

Crown Pastoral Land Tenure Review

Lease name : CORA LYNN

Lease number : PC 116

Conservation Resources Report

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

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

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

October

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CORA LYNN PASTORAL LEASE



CONSERVATION RESOURCES REPORT

DEPARTMENT OF CONSERVATION

OCTOBER 2006

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PART 1 INTRODUCTION

Cora Lynn Pastoral Lease is a 2043 ha property located on the lower north and east slopes of the Black Range in the upper Waimakariri valley in North Canterbury. It covers moderately-steep to steep slopes on the lower flanks of the Black Range and Mt Horrible, and flat to gently-sloping fans and terraces alongside the Waimakariri and Cass rivers. The property ranges in altitude from 550 m at the confluence of the Waimakariri and Cass rivers to 1234 m on the summit of Mt Horrible.

The northern part of the property is drained by the Waimakariri River and its tributaries, notably the lower reaches of Bruce Stream and Broad Stream. The eastern part of the property is drained by the Cass River and its tributaries, notably the lower reaches of McLeod Stream, Snowslide Stream and Misery Stream. The Cass River flows into the Waimakariri River. Access to Cora Lynn Pastoral Lease is from the West Coast Road (State Highway 73), which runs through the northern part of the property. Access to the homestead, farm buildings and the Arthur's Pass Wilderness Lodge is via Cora Lynn Road.

The western part of Cora Lynn Pastoral Lease, on the Bruce Stream and Broad Stream fans, lies in the Arthur's Pass Ecological District (ED), within the Hawdon Ecological Region (ER). The central part of the property, on the Black Range and Mt Horrible, lies in the Craigieburn ED. The eastern part of the property, in the lower Cass valley, lies in the Cass ED. The Craigieburn and Cass EDs are within Puketeraki Ecological Region (McEwen, 1987). The Craigieburn and Cass EDs were surveyed in the late 1980s as part of the Protected Natural Areas Programme. One area on the property, covering the north flank of Mt Misery, Mt Horrible and part of the lower Cass Valley (Cass RAP 14: Betwixt) was recommended for protection by that survey (Shanks *et al.*, 1990). The bed of the Waimakariri River adjacent to the property is listed as a Significant Site of Wildlife Interest (SSWI) and a Wetland of Ecological and Representative Importance (WERI).

Cora Lynn Pastoral Lease adjoins Craigieburn Conservation Park (Conservation Land Unit K34002) to the south on the Black Range, Bealey Spur Conservation Area (K34012 and K34013) across Bruce Stream to the west, Waimakariri Riverbed Conservation Area (K34011) to the northwest, Arthur's Pass National Park (K33011) across the Waimakariri River (UCL) to the north, Hawdon Flats Government Purpose Reserve (K33012) across the Waimakariri River to the northeast, and Corner Knob and Goldney Hill Government Purpose Reserve (K34007) at Goldney Saddle. Mt White Pastoral Lease lies northeast of the property on the northern side of the Waimakariri River. Grasmere Station, a University of Canterbury lease, adjoins the property to the east across the Cass River.

The tenure review inspection of the property was undertaken during October and November 2005, and January and March 2006 by a range of specialists. These specialists' reports (listed below) form the basis of this Conservation Resources Report.

- Cora Lynn Pastoral Lease Landscape Assessment, Alan Petrie, November 2005, 9p + photos + map.
- Cora Lynn Vegetation Report, Mark Davis, April 2006, 23p + maps.
- Assessment of the Fauna Values of Cora Lynn Pastoral Lease, Jane Sedgely, April 2006, 19p + maps.
- Cora Lynn Pastoral Lease, A Report on the Aquatic Fauna Surveys, Scott Bowie, May 2006, 18p including photos + maps.
- Cora Lynn Pastoral Lease Tenure Review Invertebrate Survey, Warren Chinn, February 2006, 8p + photos + maps + appendices.

Subsequent to the survey being completed part of the Corner Knob and Goldney Hill Government Purpose Reserve has been included as part of the tenure review of Cora Lynn Pastoral Lease.

Insert topo map here

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

2.1 LANDSCAPE

2.1.1 Landscape Context

Cora Lynn Pastoral Lease is located in the upper Waimakariri River valley and the adjoining Cass River basin. These two valleys are separated by a chain of high peaks that form the eastern end of the Black Range. The mountains of the Black Range typically have a pyramidal form, extensive stable screens, deep eroding chutes and areas of exposed rock. The vegetation pattern is strongly influenced by climate, natural weathering and fire history. The main structural components of the property are the interlocking fans spreading into the Waimakariri Valley, the central axis of high peaks including Mt Horrible, the hummocky terrain of the Corner Knob-Goldney Saddle area and the gentle floor of the Cass River valley.

The West Coast Road (State Highway 73) bisects part of the property and provides a sequence of panoramic and enclosed views of the property and the surrounding country. The property is part of an area identified by the Canterbury Regional Landscape Study (Boffa Miskell Limited and Lucas Associates, 1993) as regionally outstanding, based on the following attributes:

- Containment of the Waimakariri basin within majestic mountains.
- Dominance of natural elements, patterns and processes in many areas.
- Open simplicity of the basin floors.
- Landform variety.
- Subtle colours and textures.
- Contribution of native cover and the vast open riverbeds.
- Accessibility of the area and its recreation/tourism significance to road and rail users.

2.1.2 Landscape Description

For the purposes of this landscape assessment Cora Lynn Pastoral Lease is divided into five landscape units, principally based on aspect, landform and land use. The criteria used to assess and evaluate the landscape values of each unit are based on the following attributes:

- Naturalness: an expression of the indigenous content of the vegetative cover and the extent of human intervention.
- Legibility: an expression of the clarity of the formative processes and how striking these processes are.
- Aesthetic value: the memorability and naturalness of the area, including factors which can make a landscape vivid, such as simplicity in landform, muted colours and fine-textured ground cover.
- Visual values: a sub-set of landscape values which relate to the visibility of a particular landscape or natural feature as seen from public vantage points.

Unit 1, Waimakariri Valley Flats

This landscape unit comprises the coalescing alluvial fans formed from the outwash gravels of Bruce and Broad streams, and the lower hill slopes adjacent to these fans. The fans merge with the open gravel bed of the Waimakariri River and are bisected by the West Coast Road.

The fans have been subdivided into several paddocks, some of which are cultivated. A row of trees extend in a north-south direction from the toe of the fan along Cora Lynn Road to the farm buildings at the top of the fan. Paddocks at the lower edge of the fan adjoin areas of mature matagouri shrubland adjacent to the Waimakariri River. The steeper terrain on hill slopes to the south supports a mixture of regenerating shrubland, grassland and patches of strongly regenerating mountain beech forest. These pockets of beech forest surrounded by grassland convey parkland qualities. A prominent area of planted Douglas fir forest is present on the flanks of Mt Bruce, just southwest of the property. The small western part of the property on the river flats between Bruce Stream and the Bealey Hotel supports grassland and a substantial infestation of broom.

The homestead, farm buildings, stockyards and Arthur's Pass Wilderness Lodge are on a block of privately-owned land within this landscape unit.

Landscape Values

The large fans have moderate inherent landscape values, principally due to the extent to which the original ground cover has been modified. However, the fans have moderately high aesthetic value owing to the striking contrast between the near-horizontal plane of the fans and the steep adjoining hill slopes. The difference between the lighter colour and finer texture of the grasslands on the fans and the darker colour and coarser texture of the surrounding steeper terrain is a memorable feature of this unit. The extensive matagouri shrubland that borders the Waimakariri River forms a transition from the exposed alluvial gravels to the adjoining farmland. The hill slopes possess moderate landscape values principally due to the disjointed mosaic of vegetation that has been strongly influenced by human intervention.

Potential Vulnerability to Change

Land uses that have the potential to adversely affect this unit are:

- Further loss of beech forest by fire.
- Loss of matagouri shrubland along the margins of the Waimakariri River.
- Introduction of plantation forestry or shelterbelts.
- Erection of structures on the fans.
- Unsympathetic earthworks on the hill slopes.
- Spread of woody weeds such as gorse, broom and wilding pines.

Unit 2, Mt Horrible Faces

This unit covers the northwest and southern slopes of Mt Horrible, overlooking the Waimakariri River and Pylon Gully. The slopes are constantly steep with small ledges and hummocky terrain, but no deeply incised gullies. Vegetation on the northern slopes of Mt Horrible is highly modified, having been almost entirely burnt by wildfire in 2001. Charred remnants of shrubland and forest are scattered across these slopes. The southern (Pylon Gully) slopes support dense mountain beech forest and scrub. Power lines on pylons follow the southern property boundary through Pylon Gully.

Landscape Values

The north-facing slopes within this unit have moderate inherent landscape values owing to the extent to which the original ground cover has been modified and fragmented. However, landform dominates over land cover and land use in this unit, and the northern flanks of Mt Horrible are a distinctive landmark when traveling east from Arthur's Pass. The south-facing slopes have moderately high inherent landscape values attributable to the extent of beech forest and scrub. The

lower margins of this forest in Pylon Gully are modified by the presence of the pylon line and vehicle track. This unit possesses significant visual resource values.

Potential Vulnerability to Change

Land uses that have the potential to adversely affect this unit are:

- Further loss of beech forest and high altitude scrub and shrubland.
- Subdivision and/or changes in land use that would fragment vegetation on the prominent northern slopes.
- Unsympathetic earthworks that would be conspicuous from the state highway.
- Erection of structures (e.g. communication installations) at prominent sites.

