if the outcomes of tenure review are favourable, the settings would be equally suitable and appealing to horse riders, and for horse trekking activities.

Thus, there is a range of opportunities for active recreation (mountain bike riding, tramping, horse trekking and hunting), but the inherent natural values (especially landscapes, plants and wildlife) also provide subjects for more passive recreation such as photography, painting, botanical study and bird watching.

Probably the best public recreational access to Morven Hills would be from SH 8 on the northern side of the Lindis Pass. This would provide the shortest route to the most attractive parts of the landscape and would avoid any disturbance of the property owner's privacy. It would however, entail arrangements being made for entry through the northern locked gate, and arrangements being made with to use the Pylon Road

Alternative public recreational access (foot, mountain bike or horse) might be negotiated to enable the use the farm tracks which join SH 8 south of Lindis Pass. One or other, or ideally both of the tracks which meet SH 8 in the Pass Burn section of the highway (ie north of the Pass Burn confluence with Lindis River) would be suitable. The northernmost of these tracks meets SH 8 opposite Camp Hill (on Forest Range). Note that this route could involve carrying mountain bikes through part of the Dip Creek gorge where the track is impassable. The more southerly track joins the highway just south of Dip Creek, and would involve a longer route to include the Dip Creek Huts, and a climb to the top airstrip at about 1,000m. Both of these tracks would enable through trips from the northern side of the pass, and through the upper catchment of Dip Creek. A further alternative for public access would be from Goodger Road, using the airstrip track to the top airstrip (at about 1,000m) and out through the Dip Creek catchment to the highway near the Dip Creek bridge.

In summary, it would be ideal if 4 public recreational access routes could be established perhaps as easements where appropriate for use on foot, mountain bike or horse, as follows:- (i) Following the Pylon Road from the locked gate on the northern side of Lindis Pass to the southern locked gate on the Shirlmar boundary, and out on Goodger Road; *about 15 km between the two locked gates.*(ii) From the same starting point, through the upper catchment of Dip Creek to exit to SH 8 opposite Camp hill; *about 13 km from the northern locked gate to the highway opposite Camp Hill.* (iii) From the same starting point, to the Dip Creek Huts and thence up to the top airstrip and out to the highway near the Dip Creek bridge; *about 20km from the northern locked gate to the highway at Dip Creek.* (iv) From Goodger Road to the track leading to both airstrips, and out to the highway near the Dip Creek bridge; *about 20 km from Goodger Road to the highway at Dip Creek.* Note that all these routes are well removed from the homestead and should cause no disturbance of the owner's privacy.

There may be problems in completing negotiations to establish these routes during this tenure review. We understand that there is freehold land between Morven Hills land and Goodger Road so some form of easement (or easements) to cross this land might need to be established outside the tenure review process. It is highly desirable that this be achieved as soon as possible. This would apply to the proposed public recreational use of both the Pylon Road and the farm track up to the airstrip.

The Dip Creek Huts at the head of the Dip Creek gorge in the upper catchment of Dip Creek could be very valuable for recreational users of areas which could become new conservation land. Because of the size of this property and the distances to be travelled to find any kind of shelter in winter, and in the event of adverse weather at other times of the year, shelter here could be invaluable from a safety perspective. Some arrangements should be sought for public use of this well placed accommodation.

SIGNIFICANT INHERENT VALUES AND THEIR IMPORTANCE FOR RECREATION

This report naturally focuses on those features of Morven Hills which are important for public recreational interests. While some of this interest focuses on access, the landscapes of the areas concerned, as well as the natural and historic values, greatly influence the quality of recreational experience enjoyed. It is for this reason that significant inherent natural values, landscape and historical values, access and recreational use are all considered together in this section of the Report.

There is no doubt that the ecological and scenic highlights of Morven Hills are greater in the northern half of the property than in the more modified and lower elevation developed farmland to the south.

The significance of the vegetation on Morven Hills was discussed in the CRR: *"Morven Hills Pastoral Lease contains a wide variety of the ecosystems, communities, plant and vegetation types of the northern part of Lindis Ecological District*

The Lindis Ecological District was surveyed as part of the PNA programme during the summer of 1984/85. The resulting report (Ward et al. 1994) identified 20 RAPs of which six lie entirely within Morven Hills Pastoral Lease.