Unit 3, Central Cass River Valley

This unit encompasses the central eastern part of the property in the Cass River valley. It includes the distinctive Corner Knob, the eastern flanks of Mt Horrible, and the broad terraces and flats of the Cass valley. The eastern flanks of Mt Horrible dominate the unit, with the upper slopes featuring areas of steep rock. Lower down the terrain is undulating or flat with valley-floor wetlands, terraces and fans.

The ground cover is a mosaic of modified grassland, successional shrubland and pockets of strongly-regenerating beech forest. Much of this unit was affected by the 2001 fire, especially the eastern flank of Mt Horrible. A large proportion of the unit supports modified grassland, though shrubland and forest are rapidly regenerating on the hummocky terrain near Corner Knob. Relatively extensive areas of rushland are present in wetlands, notably in Misery Swamp. Patches of gorse are present near Misery Swamp, and extensive infestations of gorse and broom are present on and east of the bed of the Cass River. One low terrace near the Cass River has been recently cultivated.

Landscape Values

This unit possesses moderate inherent landscape values due to the fragmented nature of the vegetation. The loss of the natural transition zones and the convoluted edges of the beech forest compromise the natural character of this unit. These traits have been compounded by recent wildfire. However, landform dominates over land cover and land use, and the distinctive summits of Mt Horrible and Corner Knob are important natural features visible from State Highway 73. The landscape values of the wetlands are compromised by their isolation within more modified vegetation.

Potential Vulnerability to Change

Land uses that have the potential to adversely affect this unit are:

- Disruption of the natural regeneration of post-fire shrubland and forest.
- Further fragmentation of beech forest remnants.
- Further infestations of woody weeds.
- Erection of structures at prominent sites.

Unit 4, Lower Cass Valley

This unit covers the small hill east of Goldney Saddle in the lower Cass River valley. It is bound by the Waimakariri River, the lower Cass River, the highway and the straight-line boundary of the Corner Knob and Goldney Hill Government Purpose Reserve. It supports low-stature manuka shrubland, grassland and a small patch of beech forest. Grassland is more prevalent on the sunnier slopes overlooking the Waimakariri River. There is a wide scattering of tauhinu and matagouri, and occasional sedgeland communities in small flushes. Gorse is present but has been contained by weed control.

Landscape Values

This small landscape unit possesses high inherent values, as it is a prominent landmark close to higher mountains. In geomorphic terms, the hillock has formative process significance due to the fact that it juts out into the Waimakariri valley forcing the river to physically change direction. It has an overall appearance of naturalness and has significant visual resource values.

Potential Vulnerability to Change

Land uses that have the potential to adversely affect this unit are:

- Erection of structures at prominent sites.
- Further spread of woody weeds, including wilding pines.
- Disruption of the natural regeneration of shrubland and forest.

Unit 5, Upper Cass River Valley

This unit covers the southern part of the property in the upper Cass River valley. It comprises the lower southeast slopes of Mt Misery. These slopes are an important component of the V-shaped valley that encloses the Cass River. They are typified by an alternating pattern of straight-sided slopes and eroding gullies. Pockets of beech forest extend down to the margins of the Cass River, while the balance of the unit supports grassland and shrubland. The popular Cass-Lagoon Saddle walking route follows the Cass River at the property boundary.

Landscape Values

This unit conveys high inherent landscape values due to the overall sense of naturalness. A distinctive feature is the legibility of the natural weathering of the slopes. These natural processes have formed distinctive landscape patterns. The coherent vegetation cover contrasts with that lower down the Cass River valley. The unit possesses remote and semi-wilderness qualities due to the absence of structures and lack of intensive land uses.

Potential Vulnerability to Change

Land uses that have the potential to adversely affect this unit are:

- Reduction in the extent of beech forest.
- Spread of opportunist exotic species, such as gorse and holly, which are present in the area.
- Erection of structures.

2.1.3 Visual Values

Cora Lynn Pastoral Lease has significant visual resource values and makes a major contribution to the part of the upper Waimakariri catchment that was identified as outstanding in the 1993 Regional Landscape Study. The visual values of the property relate to the views obtained from sections of the West Coast Road, specifically:

- Travelling north towards Goldney Saddle: When approaching Cora Lynn from the south the surrounding landforms on the property, especially Mt Horrible, make an important contribution to the setting of the upland basin that includes Lake Grasmere. Nearing the property, the highway is positioned on flat terrain in the centre of the basin with Corner Knob forming a distinctive landmark at the end of a long straight. The surrounding landscape elements include the basin floor, the convoluted edges to the beech forest and pyramidal-shaped mountains. The visitor experiences a sense of openness within a mountainland setting.
- Goldney Saddle: When approaching this saddle the visitor is aware of a change in elevation and direction with the highway ascending to the saddle before descending again to the valley floor. Goldney Saddle is strategically important as it forms the abrupt change in direction of the highway (and the Midland Railway Line) from the Lake Grasmere basin into the Waimakariri River valley. This change in direction is a memorable experience for visitors.

- Travelling east towards Goldney Saddle: When travelling from the West Coast to Christchurch, the property provides the visitor with expansive views of the Waimakariri River valley due to the shallow formation of the alluvial fan that spreads out over the valley floor. There are no intervening landforms to impede distant views that extend across towards the Hawdon River flats. The distinctive grey-olive green of the forest and exposed river flats contrasts strikingly with the brown-yellow-grey that typifies the eastern Canterbury high country.

Collectively, the sequence of views along the highway alongside the property helps to enrich the visitor experience on this important tourist route between the east and west coasts.

Significance of Landscape Values

Cora Lynn Pastoral Lease is strategically positioned to make a positive contribution to the South Island high country landscape. An important attribute of the property is that it provides the setting to the wide bed of the Waimakariri River and the broad Cass River-Lake Grasmere basin, both of which are iconic features of the Canterbury high country. The property also contains an assemblage of notable landscape elements including coalescent fans, knobby landforms, rock formations, scree faces and substantial wetlands.

The property has significant visual resource values principally due to the sequence of landscape experienced by travellers on the West Coast Road and Midland Railway Line. The foreshortened views followed by wide sweeping views, and the rapid change in direction of the road and railway, are dramatic and memorable features of the area.

Although large parts of the property have been affected by recent fires, natural regeneration of scrub and forest is rapid in this area. Recovery of the woody plant communities would help provide the landscape with a greater sense of aesthetic coherence. A feature of Cora Lynn Pastoral Lease is its proximity to large areas of protected public conservation land and the extent to which the landscape features of the property are contiguous with those on adjoining lands.

Insert Landscape values map here

2.2 GEOLOGY, LANDFORMS AND SOILS

2.2.1 Geology

The basement rocks of the Black Range (Mt Misery) and Mt Horrible are strongly-indurated uniform graded-bedded greywacke and argillite of the Torlesse Group (Chlorite Subzone I), with scattered inter-bedded volcanics (Gregg, 1964). Cora Lynn Pastoral Lease is within the Monotis zone of the Torlesse sequence, which contains fossils of several species of *Monotis* bivalve (Cave, 1987). Gentle hill slopes have deposits of loess (wind-deposited sediments). An area at the southwest corner of the property near Bruce Stream comprises glacial deposits of the St Bernard Formation. Other lower-altitude areas near the homestead, on the Bruce Stream and Broad Stream fans are recent river gravels. A strip of moraine of the St Bernard Formation is present just east of Mt Horrible in the lower Cass River valley (Gregg, 1964).

2.2.2 Landforms

Cora Lynn Pastoral Lease is dominated by the steep slopes of Mt Misery (on the Black Range) and Mt Horrible, and the broad valley floors of the Waimakariri River and Cass River valleys. Most of the contemporary landforms of the property were formed during the last major ice advance, the Otira Glaciation, and altered by subsequent fluvial erosion. Two major advances of the Otira Glaciation can be recognised from the landform features (Cave, 1987).

The earliest (Blackwater) advance occurred between 26,000 and 18,000 years ago. During this advance, ice from the main Waimakariri Glacier flowed over Lagoon Saddle, through Pylon Gully, and probably over the summit of Mt Horrible. The second (Poulter) advance was between 16,000 and 13,500 years ago. Ice from this advance extended over Goldney Saddle as far as Lake Grasmere and down the Waimakariri valley to just below the confluence of the Poulter Valley. Many of the glacial features on the property result from this most recent advance, notably the ice-worn rock surfaces of Mt Horrible and Goldney Saddle, the col at Pylon Gully and glacial till resting on ice-worn rock surfaces at several places along the West Coast Road.

The post-glacial landforms have been considerably modified by continuing fluvial erosion, demonstrated most dramatically by the deep gravel deposits filling the Waimakariri valley and the extensive alluvial fans of the Cass River and Bruce and Broad streams. The over-steep valley sides have been incised by the major side streams, shown by the narrow rock gorges in the lower reaches of both Bruce and Broad streams. Movement along the active Bruce Fault, which runs along Bruce Stream to the Waimakariri Valley and then curves across Pylon Gully, has resulted in extensive erosion on the upper northern slopes of Mt Misery.

The wide braided beds of the Waimakariri and Cass rivers and the extensive fans of Bruce and Broad streams create a distinct landform which contrasts markedly with the adjoining steep glacially-smoothed mountain slopes.

2.2.3 Soils

Higher altitude parts of the property on Mt Horrible and the slopes of Mt Misery have Bealey stepland soils. Lower-altitude slopes and terraces in the Cass valley and at the southwest corner of the property near Bruce Stream have Cass soils. Recently deposited gravels on the Bruce and Broad stream fans and alongside the Cass River have Tasman sandy loams.

Significance of Geology, Landforms and Soils

The glaciated mountain ranges and wide valleys of this area are typical of this part of the Southern Alps. The range of landforms and extent to which they represent the recent influences of glaciation, movement along faults and the extensive deposition of river gravels, are significant features of the property. The proximity of these landforms to a busy highway and railway, and the history of research associated with the University of Canterbury's Cass Field Station, adds to the significance of the landforms on the property.

2.3 CLIMATE

Cora Lynn Pastoral Lease has a cool wet mountain climate with cold winters and warm summers. The climate of the area is strongly influenced by the proximity of the main divide of the Southern Alps. Predominant winds are from the northwest with occasional gales, though south and southwest winds are also common. Snow can affect all parts of the property and lie at higher altitudes for several weeks in winter. Average annual precipitation is approximately 1500 mm, though there is a marked rainfall gradient from west (higher rainfall) to east (lower rainfall) across the property (Tomlinson, 1976; Dennis, 1986; Shanks *et al.*, 1990).

2.4 LAND ENVIRONMENTS OF NEW ZEALAND (LENZ)

LENZ is, as described by Leathwick *et al.* (2003): "a classification of New Zealand's landscapes using a comprehensive set of climate, landform and soil variables chosen for their role in driving geographic variation in biological patterns." The classification units of LENZ, termed environments by Leathwick *et al.* (2003), aim to: "identify areas of land having similar environmental conditions regardless of where they occur in New Zealand." The consequences of this are that "LENZ provides a framework that allows prediction of a range of biological and environmental attributes. These include the character of natural ecosystems, the vulnerability of environments to human activity, and the potential spread or productivity of new organisms (Leathwick *et al.* 2003)." Leathwick *et al.* (2003) present the LENZ information at four levels of detail, with level I containing 20 environments, level II containing 100 environments, level III containing 200 environments and level IV containing 500 environments. These LENZ classes are presented nationally to assist use at a range of scales; however, this data should be interpreted with caution, as the predicted extent and suggested vegetation types for each Land Environment (Leathwick *et al.*, 2003) have been extrapolated from limited field data.

In an analysis of the LENZ level IV data, with consideration of the remaining indigenous vegetation cover and the legal protection of these environments, Walker *et al.* (2005) proposed a threat classification for the remaining indigenous biodiversity in New Zealand's environments based on the two components of vulnerability (likelihood of loss): poor legal protection and risk of loss. This threat classification (Table One) has become the recognised benchmark for the promotion of threatened LENZ conservation.

Table One LENZ threat categories and definitions (Walker *et al.* 2005)

Category	Criterion
Acutely Threatened	<10% indigenous cover remaining
Chronically Threatened	10-20% indigenous cover remaining
At Risk	20-30% indigenous cover remaining
Critically Underprotected	>30% indigenous cover remaining

	<10% legally protected
Underprotected	>30% indigenous cover remaining 10-20% legally protected
No Threat Category	>30% indigenous cover remaining >20% legally protected

Very small areas within the Cass Valley are “acutely-threatened”. Parts of the fans in the Waimakariri valley and parts of the terraces in the Cass valley are “at risk”. A small area in the lower Cass valley is “Critically Underprotected”.

Significance of Land Environments

Very small areas within the Cass Valley are “acutely-threatened”. Parts of the fans in the Waimakariri valley and parts of the terraces in the Cass valley are “at risk”. A small area in the lower Cass valley is “Critically Underprotected”.

Insert Lenz map here

2.5 VEGETATION

2.5.1 Ecological Context

Cora Lynn Pastoral Lease lies between the high mountain ranges of the Southern Alps (largely-protected within Arthur's Pass National Park and Craigieburn Conservation Park) and the more modified mountains and valleys of the Waimakariri basin to the southeast. The steep mountains and upper valleys in the high-rainfall zone to the west support largely intact mossfield, cushionfield, stonefield, grassland and shrubland plant communities on valley floors, beech forest on montane slopes, and shrubland, tussockland, herbfield, stonefield and rockland communities above the timberline.

The western part of Cora Lynn Pastoral Lease, on the Bruce Stream and Broad Stream fans, lies in Arthur's Pass Ecological District (ED), within Hawdon Ecological Region (ER). The central part of the property, on the Black Range and Mt Horrible, lies in Craigieburn ED. The eastern part of the property, in the lower Cass valley, lies in Cass ED. Craigieburn and Cass EDs are within Puketeraki Ecological Region (McEwen, 1987).

The Waimakariri River (on the northern flanks of the pastoral lease) is listed as a wetland of ecological and representative importance (WERI).

The vegetation of the area has been well documented by Burrows (1986) in his study of botany of Arthur's Pass National Park, by Burrows (1977) in his compilation of articles about the history and science of areas in the vicinity of the University of Canterbury's Cass field station, and by Shanks *et al.* (1990) in the Protected Natural Areas Programme (PNAP) survey report for the Coleridge, Craigieburn and Cass ecological districts. In addition, the natural history and conservation values of Cora Lynn Pastoral Lease were briefly assessed by Harding (1994).

One area on the property, covering the north flank of Mt Misery, Mt Horrible and part of the lower Cass Valley (Cass RAP 14: Betwixt) was recommended for protection by the PNAP survey (Shanks *et al.*, 1990). It represented a diversity of plant communities including wetlands, mountain beech forest, hardwood forest, scrub and shrubland in different seral stages. Since then, wildfire has had a major impact on the communities of the RAP. Other parts of the property noted for their conservation value by Harding (1994) are the matagouri shrubland and adjacent riverbed at the base of the Bruce Stream and Broad Stream fans, and the shrubland and forest in the vicinity of the homestead and Wilderness Lodge. In recent years Misery Swamp and Horrible Bog in the Cass valley have been fenced from stock. The lessee has also undertaken pest control, and threatened plant and forest restoration work in areas of forest and shrubland near the Wilderness Lodge.

The original vegetation on montane slopes of the property is likely to have been mountain beech forest, possibly with areas of red beech at some sites. Mixed hardwood forest and scrub, containing broadleaf, kohuhu, korokio, *Olearia*, *Coprosma*, *Hebe*, and *Dracophyllum* species, and occasional kowhai and cabbage tree, would have been present on warm dry faces and bluffs. Kanuka and manuka scrub may also have been present. Areas of open grassland, often with matagouri shrubland, were present on recent, poorly drained or cold sites, notably on the Cass River flats and the Bruce Stream and Broad Stream fans. Sedgeland and rushland would have been present in larger wetlands, notably those in the Cass valley, (Harding, 1994).

Analyses of soil profiles and charcoal deposits indicate that the first major fires in the area were between 500 and 700 years ago, during Maori times, though areas further east may have been affected by natural fires between 4000 and 8000 years ago (Molloy, 1977). During the more recent period of burning, forest was eliminated from extensive areas in the Waimakariri Basin, probably including eastern parts of the property. The first recorded fire in European times was lit by Joseph Pearson in 1857 as he searched the Waimakariri basin for grazing land. Further fires, associated

with sheep farming, in the 1880s and in 1895 removed forest from much of the northwest face of Mt Misery, Mt Bruce (Burnt Face) and Bealey Spur. In c.1914 the slopes either side of the Cass River above Grasmere homestead were burnt. Areas around Goldney Saddle were burnt in 1947, 1959 and the mid 1960s (Molloy, 1977).

Two major uncontrolled fires have affected the property in recent times. The first, in 1995, burnt most of the lower Cass River valley between the Waimakariri River and the large colluvial fan south of Misery Swamp, though excluding the area east of the West Coast Road (Kelly, 1995). The second, in 2001, burnt from State Highway 73 at Paddys Bend across the northern slopes of Mt Horrible and then across Corner Knob, and into the Cass valley (Department of Conservation, 2001). These fires resulted in the loss of extensive areas of shrubland, scrub and regenerating forest.

2.5.2 Vegetation and Flora

The present vegetation of the property is a complex mosaic of exotic grassland, shrubland, scrub, hardwood forest, beech forest and wetland. Approximately half of the property is characterised by exotic grassland with an indigenous component. This dominates recently burnt areas, especially the mountain slopes above the Waimakariri River and much of the land in the Cass River valley. Cultivated paddocks are present on fans near the homestead and terraces adjacent to the Cass River. Matagouri shrubland is present on alluvial fans and terraces and on some lower mountain slopes, while grey shrubland and *Dracophyllum* shrubland occur on some alluvial fans, colluvial fans, mountain slopes and moraines. Low-stature mixed hardwood forest is present in a gully on steep slopes above the Waimakariri River, with lesser amounts elsewhere. Mountain beech forest occurs near the homestead, in the upper Cass valley, in Pylon Gully, at Corner Knob and on sunny slopes below Mt Horrible. Wetlands are present in the basins and gullies between Mt Horrible and the Cass River.

The vegetation is described below for the three main parts of the property. The naturalness of plant communities is rated low, medium or high.

Waimakariri River Flats

This area comprises the lower-altitude river flats, fans and terraces in the Waimakariri valley. The vegetation of the Waimakariri River flats is characterised by extensive grassland with scattered matagouri, short tussock grassland, weedy exotic grassland and cultivated paddocks. The active riverbeds are outside the property except for a narrow strip of the Waimakariri River bed at the toe of the Bruce Stream-Broad Stream fan and a small part of the bed of Broad Stream.

Grassland with matagouri occurs on the fan between Broad Stream and Bruce Stream. Total matagouri cover is 10-40%, averaging around 30%. The tallest matagouri is 4-5 m tall though most is between 0.3 m and 2 m. Browntop is co-dominant with the matagouri while other prominent species are Chewings fescue, sweet vernal and sweet brier. Additional indigenous species are rautahi, blue wheatgrass, *Acaena inermis*, fescue tussock, *Gonocarpus aggregatus*, patotara, *Pimelea oreophila*, *Coprosma atropurpurea*, creeping pohuehue, mingimingi, porcupine shrub, lichens and mosses. Other exotic plants present are Californian thistle, Scotch thistle, sheep's sorrel and white clover. Individual plants and patches of gorse and broom are scattered through the matagouri, and there is a patch of blackberry near the mouth of Broad Stream. Overall naturalness is low/medium to medium, reflecting the abundance of exotic grasses.