The most recent (CRR, 2005) evaluation of the inherent values confirms and endorses the RAP descriptions in Ward (1994) indicating their significant inherent value at that time. The areas are briefly described as follows:-

Lindis RAP A2: Double Peak is a 650ha area south of the Lindis Pass Scenic Reserve. The RAP has a much greater effective altitudinal range than the reserve because of the predominance of shady faces. Snow tussockland density and diversity is superior to that within the reserve.

Lindis RAP A3: Chain Hills is 1,230ha encompassing a west-east transect across the northern end of the Chain Hills. The RAP includes a full range of tussocklands including red tussockland and significant mixed shrublands on talus and boulderfields which include celery pine. Celery pine on talus fire refuges is unusual in the Lindis District.

Lindis RAP A4: Dip Creek (Beech) in the gorge of Dip Creek, is a 1ha stand of mountain beech. A recommendation for protection arose from its identification as the south-eastern most, driest outlier of the beech forest remnants characteristic of the north-western Lindis District.

Lindis RAP 5: Dip Creek (Totara), also in the gorge of Dip Creek, is a small stand of Hall's Totara. It is the eastern-most and driest site for Hall's Totara in the District and the only example of Totara on a talus fire refuge in the District.

Lindis RAP A6: Morven Hills is a 330ha area encompassing the middle and upper reaches of a small tributary of the Lindis River. It is a compact area including all the major indigenous ecological features of the Georges land system. It is notable for the good representation of the combination of narrow-leaved snow tussockland with the two main shrubland types: kanuka and matagouri-Coprosma.

Lindis RAP B5: West Chain Hills is a 540ha area adjoining the southern boundary of RAP A3. Although the mid-upper altitude tussockland is in poorer condition than the neighbouring RAP it has superior vegetation at lower altitudes.

The details of the vegetation over wider areas of Morven Hills is comprehensively reported in the CRR and will not be repeated in detail here. Only the following brief summary is presented. The CRR (2005) describes the vegetation in each of 10 vegetation units which are based on topography.
The units are:- Lindis Valley, Long Slip, Manuka Gullies, Western hill country, Lower Dip Creek, Upper Dip Creek, Upper Lindis faces, North-western Chain Hills, Long Spur Creek headwaters, Eastern Chain

Hills. For each of these vegetation units the CRR details the plants present in the following ecological habitats:- Dryland, Wetland, Rock faces, Shrubland, Grassland/Tussockland, and Ridge crests.

The 'ecosystem service' value of the tall tussock grasslands, as for example on the Chain Hills and in the Black Hills Dark block, should not be overlooked. Water is becoming an increasingly valuable resource and the additional moisture harvested by tussock foliage has been shown to make a significant contribution to water collection from the high country.

In this report only the following brief comments are made on vegetation – enough to indicate the likely interest to those enjoying recreation in these areas.

Lindis Valley is generally dominated by exotic grasses and weeds such as briar and Hieracium with areas of cultivated land on the valley floor. Dryland and wetland areas are present with scattered communities on rock faces and shrublands particularly in gullies and lower slopes.

Long Slip is similarly dominated by exotic pasture plants and weeds with some cultivated areas in the valley. Some gullies and lower slopes are characterised by scattered shrublands where briar is a major component.

Manuka Gullies – Kanuka shrubland with associated rock outcrop systems are a feature of this unit, thus presenting a vegetation pattern of greater diversity and interest to visitors.

Western hill country is dominated by fescue and snow tussock grasslands with some shrublands, dryland and wetlands. The area includes RAP A6: Morven Hills, which is representative in that it contains all the major vegetation communities present within the unit. It is strongly recommended that this and other RAPs should become conservation areas through tenure review and would therefore be open for public appreciation and enjoyment. Access could be available to those following the proposed public access route (iii) described in the previous section of this Report. The shortest (but steep) access would be from SH8 near the Dip Creek bridge.

Lower Dip Creek contains examples of shrublands, forest remnants, wetlands, rock outcrop communities and tussock grasslands. As such this represents significant biodiversity and in turn significant botanical interest for visitors. The shrublands are extensive and contiguous in the lowest 3km of the Dip Creek gorge, and extend up some tributary gullies. Two small remnants (one of beech and the other of totara forest) were identified in the PNA Programme and are listed as RAP 4 and 5 respectively. These remnants certainly deserve protection as they are the sole examples of forest remnants on the property. The rock outcrops contain a wide range of species demonstrating significant biodiversity in any one locality and variation with environmental conditions (altitude and aspect) from one locality to another.

Upper Dip Creek includes all the high country around Double Peak (up to 1,400 m) at the 'back' of the Lindis Pass Scenic Reserve. It contains some degraded cushionfields, and extensive tussock grasslands in the form of tall snow tussock on the higher land and short tussock grasslands especially on the lower sunny slopes. The unit also includes some wetlands, shrubland and wetlands so it has significant biodiversity and represents an attractive visual landscape (ranging in altitude from 700m to 1,400m) and a mix of vegetation types which would provide an appealing backdrop for any outdoor recreational activity.

Upper Lindis Faces include the broad north-facing tussock and shrubby slopes stretching up to 1,400m along the Lindis Pass scenic corridor. Although the shrubland includes exotics (notably briar) among the native species this landscape is very important as part of the experience of travelling on such a well used tourist route through one of New Zealand's best known iconic landscapes. If this area is not returned to full Crown ownership (the preferred outcome) then at the very least, all faces from the roadside to summit crest in Sledges Hill and Black Hill Sunny blocks should be included in a binding Landscape Protection Covenant.

North-Western Chain Hills includes the badly eroded faces at the northern end of the Chain Hills to the east of the Pylon Road. The degraded state of this area suggests that a Sustainable Management Covenant prescribing strict conditions for its grazing use (or preferably complete destocking) may be appropriate. The remainder of the unit is dominated by RAPs A3 and B5 which were identified by the PNAP survey consisting of extensive tussock grasslands extending from valley floor (~800m) to ridge crest at 1,600m. The PNAP surveys correctly identified significant inherent values which should be protected and will provide a dramatic backdrop to what will hopefully, become a popular recreational route along the Pylon Road.

Long Spur Creek Headwaters This unit occupies the southwest part of the Chain Hills enclosed by the southern boundary of Morven Hills pastoral lease. It includes intact vegetation sequences from valley floor tussock grasslands to the crest of the Chain Hills, and the community is generally similar to that described for the Western Hill country. The tussock grassland includes a minor component of shrubland with talus slopes and rock outcrops. At lower altitudes the grey shrubland is dominated by Matagouri. This has appeal as a recreational setting because it is largely natural with only minor modification with farming practices.

Eastern Chain Hills This unit also retains intact vegetation sequences which comprise narrow-leaved snow tussock on the valley floor and slim snow tussock on higher slopes. A feature of this unit is the extent and diversity of wetland communities which include flush/seepage systems and valley floor wetlands. This diversity makes the area an inviting setting for traverses across the Chain Hills to Dunstan Creek.

The significance of the vegetation was discussed in the CRR where it was concluded that *"Morven Hills Pastoral Lease contains a wide variety of the ecosystems, communities, plant and vegetation types of the northern part of Lindis Ecological District. Ecosystems reflect both a climatic gradient and the strongly partitioned land systems of the ecological district. The Lindis ED along with the Pisa and Dunstan EDs were surveyed as part of the Protected Natural Areas Programme (PNAP) during the summer of 1984/85. The resulting report (Ward et al. 1994) identified 20 Recommended Areas for Protection (RAPs) of which six lie entirely within Morven Hills Pastoral Lease. The most recent evaluation of the inherent values confirms and endorses the RAP descriptions, but notes extensions to these RAPs which contain similar inherent values."*

This provides support for the significant inherent values of these RAPs which should all be included in the area recommended for return to full Crown ownership as an outcome of this tenure review. It is therefore, recommended that the entire areas of all the RAPs previously identified should become conservation land, to be managed for conservation and recreational purposes. FMC considers that the conclusion quoted above is right and that a wider area should be considered for protection.

On the basis of the inspection carried out in January 2011, and on evidence from both the PNA survey and the more recent CRR (both of which are summarised above), FMC recommends that in addition to the RAPs, the remaining parts of the land north and east of Dip Creek, and all that land east of the Pylon Road (viz. all of Landscape Units LU 2 and LU 3) should be returned to full Crown ownership and control to be managed for conservation and recreation purposes This would include the farm blocks known as Sledges Hill, Ewe Block, Black Hill Sunny and Dark, Bluecliffs, Davis and Dunstan, plus RAP 5 in Farmers Gully.