The fan east of Broad Stream supports denser matagouri up to 4 m tall and mingimingi up to 3 m tall. Also present are lawyer, fescue tussock, silver tussock and some pohuehue. On recent stony surfaces the matagouri is usually less than 1 m tall and between the shrubs is a grazed sward of browntop, sweet vernal and Chewings fescue. Additional plants in this community are creeping

pohuehue, catsear, mosses, sheep's sorrel, stonecrop, patotara, *Acaena inermis*, scabweed and *Raoulia* sp. "grey". Sweet brier and occasional gorse are scattered through the shrubland. Overall the shrubland is denser here, and naturalness is medium to medium/high where the matagouri is most dense.

The fenced paddock between the pine shelter belt and Broad Stream contains fescue tussock grassland. Fescue tussock has a cover of 10-15%, while browntop, sweet vernal, Chewings fescue and white clover make up much of the remaining cover. Low matagouri is very sparse. Other species present are catsear, blue wheatgrass, blue tussock, silver tussock, Kentucky bluegrass and Yorkshire fog. The tussocks are vigorous, presumably because of fertiliser application. Naturalness is low.

The vegetation of the Waimakariri River bed is dominated by lichens, mosses and *Raoulia* sp. "grey". Other plants include Chewings fescue, *Pimelea prostrata*, Lindsay's poa, *Epilobium melanocaulon*, *E. microphyllum*, *Scleranthus uniflorus*, *Stellaria gracilentia*, *Trisetum antarcticum* var. *tenella?*, scabweed, *Raoulia haastii*, creeping pohuehue, *Helichrysum depressum*, patotara, *Luzula rufa* var. *albicans*, matagouri, fescue tussock, white clover, sheep's sorrel, haresfoot trefoil and mouse-ear hawkweed. The youngest surfaces are dominated by *Epilobium melanocaulon*, *Raoulia tenuicaulis* and scabweed, while older surfaces have low matagouri, often with widespread exotic grasses. *Myosotis uniflora* (data deficient) is present. The main weeds present are stonecrop and Russell lupin. Stock tracks are present throughout and disturbance is locally significant. Naturalness is mostly high.

The low terrace between Bealey Spur and the Waimakariri River supports an exotic turf dominated by Chewings fescue and browntop, with white clover, scattered sweet brier, matagouri, occasional mingimingi and widespread broom. The small creek adjacent to the highway is dominated by crack willow, Lombardy poplar and other poplars. A small wetland near the Bealey Hotel is dominated by *Carex sinclairii*, bog rush and rautahi. Crack willow is scattered through the wetland and on adjacent land, while broom is common nearby. Other plants in the wetland include mingimingi, little hard fern, Yorkshire fog, sweet vernal, browntop, Chewings fescue, white clover, creeping buttercup, yarrow, mint and selfheal. Manuka occurs on the western margin with koromiko and one mountain toatoa. Cattle pugging is severe and naturalness of the wetland is low to low/medium.

The terrace west of Bruce Stream supports scattered matagouri 0.5 to 2 m tall, with some up to 3 m tall. Sweet brier (up to 3 m tall) is common and much more abundant than on fans to the east. Porcupine shrub and mingimingi are present with some mingimingi up to 3 m tall. Overall the shrubland is quite open, with a total shrub cover of 20-30%. The ground tier is dominated by an exotic sward of browntop, Chewings fescue, sweet vernal, cocksfoot and Yorkshire fog, with Californian thistle, white clover and yarrow. Overall naturalness is low/medium.

Waimakariri Valley Mountain Slopes

This area covers the higher-altitude parts of the property in the Waimakariri Valley. The mountain slopes are dominated by exotic grassland with some regenerating indigenous shrubs. Manuka shrubland and mountain beech forest occur mostly at the western end, while grey shrubland is present on steep fans and mixed hardwood low-forest/scrub is present in a gully southwest of the power pylons. A strip of shrubland occurs above the highway at Paddys Bend. The upper slopes of Mt Horrible support turpentine shrubland and rockland communities. Small wetlands occur in the beech forest near Bruce Stream and above Cornishmans Rise.

The Conservation Area east of Cornishman's Rise is dominated by exotic grassland with a few small groups of beech, low manuka and tauhinu occurring near a rocky knob. On lower slopes irregular patches of low manuka and seedlings occur in the grassland with tutu, patches of bracken, sparse matagouri and mingimingi. A wetland occurs on the saddle south of Cornishmans Rise. It contains a mosaic of exotic grasses, *Carex gaudichaudiana*, *Gonocarpus micranthus*, bog rush, soft rush, spike

sedge, cutty grass, *Ranunculus amphitrichus*, *Carex sinclairii*, marsh thistle, little hard fern, native violet, white clover, dainty daisy, localised *Sphagnum* and raupo. The threatened *Carex tenuiculmis* occurs at its northern end. Overall the wetland is of low to low/medium naturalness, reflecting the dominance of exotic grasses and stock pugging.

The northern slopes and northeast ridge of Mt Horrible are dominated by a sward of exotic browntop and sweet vernal, with fescue tussock, patotara, matagouri, dainty daisy, bracken and occasionally silver tussock. Naturalness is low. Exotic grasses are also common on rock outcrops. Other plants on rock outcrops are low-stature manuka, *Hebe venustula*, *Dracophyllum acerosum*, snowberry, tauhinu, cotton daisy, *Exocarpus bidwillii*, blue tussock, tutu, bristle tussock, *Pimelea traversii*, *Raoulia glabra*, *Pentachondra pumila* and *Leucopogon suaveolens*. Naturalness is low/medium. On mid slopes, locally common indigenous plants among the grassland include tauhinu, bracken, *Helichrysum filicaule*, tutu, *Carex breviculmis* and *Pentachondra pumila*. The threatened *Coprosma wallii* (gradual decline) has been previously recorded here.

At the upper limit of a recent fire (c.1100 m) there is a dramatic change in the vegetation to subalpine shrubland containing turpentine shrub, manuka, matagouri, tauhinu, *Hebe venustula*, *Dracophyllum acerosum*, inaka, *Gaultheria crassa* and *Coprosma acerosa*. Other plants present are woolly moss, cotton daisy, *Pentachondra pumila*, *Raoulia subsericea*, blue tussock, mountain clubmoss, mountain oat grass, fescue tussock, golden speargrass, *Gonocarpus aggregatus*, *Brachyglottis bellidioides*, *Exocarpus bidwillii*, *Leucopogon suaveolens*, bristle tussock and sweet vernal. Naturalness is medium/high. On the summit additional species in the shrubland are creeping mapou, *Coprosma* aff. *pseudocuneata*, snowberry, *Anisotome flexuosa*, patotara, *Raoulia glabra*, *Hebe lycopodioides* and *Helichrysum intermedium*. Naturalness is high. There are also a few mountain beech trees near the summit.

Rock outcrops and bluffs at the top of Mt Horrible support mosses, lichens, edelweiss, bristle tussock, turpentine shrub, *Coprosma* aff. *pseudocuneata*, *Gaultheria crassa*, snow daisy, cotton daisy, *Anisotome flexuosa*, woolly moss, midribbed snow-tussock, *Dolichoglottis scorzoneroideis*, *Brachyglottis bidwillii*, blue tussock, *Geum parviflorum* and *Anisotome pilifera*. Naturalness is high.

On the northwest slopes of Mt Horrible exotic grassland becomes dominant below the fire line at c.1100 m. Beneath burnt mountain beech trees the vegetation is dominated by browntop and sweet vernal with locally common Chewings fescue, Californian thistle, woolly mullein, foxglove, bracken, catsear, *Lachnagrostis* sp. and other exotic grasses. Grassland is also dominant among burnt manuka groves. Further down the slope small patches of mountain beech survive with regenerating manuka c.1-2 m tall. Above Paddys Bend the steep slopes support exotic grassland, scattered mountain beech forest, patches of manuka, scattered emergent kohuhu, tutu, patches of broom, bracken and some blackberry. Plants among steep bluffs are matagouri, mingimingi, tutu, korokio, koromiko, *Hebe* spp., kohuhu, broadleaf, mountain akeake, manuka, scattered mountain beech and uncommonly kowhai. Broom is scattered through these shrublands. The largest mountain beech remnants survive at the entrance to Pylon Gully.

Further southwest of Pylon Gully, between the power pylons and a steep fan, slopes are again dominated by exotic grasses. Other plants in the grassland are fescue tussock, silver tussock, white clover, bracken, sweet brier, matagouri, mingimingi, korokio, porcupine shrub, tauhinu, *Coprosma rugosa*, mountain wineberry, *Hebe venustula*, native broom, lawyer, manuka and rarely kohuhu. Naturalness is low or low/medium where more shrubs are present. A group of about 10 kowhai is also present. The largest gully contains dense regenerating hardwood forest dominated by young kohuhu, manuka and broadleaf. Also present are mountain akeake, *Hebe venustula*, matagouri, korokio, mingimingi, tutu, bracken, *Coprosma rugosa* and bush snowberry. Naturalness is at least medium/high. Small creek gullies contain manuka, abundant koromiko, bracken, bog rush and occasional kohuhu. An irregular strip of grey shrubland and kohuhu occurs directly above the road, with patches of gorse and broom. Near Pylon Gully small mountain beech remnants have survived the recent fire beneath cliffs and are surrounded by bracken.

The steep fan adjacent to point 1051 supports dense matagouri, mingimingi, *Coprosma rugosa*, korokio, *Hebe venustula*, bracken, tutu, sweet brier, emergent kohuhu and uncommonly broadleaf. The tallest shrubs are 3-4 m tall. Areas of grassland within the shrubland and stonefield support mosses, lichens, grasses, lawyer, scrub pohuehue, creeping pohuehue, *Raoulia haastii*, *R. glabra*, *Scleranthus uniflorus*, *Geranium sessiliflorum*, *Epilobium melanocaulon*, patotara, silver tussock, *Coprosma rugosa*, porcupine shrub, bracken, woolly mullein and foxglove. An incised channel contains a ribbon of toetoe. One wilding conifer was seen on the fan. Between this fan and McKay Stream there is much manuka and a little scattered mountain beech on the slopes.

The McKay Stream fan supports a mosaic of grassland, shrubland and, lower down, bog rush seepages. A walking track (the McKay Forest Moa Walk) meanders across the upper fan. Here the shrubland contains matagouri, manuka, mingimingi, porcupine shrub, *Coprosma tayloriae*, *Coprosma wallii* (threat status: gradual decline), *C. ciliata*?, *C. rugosa*, pohuehue, prickly shield fern and lawyer. Weeping mapou is common in the shrubland with some very impressive specimens up to 7 m tall. The mountain beech forest margins near McKay Stream support a similar diversity of shrubs with the addition of *Pittosporum divaricatum* and several plants of *Carmichaelia kirkii* (nationally endangered). The threatened plant *Helichrysum dimorphum* (nationally endangered) has been planted near Broad Stream, and blackberry occurs near its confluence with McKay Stream. White fuzzweed (*Vittadinia australis*), (data deficient) is common adjacent to the property on the stable bed of Broad Stream. Between McKay Stream and Broad Stream there is a mosaic of mountain beech forest, manuka shrubland, grey shrubland, grassland and bracken. Broadleaf and *Pseudopanax "ternatus"* occur in the beech forest understorey. Mountain beech regeneration is vigorous in the absence of stock. Saplings and occasional trees of Douglas fir occur among the manuka and in the open grassland.

Another walking track (the Rainbow Valley Nature Walk) meanders through mountain beech forest between the Wilderness Lodge and Bruce Stream. This area contains a mosaic of mountain beech forest, regenerating manuka and open grassland. The grassland is dominated by browntop with woolly moss, scattered fescue tussock, Chewings fescue and sweet vernal. Other species present are mouse-ear hawkweed, catsear, *Pimelea oreophila*, blue tussock, *Geranium sessiliflorum*, *Carex breviculmis*, lichens, patotara, bracken, *Coprosma atropurpurea*, king devil hawkweed, blue wheatgrass, *Rytidosperma unarede*?, *Mazus radicans*, harebell and *Raoulia subsericea*. Manuka seedlings are common in the grassland, indicating successional change. Naturalness is low to low/medium. Manuka thickets border the grassland and beech forest margins and where they are particularly dense few other plants grow beneath them. Their naturalness is high. Occasional Douglas fir wildings are present in the manuka and grassland.

The mountain beech forest has a subcanopy of broadleaf, manuka, *Coprosma tayloriae*, yellowwood, *Cyathodes juniperina*, lancewood, mountain wineberry, weeping mapou, *Pittosporum divaricatum* and lawyer. Two species of mistletoe (*Alepis flavida* and *Peraxilla tetrapetala*) are present. The forest floor is dominated by mosses and locally abundant mountain beech seedlings. Other species include wall lettuce, *Leptinella serrulata* (gradual decline), *Rytidosperma gracile*?, common pennywort, tussock hawkweed, *Carex dissita*, *Uncinia fuscovaginata*, bracken, mountain clubmoss, *Blechnum chambersii*? and prickly shield fern. Occasional blackberry is present and Douglas fir is scattered along the southern margin. Overall the beech forest has high naturalness values. A small wetland occurs in a depression within the beech forest. It is dominated by *Carex sinclairii*. Other species present are sphagnum moss, jointed rush, pukio, swamp kiokio, weeping mapou, *Coprosma tayloriae*, little hard fern, selfheal, white clover, spike sedge, *Ranunculus amphitrichus*, mosses, soft rush and *Veronica scutellata*. The threatened *Carex tenuiculmis* (sparse) is also present. Naturalness is medium to medium/high.

Cass River Valley

This area comprises the part of the property in the Cass Valley. Mountain beech forest remnants, scrub and shrubland are common on mountain slopes, moraines and fans. Exotic grassland is common and locally dominant, especially in recently burnt areas. Wetlands are concentrated in basins and moraine gullies between mountain slopes and the Cass River, the largest being Misery Swamp and the locally named Horrible Bog.

Sizeable mountain beech forest remnants occur in the upper Cass Valley. Subcanopy plants are *Coprosma tayloriae*, *C. microcarpa*, *C. colensoi*?, mountain akeake, mountain toatoa, *Cyathodes juniperina*, koromiko, manuka and lawyer. Forest floor plants include lawyer, bush snowberry, *Olearia arborescens*, korokio, *Hebe venustula*?, snow totara, prickly shield fern, *Rytidosperma gracilis*?, *Grammitis billardierei*, little hard fern, thousand-leaved fern, mosses and lichens. Naturalness is medium/high to high, despite animal tracks and scattered holly in at least two remnants. Between the beech forest remnants, diverse shrublands occur and are dominated by regenerating manuka up to several metres high, with woolly moss, snowberry, browntop, mosses and *Hebe venustula*. Additional species present are snow totara, mountain toatoa, *Coprosma rugosa*, *C. tayloriae*, mountain beech, korokio, matagouri, bracken, *Hebe odora*, turpentine shrub, *Dracophyllum kirkii*, tauhinu, mountain clubmoss, *Brachyglottis bellidioides*, *Olearia arborescens*, lichens, harebell, dainty daisy, mouse-ear hawkweed, king devil hawkweed, tussock hawkweed, white clover and sweet vernal. Occasional broom is present and naturalness is medium to medium/high. Patches of grassland are dominated by browntop and Chewings fescue. Other species present are lotus, fescue tussock, manuka seedlings, tauhinu, snowberry, *Leucopogon suaveolens*, matagouri, *Pimelea oreophila* and blue tussock. Similar grasslands are widespread between the Cass River and Misery Swamp.

Misery Swamp is contained by Waterfall Terrace (a local name) and the colluvial fans of Mt Misery. It is fenced from stock and dominated by bog rush. Other prominent plants are lotus, *Carex gaudichaudiana*, pukio, sweet vernal, *Hebe odora*, rautahi and sphagnum moss. Additional indigenous species are *Galium perpusillum*, *Ranunculus amphitrichus*, little hard fern, *Rytidosperma nigricans*?, native violet, common pennywort, dainty daisy, *Microtis oligantha*?, *Gonocarpus micranthus*, mosses and lichens. A few scattered matagouri and mingimingi occur at the south end and along its margins, while a small ridge at the northwest end supports *Hebe odora*, tauhinu, manuka, turpentine shrub and scattered broom. Exotic species are widespread in the wetland including sweet brier, browntop, Yorkshire fog, purging flax, tussock hawkweed, catsear, Chewings fescue and soft rush. Naturalness is medium. Gorse is scattered along the western edge of Misery Swamp and across the Mt Misery fans, with several large patches present. The fans support a mosaic of grassland, dense matagouri, small patches of mountain beech forest, regenerating manuka and tauhinu. Gorse and broom are widespread alongside the Cass River.

East of Misery Swamp, the terrace (Waterfall Terrace) is dominated by browntop, woolly moss (up to 20% cover) and tauhinu (10% cover). Other species present are manuka, lotus, red woodrush, Chewings fescue, fescue tussock, sweet vernal, catsear, patotara, *Leucopogon suaveolens*, little hard fern, *Pimelea oreophila*, cotton daisy, porcupine shrub, matagouri, mingimingi and mouse-ear hawkweed. Naturalness in these areas is low to low/medium, though the vegetation is regenerating to shrubland. Further north *Hebe odora* or hybrids with *H. venustula* become common, along with turpentine shrub, *Pimelea traversii*, patches of manuka and a few surviving beech trees. Small ephemeral wetlands support the grass-like *Herpolirion novae-zelandiae*. Gorse and broom are scattered across the terrace. A population of *Botrychium australe* (sparse) has been recorded and studied in this area (Kelly, 1994). *Pittosporum anomalum* has been previously recorded here (Shanks *et al.*, 1990).

Between Misery Swamp and Horrible Bog, a wetland complex supports bog rush, *Hebe odora*, star sedge, soft rush, grasses, sphagnum moss, *Coprosma elatirioides*, marsh thistle, mountain clubmoss, little hard fern, lichens, *Anisotome aromatica*, *Gonocarpus micranthus*, manuka, *Carpina alpina*,

Carex gaudichaudiana, *Ranunculus amphitrichus*, dainty daisy, rautahi, native violet, catsear, purging flax, tussock hawkweed, turpentine shrub and inaka. Naturalness is medium to medium/high. The wetland is connected to Horrible Bog by a small gully containing wetland vegetation.