Because of the scenic value of the iconic Lindis Pass corridor, it is strongly recommended that this area (in blocks Blue Slip, Sledges Hill and Black Hill Sunny should be protected under a Landscape Protection Covenant, even if they are not designated Conservation Land.

HISTORIC VALUES

The best known historic feature of Morven Hills is the impressive stone woolshed which is still in use, more than 150 years since the run was first settled in 1858. The woolshed has an approved Category 1 status Registered by the NZ Historic Places Trust and has 34 blade shearing stands.

The woolshed is just one of a group of historic buildings in the vicinity of the homestead which include shearers quarters, cookshop and schoolroom. The entire site with all its historic buildings should be designated Historic Reserve.

There is a rare example of a nineteenth century stone sheep dip close to the highway bridge over Dip Creek. The site, listed in the NZ Archaeological Association Records (G40/66) consisting of the stone-lined dip itself plus a hut ruin, water race and reservoir, should also be recognised as an Historic Reserve to protect the old dip from destruction by roadworks. This entire site and all the features listed above should be recognised as an Historic Reserve.

The third site of historic significance on Morven Hills is Polson's Hut. This well constructed schist hut was built in the earliest days of settlement of the run by shepherd John Polson and is still in good condition. It was home to Polson and his family who suffered a tragedy when his new-born twin daughters died of exposure in the severe winter of 1869. Ironically, some 30 years later a lignite pit was developed within 300m of this hut. The twins were buried under an old willow which still stands but the grave is now hard to find.

The hut is protected by a wire fence which has been erected for that purpose. Further protection is not currently required as the hut is well maintained and is still in use. Longer term recognition as an Historic Reserve may be appropriate because the property could change ownership, leading to an unknown future for the hut.

A number of gold workings have been identified on Morven Hills and these are described in the CRR. These remains which include tailings, a fireplace, a few chimneys, hut foundations, are not likely to be badly disturbed by normal farm practices or by grazing, so protection may not be required.

All these sites are protected by the archaeological provisions of the Historic Place Act, 1993.

AREAS TO BE PROTECTED

The discussion above suggests that there is a very large area of land in the northern and eastern parts of Morven Hills with significant landscape, natural, and ecosystem service values which deserve protection in terms of the CPL Act 1998. The nature of those landscape and other natural inherent values has been discussed in the previous section including the visual scenic value of the rocky faces overlooking the iconic Lindis Pass corridor through the Pass Burn and Lindis River gorges and valleys.

The first candidates for protection must be the 6 RAPs recognized in the PNA survey conducted in the 1980s and reported in Ward (1994), and endorsed in the CRR (2005). The CRR indicated that the same values present within the RAPs were more widespread and deserved consideration for protection.

The section above on significant inherent values concluded that on the basis of the inspection carried out in January 2011, and on evidence from both the PNA survey and the more recent CRR (both of which are summarised above), all that land north and east of Dip Creek, and all that land east of the Pylon Road (viz. all of Landscape Units LU 2 and LU 3) should be protected.

FMC therefore, recommends that (i) all 6 RAPs identified in the PNA Survey programme, together with (ii) all the remaining parts of the land north and east of Dip Creek, and all that land east of the Pylon Road (viz. all of Landscape Units LU 2 and LU 3) should be returned to full Crown ownership and control to

be managed for conservation and recreation purposes. This would include the farm blocks known as Sledges Hill, Ewe Block, Black Hill Sunny and Dark, Bluecliffs, Davis and Dunstan, plus RAP 5 in Farmers Gully.

We also consider it very important that the scenic value of the iconic Lindis Pass corridor should be protected. It is strongly recommended that the steep rocky faces above the Lindis River and the Pass Burn in the following farm blocks – Blue Slip, Sledges Hill and Black Hill Sunny should be protected under a Landscape Protection Covenant, even if they are not designated Conservation Land.

Recognition of the historic significance of the woolshed, the stone-lined dip at Dip Creek and Polsons Hut would be appropriate, and in particular the designation of Historic Reserve status for the group of historic buildings in the vicinity of the woolshed, and the Dip Creek site is recommended.

ACCESS REQUIREMENTS

In the section on Recreational Use and Potential, four routes for mountain bike, walking, and horse trekking were identified. These were:- (i) Following the Pylon Road from the locked gate on the northern side of Lindis Pass to the southern locked gate on the Shirlmar boundary, and out on Goodger Road, (ii) From the same starting point, through the upper catchment of Dip Creek to exit to SH 8 opposite Camp hill, (iii) From the same starting point, to the Dip Creek Huts and thence up to the top airstrip and out to the highway near the Dip Creek bridge and (iv) From Goodger Road to the track leading to both airstrips, and out to the highway near the Dip Creek bridge. Note that all these routes are well removed from the homestead and should cause no disturbance of the owner's privacy.

There is a strip of freehold land adjacent to Goodger Road which would need to be crossed in order to complete two of the recommended routes. We appreciate that access across this land is outside the terms of reference of this tenure review but submit that strenuous efforts should be made to resolve this issue as soon as possible.

FMC recognizes that there is great scope for public recreational enjoyment of the landscapes and natural values of the Chain Hills and Lindis Pass area if public access is provided through Tenure Review. Significant parts of the four routes described above will hopefully be included within new Conservation Land. It is strongly recommended that public access easements for use on foot, or bike or horse should be negotiated over those parts of the above routes which will become freehold.

OTAGO CONSERVATION MANAGEMENT STRATEGY

The Otago Conservation Management Strategy has recognised the Hawea- Lindis area as one of 41 Special Places in Otago. DOC has recognised one of the management issues in this areas as the need to protect representative natural areas recognised in the Lindis PNA survey. Another recognised issue was the preservation and rehabilitation of the natural scenic values of the Lindis Pass highway corridor. The objectives stated for this Special Place included *"To achieve permanent protection for areas of significant nature conservation interest in this area"*.

Implementation methods for this area included *"Negotiation opportunities presented by pastoral lease tenure review or land exchanges on the large pastoral runs in the area, or Crown land allocation opportunities will be taken with a view to*: [inter alia]

- *Protecting areas of significant nature conservation value,*
- *Improving public access,*
- *Protecting landscape qualities in the area, particularly those of the visual catchments visible from State Highways.*

It is clear from these public statements that DOC is committed to achieving many of the same objectives as are included in this Report. Tenure Review presents an important opportunity to advance those objectives.

ISSUES AND RECOMMENDATIONS

In this section, the resources described above, and the issues and options for their future management and allocation between freehold disposal and public interests are discussed in relation to the Crown Pastoral Land Act, 1998. The issues and recommendations are presented in sections related to Section 24 of the Act as follows:-

S24 (a) (i) To promote the management of reviewable land in a way that is ecologically sustainable
S24 (b) (i) To enable the protection of significant inherent values of reviewable land by the creation of protective mechanisms
S24 (b) (ii) To enable the protection of significant inherent values of reviewable land (preferably) by the restoration of the land concerned to full Crown ownership and control
S24 (c) (i) The securing of public access to and enjoyment of reviewable land [including recreation] *and*
S24 (c) (ii) The freehold disposal of reviewable land

S24 (a) (i) To promote the management of reviewable land in a way that is ecologically sustainable

The soils and the Land Use Capability (LUC) Classification of Morven Hills have been considered carefully. Arguments have been presented as to why LUC Class VIIe land cannot be managed in a way that is ecologically sustainable without the replenishment of nutrient reserves depleted by removal in animal products (meat and wool) and through historical burning.

Rather less than half of the property (48%), mainly in the northern and eastern sectors, is situated above 1,000m and is characterised by LUC Class VIIe or Class VIII land which we have argued is not capable of being managed *"in a way that is ecologically sustainable"*. Some of this land has highly significant inherent value and should be returned to full Crown ownership.

However, there is also a large area of land above 1,000m classified LUC Class VIIe and VIII on both flanks of the Chain Hills which is almost certainly not capable of being managed in a way that is ecologically sustainable (as discussed above) but which does not have significant conservation value either. It may be more appropriate to consider the designation of a Sustainable Management Covenant (as provided for in s. 97 of the CPL Act 1998) over this land with conditions to minimize future erosion by destocking the entire area of Morven Hills land on the Chain Hills.