The lower eastern faces of Mt Horrible support a mosaic of exotic grasses, scattered tauhinu, manuka, bracken, *Hebe* sp., patches of grey shrubland that escaped the recent fire and seepages with mountain flax, bog rush, toetoe, and *Hebe odora*. The upper shady aspects of Mt Horrible support shrubland dominated by turpentine shrub, with prominent mosses, *Hebe venustula*, bristle tussock, snowberry, cotton daisy, *Gaultheria crassa*, *Coprosma cheesemaniae* and blue tussock. Other species present are *Dracophyllum acerosum*, tauhinu, mingimingi, golden speargrass, *Coprosma* aff. *pseudocuneata*, midribbed snow-tussock, fescue tussock, harebell, *Anisotome aromatica*, *A. pilifera*, little hard fern, *Raoulia subsericea*, *Euphrasia zelandica*, native violet, *Brachyglottis bellidioides*, everlasting daisy, *Geum parviflorum* and *Forstera sedifolia*. This shrubland has high indigenous species diversity and very few exotic species. Naturalness is high. On sunny north faces, plants on rock slabs include *Dracophyllum* spp., snow totara, *Helichrysum intermedium*, manuka, tauhinu, tutu, mountain akeake, golden speargrass, *Leucopogon suaveolens*, *Hebe* sp. and rarely mountain beech trees. Mountain beech also occurs in steep gullies, and turpentine shrubland extends at least half way down the face via these gullies. Pylon Gully was not visited but its values have previously been identified by Harding (1994) and Shanks *et al.* (1990). It contains substantial areas of mountain beech and manuka, fire-induced *Dracophyllum* shrubland and a small sloping wetland on the valley floor.

Horrible Bog is located below Mt Horrible, and has been largely fenced from stock. It is dominated by bog rush. Other prominent plants are *Carex sinclairii*, catsear, mosses and *Hebe odora*. Additional plants present are tauhinu, manuka, mingimingi, native violet, *Carex gaudichaudiana*, *C. flaviformis*, common pennywort, *Rytidosperma nigricans*?, dainty daisy, spike sedge, star sedge, sphagnum moss, *Potamogeton cheesemaniae*, rautahi, *Galium perpusillum* and little hard fern. There are two patches of raupo on the eastern side. Moraine ridges within the wetland support *Hebe odora*, manuka, tauhinu, turpentine shrub and matagouri plus a range of grasses and herbs similar to those on adjacent moraine ridges. Other exotic species within the wetland include marsh thistle, purging flax, sweet vernal, soft rush, jointed rush, Yorkshire fog, browntop and tussock hawkweed. A small patch of broom occurs inside the western fence. Perched wetlands on and behind moraine terraces to the west are an integral part of the wetland, being connected via gully seepages containing bog rush and pukio. *Aciphylla subflabellata* was found in a seepage near Horrible Bog. Overall naturalness is medium/high, as there are fewer exotic plants than in Misery Swamp.

The vegetation of the moraine ridges east of Horrible Bog is similar to that on Waterfall Terrace, though it is generally in better condition and some parts escaped the recent fire. Ridge tops are dominated by manuka, woolly moss, patotara and browntop, with tauhinu, *Leucopogon suaveolens* and mountain oat grass. Additional species present are korokio, *Pimelea oreophila*, *P. traversii*, sweet vernal, catsear, harebell, dainty daisy, *Gonocarpus micranthus*, *Raoulia subsericea*, turpentine shrub, lichens, mountain clubmoss, native violet, snowberry, blue tussock, cotton daisy, *Brachyglottis bellidioides*, mouse-ear hawkweed and rarely snow totara. Naturalness is medium. The gullies support grey shrublands of matagouri, mingimingi, *Coprosma tayloriae*, turpentine shrub, korokio, *Hebe* spp., bracken, tauhinu and mountain beech saplings. Scrub that escaped recent fires contains additional species such as mountain akeake, *Dracophyllum acerosum*, snow totara, mountain toatoa and rarely mountain totara.

Mountain beech remnants occur adjacent to the shrublands. Corner Knob has, in recent times, been colonized by red beech, presumably from seed blown from the north side of the Waimakariri River (Burrows and Lord, 1993). Recent fires have removed much of the forest from this area, though a young red beech tree was observed here during this survey (M. Harding, *pers.comm.*). Within the small forest remnants, sub-canopy plants include korokio, snow totara, *Coprosma tayloriae*, *Pittosporum divaricatum*, manuka, beech saplings and *Hebe traversii*? The margins support

korokio, mountain beech seedlings, snow totara, *Hebe traversii?*, tauhinu, *Pittosporum divaricatum*, manuka and *Clematis marata*. Mosses and ferns are absent from the forest floor, perhaps reflecting the small size of the forest remnants and their vulnerability to animal disturbance, snow and wind damage. Depressions and gully floors also support seepages and bogs containing sphagnum moss, bog rush, star sedge, rautahi, *Hebe odora*, manuka, tauhinu, turpentine shrub, jointed rush, soft rush, *Potamogeton cheesemaniae*, little hard fern, native violet, *Ranunculus amphitrichus?*, dainty daisy, browntop, sweet vernal, *Coprosma elatirioides* and sometimes *Carex tenuiculmis* (threat status: sparse). Their naturalness is medium to medium/high.

Another shrubland occurs on steep eastern slopes adjacent to the Cass River, close to the road bridge. It contains matagouri, manuka, mingimingi, korokio, tauhinu, *Hebe* sp., mountain akeake, *Coprosma tayloriae*, bracken, lawyer and sweet brier, with open areas dominated by browntop. Broom, gorse and wilding Douglas firs are scattered through the area. *Aciphylla subflabellata* was found in grassland near the Cass River bridge. There is a substantial beech forest remnant near the top of the slope, behind which is a diverse shrubland which appears to contain mountain toatoa. Between here and the Corner Knob shrublands, manuka and tauhinu are regenerating in the grassland.

Near the Cass River mouth, a small mountain beech remnant occurs on steep slopes above the river. Beneath its partly closed canopy is a diverse understorey of mingimingi, *Hebe traversii*, mountain akeake, *Coprosma tayloriae*, *C. microcarpa*, korokio, *Pittosporum divaricatum*, kohuhu, mountain wineberry, mountain toatoa, koromiko, beech saplings and occasionally sweet brier. Forest floor plants present are abundant mosses, wall lettuce, *Uncinia uncinata?*, *Gingidia montana*, prickly shield fern, hanging spleenwort, *Asplenium trichomanes*, *Cystopteris tasmanica*, lawyer, browntop, catsear and sweet vernal. A few broom plants are scattered along the margins beside the Cass River. To the southwest is an extensive shrubland of manuka, tauhinu, matagouri, mingimingi, *Coprosma tayloriae*, *Hebe venustula*, korokio, *Dracophyllum* spp. and regenerating mountain toatoa. Tauhinu and matagouri are also regenerating in the grassland above the wetland adjacent to the Cass River.

Shrubland to the north is similar but supports additional species such as *Hebe traversii?*, kohuhu, mountain akeake, lawyer, pohuehue, tutu and bracken. Sweet brier, broom and gorse are scattered through the shrubland. Broom is abundant next to a line of crack willows along the Cass River. Further west above the Waimakariri River, the hill slopes are characterised by exotic grassland with regenerating manuka, sweet brier, tauhinu, bracken, matagouri, mingimingi, scattered mountain beech and occasional kohuhu. Patches of broom and gorse are common, especially on toe slopes close to the railway line, and these become very common past the Mt White Bridge. There are further patches of mountain beech and a grove of kowhai near the Mt White Bridge.

South of Goldney Saddle a terrace wetland occurs near the Cass River. Its vegetation is dominated by *Carex gaudichaudiana*, browntop, spike sedge and rautahi. Other prominent species are bog rush, sweet vernal, white clover and Yorkshire fog. Additional species present are fescue tussock, matagouri, Chewings fescue, jointed rush, soft rush, mouse-ear chickweed, native violet, little hard fern, *Carex sinclairii*, *Galium perpusillum*, common pennywort and red clover. Sweet brier, gorse and broom are scattered through the wetland, which is heavily pugged by cattle. Overall naturalness is low to low/medium. Gorse and broom are widespread at the south end of the wetland, adjacent to the road and the Cass River. Blackberry also occurs adjacent to the road.

Notable Flora

Notable plant species recorded on the property are listed in Table Two below. Threat categories are those proposed by de Lange *et al.* (2004). Ecological district distributions are from Shanks *et al.* (1990).

Table Two Notable plant species, Cora Lynn Pastoral Lease.

Plant species	Threat status	Distribution on property
<i>Aciphylla subflabellata</i>	Sparse	Seepage near Horrible Bog; grassland near Cass River bridge.
<i>Alepis flavida</i>	Gradual decline	Mountain beech forest near the Wilderness Lodge.
<i>Botrychium australe</i>	Sparse	Waterfall Terrace (Kelly, 1994)
<i>Carex tenuiculmis</i>	Sparse	Wetlands above Cornishmans Rise; near Corner Knob; beech forest near Bruce Stream.
<i>Carmichaelia kirkii</i>	Nationally endangered	Shrubland near confluence of Broad Stream and McKay Stream.
<i>Coprosma wallii</i>	Gradual decline	Shrubland on McKay Stream fan.
<i>Helichrysum dimorphum</i>	Nationally endangered	Planted next to Broad Stream.
<i>Leptinella serrulata</i>	Gradual decline	Beech forest near Bruce Stream
<i>Myosotis uniflora</i>	Data deficient	Waimakariri River bed.
<i>Peraxilla tetrapetala</i>	Gradual decline	Mountain beech forest near the Wilderness Lodge.
<i>Vittadinia australis</i> (White fuzzweed)	Data deficient	Broad Stream (adjacent to property).
Significance		
<i>Nothofagus fusca</i> (Red beech)	Uncommon south of the Waimakariri River.	Southern slopes of Corner Knob.
<i>Olearia arborescens</i>	Not recorded in ED	Upper Cass valley shrubland and beech forest.
<i>Pittosporum anomalum</i>	Uncommon in ED	Waterfall terrace (Shanks <i>et al.</i> 1990).
<i>Podocarpus hallii</i>	Uncommon in ED	Scrub below Corner Knob.
<i>Sophora microphylla</i>	Uncommon in ED	Northwest slopes between Paddys Bend and McKay Stream fan.