S24 (b) (i) To enable the protection of significant inherent values of reviewable land by the creation of protective mechanisms

Environmental NGOs generally agree with the preference expressed in the CPL Act *for "protection of significant inherent values of reviewable land (preferably) by the restoration of the land concerned to full Crown ownership and control."* However, there are some discrete areas which may be suitable for protection under conservation covenant *("protective mechanism")*. The steep and largely unproductive faces overlooking the Lindis Pass Scenic Corridor between the Scenic Reserve at the Lindis Pass summit and the confluence of Dip Creek with the Lindis River is a case in point. It may be appropriate to protect these areas under a landscape Protection Covenant.

S24 (b) (ii) To enable the protection of significant inherent values of reviewable land (preferably) by the restoration of the land concerned to full Crown ownership and control

There are significant areas on Morven Hills where the significant inherent natural values have been

recognised since the PNA programme of inspections carried out in the 1980s. In the Section above dealing with Significant Inherent Values, 6 individual areas totalling 2753ha were identified as RAPs. This recognition was confirmed in the previous phase of tenure review (2005) and should now be recognised by designating this area for return to full Crown ownership and control.

The CRR recognised that the values identified in the RAPs were more widespread. FMC has indicated above that the entire areas on Landscape units LU 2 and LU 3 should be returned to full Crown ownership and control to be managed for conservation and recreation purposes. It should be noted that an exception to this has been suggested where a Sustainable Management Covenant over the more severely eroded parts of the Blue Cliffs block may be more appropriate.

S24 (c) (i) The securing of public access to and enjoyment of reviewable land [including recreation]

There are four potential access points have been identified to the 14,000ha area of Morven Hills. None one of these are currently available for public access, and both ends of the Pylon Road are barred by locked gates. Proposed new conservation land must be accessible to the general public. Because of the scale and size of this property and its potential value for recreation (especially MTB use) public access is essential to satisfy the requirements of the CPL Act. It is recommended that four access points should be established and that easements should provide for public access on foot, or bike or horse over the four routes described in the Recreation Section above. It should be noted that these routes are well away from the homestead and should cause no disturbance of the property owner's privacy.

Access over freeholod land adjacent to Goodger Road will need to be established outside this tenure review, but needs to be achieved without delay.

It is therefore recommended that strenuous efforts be made to negotiate public access over the Pylon Track and the sections of farm tracks described above

S24 (c) (ii) The freehold disposal of reviewable land

Freehold disposal of reviewable land follows as a logical consequence of the identification of those parts of Morven Hills which have been assessed to be capable of being managed *"in a way that is ecologically sustainable"*.

Accordingly, it is recommended that land below about the 1,000m contour line generally within LU 1 should be suitable for freehold disposal to the runholder.

CONCLUSIONS AND RECOMMENDATIONS

1. It is noteworthy that the CRR for Morven Hills refers to the recreational potential, rather than its current usage, because access has not always been available despite the Pylon Road running for more than 15km through the property from SH8 north of Lindis Pass to Goodger Road. This road is closed with locked gates at both ends.

2. The natural and landscape values are outstanding on Morven Hills and will contribute significantly to the enjoyment of visiting this high country run.

3. No less that 6 RAPs were recognised during the PNA survey of Morven Hills conducted in the 1980s. Many of these areas retain their highly significant inherent values which were endorsed in the CRR (2005) and are still worthy of protection by return to full Crown ownership.

4. There is a good description of the property in the CRR (2005). That Report identified 3 landscape units on the property which have been used as a framework for the this Report. LU 1 covers the lower and mid

altitude country in the southern and western parts of Morven Hills, LU 2 occupies the steeper and higher and more rugged land in the northern and eastern parts of the property, except for the Dunstan face which is identified separately as LU 3.

5. LU 1, with smooth undulating ridges and incised gullies, is visually interesting and reasonably distinctive, but not striking.
LU 2 contains very high visual values derived from the distinctive landform patterns and dominant tussock cover from valley floor to ridgeline. The characteristics are similar to the Lindis Pass landscape which is widely recognized as an outstanding NZ iconic landscape
Within LU 3 intactness, legibility, aesthetic factors and significance are all classed as high, while vulnerability to ecological degradation is also considered high.

6. There is a total of about 7,200 ha of land classified LUC Class VI on Morven Hills. Most of this land is situated in the mid altitude part of the property especially within LU 1. This land should be capable of being managed in a way that is ecologically sustainable so long as maintenance fertilizer is applied to replenish nutrients removed in animal products, and through historical burning.