Significance of Vegetation and Flora

The alluvial fans above the Waimakariri River are important for their matagouri shrublands which contain some tall matagouri and mingimingi. The small portion of the Waimakariri River bed in the property is in excellent condition and contains a high diversity of seral riverbed plants, including *Myosotis uniflora* (data deficient).

Mountain beech forest near the homestead is in very good condition. Smaller beech forest remnants occur below Mt Horrible and near the entrance to Pylon Gully, though these have been affected by recent fires. Diverse grey shrubland on the McKay Stream fan supports *Coprosma wallii* (gradual decline), tall weeping mapou and, near McKay Stream, *Carmichaelia kirkii* (nationally endangered). Regenerating mixed hardwood forest occurs in a central gully and to a limited extent around Paddys Bend. Manuka shrubland is scattered across the slopes, especially towards the west. The upper slopes and summit of Mt Horrible are notable for diverse subalpine shrubland which is in excellent condition. The threatened *Carex tenuiculmis* (sparse) occurs in a wetland above Cornishmans Rise and in a small beech forest wetland near Bruce Stream.

Substantial mountain beech forest remnants occur in the upper Cass River valley, with smaller remnants near Corner Knob and alongside the lower Cass River. Isolated red beech is present on the southern slopes of Corner Knob. Extensive manuka shrubland, grey shrubland and small patches of scrub occur in the upper Cass valley, near Corner Knob and east of Goldney Saddle. The moraine ridges south of Corner Knob support diverse shrub and herb communities. Horrible Bog and Misery Swamp are important wetlands, and there are numerous smaller ones nearby. The smaller ones are

often interconnected and some are in particularly good condition. *Carex tenuiculmis* occurs in the wetlands. *Aciphylla subflabellata* (sparse) and *Botrychium australe* (sparse) are also present.

Insert Botanical Values map in here

2.5.3 Problem Plants

There are some substantial weed infestations on and adjacent to Cora Lynn Pastoral Lease, despite the weed control efforts of the current lessee. Scattered infestations of gorse and broom occur across the property, notably adjacent to the Cass River, west and south of Misery Swamp, in shrubland near the Cass River bridge, above the highway from Cornishmans Rise to below Pylon Gully and on the low terrace west of Bruce Stream. Many small infestations have been effectively removed or contained, but larger infestations adjacent to the Waimakariri River, Cass River and the highway would require substantial and ongoing effort to eradicate or contain.

Wilding conifers (mostly Douglas fir) are scattered through beech forest, shrubland and grassland above the Bruce Stream and Broad Stream fans. Wilding conifers are also present in shrubland above the Cass River bridge and east of Corner Knob. Wilding trees have been removed from a number of locations. The Douglas fir plantation on the slopes of Mt Bruce and the exotic tree plantings in the Cass valley provide seed sources for ongoing wilding spread.

Holly occurs in beech forest remnants in the upper Cass valley. The presence of holly on and adjacent to the property poses a significant threat to plant communities on the property and on adjacent public conservation land, as its fleshy fruits are attractive to birds and can be dispersed by birds over long distances.

Blackberry occurs at the mouth of the Cass River, adjacent to the wetland beside the Cass River, on slopes above Paddys Bend, at the mouth of Broad Stream, near the confluence of Broad Stream and McKay Stream and beneath beech forest near the Wilderness Lodge. Crack willow is common in and around the small modified wetland immediately east of the Bealey Hotel. Sweet brier is scattered across much of the property and is particularly common on sunny slopes, terraces and fans, notably on the low terrace west of Bruce Stream. Stonecrop is present on open riverbeds.

Infestations of coltsfoot have been previously recorded adjacent to the property in Broad Stream and the lower Cass River. Spanish heath is present adjacent to the property at Bealey Spur. Infestations of Californian poppy have been previously recorded along the West Coast Road at Bruce Stream (Harding, 1998). Extensive infestations of Russell lupin are present on the open bed of the Waimakariri River. Isolated patches of Russell lupin have been controlled by the lessee in lower Bruce Stream.

2.6 FAUNA

2.6.1 Bats

There are unconfirmed reports of bats from the Rainbow Valley Nature Walk on Cora Lynn. These reports are most likely sightings of South Island long-tailed bats (threat status: nationally endangered), a species which forages on dusk. There are also reports of bats from Broken River in the 1960s. The closest confirmed records of long-tailed bats are from Boyle Base in the Lewis Pass area and from Springs Junction in the 1990s (Max Cullen, *pers. comm.*; C. O'Donnell, *unpublished data*). Short-tailed bats have not been recorded in Canterbury since the arrival of Europeans.

Bat detector units were placed in six different locations on forest edges and clearings and in indigenous shrubland. Three units were placed on Rainbow Valley Nature Walk close to the Wilderness Lodge, one at Pylon Gully, and two in the Cass valley west of Romulus Hill. The units were left in place for two nights. No bats were recorded, though conditions were generally unfavourable for detecting bat activity.

The beech forest surveyed on the property is mainly mountain beech forest with few large cavity-bearing trees. These trees are unlikely to provide suitable roosting habitat for bats. Long-tailed bats prefer to roost in old large-diameter trees, particularly red beech (Sedgeley and O'Donnell, 1999a; 1999b). Roosting habitat of this type can be found nearby on the north side of the Waimakariri River in Arthur's Pass National Park. Long-tailed bats often fly some distance from their roosting areas to forage (up to 20 km) along forest edges and over indigenous shrublands, particularly kanuka and manuka (O'Donnell, 2000a; 2000b).

Significance of the Bat Fauna

No bats were recorded on the property. However, favourable bat roosting habitat is present in the area and the property provides suitable foraging habitat for long-tailed bats.

2.6.2 Birds

Important bird habitats present in the vicinity of Cora Lynn Pastoral Lease are beech forest, wetland, braided river and alpine habitats, much of which is protected within Arthur's Pass National Park and Craigieburn Conservation Park. Forests in the area support healthy populations of common forest birds and several threatened species, including orange-fronted parakeet (nationally critical), long-tailed cuckoo (gradual decline), yellowhead (nationally endangered), yellow-crowned parakeet (gradual decline), great spotted kiwi (gradual decline), South Island kaka (nationally endangered), kea (nationally endangered) and South Island rifleman (gradual decline). A remnant population of blue duck (nationally endangered) persists in the headwaters of the Waimakariri River (Department of Conservation Blue Duck Database). In the extensive alpine zone, kea (nationally endangered) and rock wren (nationally vulnerable) are present (Read and McClelland, 1984; Bull *et al.*, 1985; O'Donnell, 1996). Tui and western weka have been occasionally recorded in the vicinity of the property (M. Harding, *pers.comm.*).

The open braided bed of the Waimakariri River is a dominant habitat adjacent to the property. It is recognised as a Site of Significant Wildlife Interest (SSWI) of "outstanding" value to wildlife (O'Donnell and Moore, 1983) and ranked as highly significant for threatened species and regionally significant for other species (O'Donnell, 2000c). Braided rivers of the type found in Canterbury are nationally and internationally rare habitat types. They provide habitat for over 80 species of birds, virtually all of which have been recorded in the Waimakariri River. Four endemic threatened species have evolved on braided rivers: wrybill (nationally vulnerable), black stilt (nationally critical), black-billed gull (serious decline) and black-fronted tern (nationally endangered). Two

further endemic species, banded dotterel (gradual decline) and South Island pied oystercatcher use braided rivers as their major breeding habitats (O'Donnell and Moore, 1983). All of these species, with the exception of black stilt, have significant populations on the Waimakariri River. Caspian tern (nationally vulnerable) also breeds on the river.

Collectively, wetlands and tarns in the adjacent Cass basin provide breeding and feeding habitat for numerous indigenous wetland bird species including Australasian crested grebe (nationally endangered), Australasian bittern (nationally endangered), black-fronted tern, grey duck (nationally endangered), black-billed gull, marsh crake (sparse) and black shag (sparse) (O'Donnell, 2000; Jensen and Snoyink, 2005).

Birds observed on Cora Lynn Pastoral Lease are described below for the eight distinct parts of the property surveyed.

Forest and Shrubland West of the Wilderness Lodge

South Island tomtit, bellbird, brown creeper, South Island rifleman (gradual decline), South Island fantail, grey warbler, silvereve, New Zealand falcon (gradual decline) and kea (nationally endangered) were present in the mountain beech forest and indigenous shrubland close to the Wilderness Lodge. A range of introduced passerines was also present.

Fans on the Lower Slopes of the Black Range, South Side of West Coast Road

Silvereve, brown creeper, South Island fantail, welcome swallow and grey warbler were present in the matagouri shrubland on the slopes of the unnamed fan east of Broad Stream. Spur-winged plover, southern black-backed gull, Australasian harrier and paradise shelduck were present along the open margin of the shrubland and on developed pasture. A range of introduced passerines was also present. These areas provide valuable feeding habitat for the threatened black-fronted tern early in the summer during the breeding season, though this species was not recorded during this survey.

Shrubland and Pasture on the North Side of West Coast Road

Three areas were visited during heavy rain and no birds were recorded. However, one area between Bruce Stream and Broad Stream, and one area immediately east of Broad Stream contain indigenous matagouri-dominated shrubland that is likely to support silvereve, brown creeper, South Island fantail, welcome swallow and grey warbler. Black-fronted tern feed over these shrublands early in the summer during the breeding season. The central areas of these two blocks are grazed and developed, but dense shrubland is present outside the fenced areas closer to the Waimakariri River and Broad Stream.