7. There is a total of some 6,000ha of LUC Class VII land with low suitability and serious limitations for pastoral use on Morven Hills. Most of this land is Class VIIe where erosion is an actual or potential threat or limitation. It is most unlikely that this land could be managed in a way that is ecologically sustainable in the long term.

8. Surprisingly in view of the eroded appearance of much of the highest land on Morven Hills, there is only about 800ha of land that has been recognized as LUC Class VIII. This land is entirely unsuited to pastoral use, and not capable of being managed in a way that is ecologically sustainable as required by the CPL Act. As an alternative, its recreation and significant inherent natural values are important.

9. Although mountain bike riding is likely to be the most popular recreational use of Morven Hills in the future, if the outcomes of tenure review are favourable, the settings would be equally suitable and appealing to horse riders, and for horse trekking activities. There is a range of opportunities for active recreation (mountain bike riding, tramping, horse trekking and hunting), but the inherent natural values (especially landscapes, plants and wildlife) also provide subjects for more passive recreation such as photography, painting, botanical study and bird watching.

10. There are musterers huts in the upper Dip Creek catchment, some 7km in from the locked gate at the northern end. With permission from the property owner, or by negotiation through tenure review, public use of these huts would greatly increase the range of options available for recreation, especially for trampers, and would provide shelter in emergencies

11. It would be ideal if 4 public recreational access routes could be established perhaps as easements where appropriate for use on foot, mountain bike or horse, as follows:- (i) Following the Pylon Road from the locked gate on the northern side of Lindis Pass to the southern locked gate on the Shirlmar boundary, and out on Goodger Road, (ii) From the same starting point, through the upper catchment of Dip Creek to exit to SH 8 opposite Camp hill, (iii) From the same starting point, to the Dip Creek Huts and thence up to the top airstrip and out to the highway near the Dip Creek bridge, (iv) From Goodger Road to the track leading to both airstrips, and out to the highway near the Dip Creek bridge, Note that all these routes are well removed from the homestead and should cause no disturbance of the owner's privacy.

12. The 'ecosystem service' value of the tall tussock grasslands, as for example on the Chain Hills and in the Black Hills Dark block should not be overlooked. Water is becoming an increasingly valuable resource and the additional moisture harvested by tussock foliage has been shown to make a significant contribution to water collection from the high country.

13. Three sites of historic significance have been recognised on Morven Hills. These are the historic 1873 Woolshed and surrounding complex of original farm buildings, the stone-lined sheep dip near the Dip Creek bridge, and Polson's Hut. Designation as Historic Reserve sites should be considered for these significant reminders of pastoral history.

14. FMC recommends that (i) all 6 RAPs identified in the PNA Survey programme, together with (ii) all the remaining parts of the land north and east of Dip Creek, and all that land east of the Pylon Road (viz. all of Landscape Units LU 2 and LU 3) should be returned to full Crown ownership and control to be managed for conservation and recreation purposes.

15. It is very important that the scenic value of the iconic Lindis Pass corridor should be protected. It is strongly recommended that the steep rocky faces above the Lindis River and the Pass Burn in the following farm blocks – Blue Slip, Sledges Hill and Black Hill Sunny should be protected under a Landscape Protection Covenant, even if they are not designated Conservation Land.

16. Four routes for mountain bike, walking, and horse trekking have been identified. These are:- (i) Following the Pylon Road from the locked gate on the northern side of Lindis Pass to the southern locked gate on the Shirlmar boundary, and out on Goodger Road, (ii) From the same starting point, through the upper catchment of Dip Creek to exit to SH 8 opposite Camp hill, (iii) From the same starting point, to the Dip Creek Huts and thence up to the top airstrip and out to the highway near the Dip Creek bridge and (iv) From Goodger Road to the track leading to both airstrips, and out to the highway near the Dip Creek bridge. All these routes are well removed from the homestead and should cause no disturbance of the owner's privacy.

17. It is clear from public statements in the Otago CMS that DOC is committed to achieving many of the same objectives as are included in this Report. Tenure Review presents an important opportunity to advance those objectives.

ACKNOWLEDGEMENTS

FMC is grateful for assistance from the Contractor, Opus International Consultants, for arranging permission to inspect Morven Hills, and to the runholder, Richard Snow in making the assessment possible. Permission for access and use of farm tracks was freely given and assistance was offered in making the choice of the most appropriate route for our inspection.