Margins of the Waimakariri River

The southern margins of the Waimakariri River bordering the northern boundary of the property were inspected. River edge habitat consists of stonefield (bare shingle), herbfield, cushionfield and scattered matagouri. Seven indigenous bird species were recorded in these habitats, including three threatened species: wrybill (nationally vulnerable), black-billed gull (serious decline) and banded dotterel (gradual decline). Black Shag (sparse) was also recorded. These habitats also provide valuable feeding habitat for the threatened black-fronted tern.

Paddock on South Side of West Coast Road, west of Cora Lynn Road

A large flock of wetland birds was observed feeding in this paddock. The flock included c.40 black-billed gull, 25 banded dotterel, seven South Island pied oystercatcher, and numerous paradise shelduck, southern black-backed gull and spur-winged plover.

Goldney Saddle

An area of manuka shrubland, tauhinu shrubland and small wetlands (sedgeland) was surveyed. Silvereeye, New Zealand pipit and introduced finches were recorded in the shrublands. There was no standing water in the wetlands and no wetland bird species were recorded. Three kea were observed flying over this area.

Pylon Gully

The lower slopes of Pylon Gully are dominated by mountain beech forest. New Zealand falcon, South Island rifleman, kea, South Island tomtit, bellbird, brown creeper, South Island fantail, grey warbler and silvereeye were observed. Rock bluffs provide suitable nesting habitat for New Zealand falcon. A range of introduced passerines was also present.

Cass River Valley

The Cass River valley contains a diverse range of bird habitats including mountain beech forest, manuka shrubland, tauhinu shrubland and several wetlands. A family group of two adult with two fledgling New Zealand falcon was observed on several occasions in dead trees among shrubland close to the edge of mountain beech forest in the upper valley (adjacent to Romulus). South Island rifleman, kea, South Island tomtit, bellbird, brown creeper, South Island fantail, grey warbler and silvereeye were also present in the shrubland and forest. A range of introduced passerines was also present.

The two largest wetlands inspected were Misery Swamp and Horrible Bog. Misery Swamp contains pukio along streams and wetter areas and bog rush in drier areas. Horrible Bog contains a small area of raupo. Australasian harrier and paradise shelduck were recorded at Misery Swamp. Weather conditions were unsuitable for surveying for the threatened marsh crake (sparse). However, marsh crake was common in wetlands at nearby Lake Sarah in the 1990s (C. O'Donnell, *pers. comm.*). Habitats here are suitable for this species. Banded dotterel (gradual decline) was recorded in the Cass River adjacent to the property boundary. Black shag (sparse) was recorded near the Cass River bridge.

Bird Species Recorded

Thirty one bird species were recorded on Cora Lynn Pastoral Lease: 20 indigenous species and 11 naturalised species.

Table Three Indigenous bird species recorded from Cora Lynn Pastoral Lease, 2006.

Bird species	Threat status*	Distribution on property
Australasian harrier	not threatened	Throughout.
banded dotterel	gradual decline	Paddock at corner of Cora Lynn Road and West Coast Road; Waimakariri and Cass rivers.
bellbird	not threatened	Forest and shrubland throughout.
black-billed gull	serious decline	Paddock at corner of Cora Lynn Road and West Coast Road plus Waimakariri River.
black shag	sparse	Waimakariri and Cass rivers.
brown creeper	not threatened	Forest and shrubland throughout.
grey warbler	not threatened	Forest and shrubland throughout.
kea	nationally endangered	Goldney Saddle; Pylon Gully; Wilderness Lodge, Snowslide Stream.

New Zealand falcon (eastern)	gradual decline	Wilderness Lodge; Pylon Gully; Cass valley.
New Zealand pipit	not threatened	Cass River.
paradise shelduck	not threatened	Paddock at corner of Cora Lynn Road and West Coast Road; Waimakariri and Cass rivers.
silvereeye	not threatened	Forest and shrubland throughout.
southern black-backed gull	not threatened	Throughout.
South Island fantail	not threatened	Forest and shrubland throughout.
South Island pied oystercatcher	not threatened	Paddock at corner of Cora Lynn Road and West Coast Road.
South Island rifleman	gradual decline	Forest and shrubland throughout.
South Island tomtit	not threatened	Forest and shrubland throughout.
spur-winged plover	not threatened	Paddock at corner of Cora Lynn Road and West Coast Road; Waimakariri and Cass rivers.
Wrybill	nationally vulnerable	Waimakariri River (adjacent to property)
welcome swallow	not threatened	Throughout.

* Hitchmough and Bull (*in press*).

Naturalised bird species observed on the property were Australian magpie, blackbird, chaffinch, dunnock, goldfinch, greenfinch, house sparrow, redpoll, song thrush, starling and yellowhammer.

Significance of the Bird Fauna

Six threatened bird species, kea (nationally endangered), Black-billed gull (serious decline), New Zealand falcon (gradual decline), banded dotterel (gradual decline), South Island rifleman (sparse) and black shag (sparse) were recorded on the property. The rock bluffs in Pylon Gully appear to provide suitable nesting habitat for New Zealand falcon, and a family group of falcons was observed elsewhere in the Cass valley. Black-fronted terns (nationally endangered) were observed feeding over shrublands and paddocks on the property earlier in the summer. Wrybill (nationally vulnerable) were recorded on the Waimakariri River adjacent to the property. Marsh crake (sparse) may utilise wetland habitats on the property.

2.6.3 Lizards

There is only one lizard record from Cora Lynn Pastoral Lease listed in the Department of Conservation Herpetofauna Database: a Southern Alps gecko observed on Mt Horrible in 1995. Recent fires are likely to have affected the numbers and distribution of lizards on the property. There are few lizard records for the surrounding area; the most notable record is that of a spotted skink (threat status: gradual decline) just east of the property in the Cass valley between Romulus and Remus. Common skink, McCann's skink and Southern Alps gecko have been recorded from several locations nearby including Cass, Remus, Mt Olympus, Castle Hill, and the Edwards River valley.

Lizards observed on Cora Lynn Pastoral Lease are described below for the five distinct parts of the property surveyed.

Forest and Shrubland around the Wilderness Lodge

One common skink and one Southern Alps gecko were found underneath a piece of metal on the edge of the mountain beech forest and shrubland near Bruce Stream.

Fans on the Lower Slopes of Black Range, South Side of West Coast Road

Lizard habitat on these fans is provided by matagouri shrubland and exposed rock and scree on the steeper slopes. Two Southern Alps geckos were found under rocks among the scree on the steep slopes of the unnamed fan. Two common skinks and two Southern Alps geckos were found close to McKay Stream and Broad Stream.

Shrubland, River Terraces and River Margins North of the West Coast Road

Three Southern Alps geckos and one common skink were found under rocks on a small river terrace at the edge of the matagouri shrubland near the Waimakariri River.

Mt Horrible

One Southern Alps gecko was found under a rock in fire-induced grassland on the lower north-facing slopes of Mt Horrible. Suitable lizard habitats appear to be present on the upper slopes and summit of Mt Horrible.

East-Facing Slopes, South of Corner Knob

Three Southern Alps geckos and three common skinks were found under rocks at the base of the hill among small scree, shrubland and grassland.

Lizard Species Recorded

Two lizard species were observed on the property: Southern Alps gecko and common skink. Both species were found at a number of locations.

Significance of lizard fauna

Relatively low numbers of common lizard species (common skink and Southern Alps gecko) and no threatened lizard species were observed on the property. Favourable lizard habitats are present, though some of these have been affected by recent fires.

Insert Bird and Lizard values map in here

2.6.4 Freshwater Fauna (fish and invertebrates)

Cora Lynn Pastoral Lease lies in the upper Waimakariri River catchment. It is drained by the Waimakariri River and its tributaries (Bruce Stream, Broad Stream and McKay Stream) and the Cass River and its tributaries (Misery Stream, Snowslide Stream and McLeod Stream). There are two large wetlands on the property, one in the Cass valley just east of Mt Horrible (known locally as Horrible Bog) and Misery Swamp a little further south up the Cass River valley.

One of the distinguishing features of the Waimakariri River is that it is not affected by dams. This has two effects on the fish communities. The first is that diadromous species (those species with a sea-going phase in their lifecycle) are more likely to be present. The second effect is that fish are able to move between catchment tributaries, allowing re-colonisation of streams.

The New Zealand Freshwater Fish Database (NZFFD) has 342 records from the Waimakariri River catchment (at 11th May 2006). Species recorded from rivers and streams near the property are longfin eel, alpine galaxias, Canterbury galaxias, koaro, upland bully, common bully, rainbow trout, Chinook salmon and brown trout. Longfin eel is considered threatened (gradual decline) by Hitchmough and Bull (*in press*).

Cora Lynn Pastoral Lease comprises two main geographic areas of freshwater habitat, classified by physical character and location (catchment). Freshwater habitats and the fish and macro-invertebrate species recorded are described below for each of these areas.

Waimakariri River Catchment

This area comprises the part of the property that is drained by the main stem of the Waimakariri River. Freshwater habitats are mostly small ephemeral streams, as the open gravel beds of the two larger Bruce and Broad streams and the Waimakariri River lie outside the property boundary. The smaller ephemeral streams flow through shrubland, scrub, grassland and small areas of mountain beech forest. Tutu is present along some stream margins, and willow and poplar are present on the margins of the larger streams and rivers adjacent to the property. Russell lupin, gorse, broom and stonecrop are present on some open riverbeds adjacent to the property. Stock and wild animal access to smaller streams appears unrestricted; however, areas along McKay Stream and the upper parts of Bruce and Broad streams have been retired from grazing.

The ephemeral streams were all dry at the time of the survey, but appear to be a metre wide and c.100 mm deep when flowing. Bruce and Broad streams are between two and seven metres wide, and c.100 mm deep with pools more than 600 mm deep. Bruce Stream is larger than Broad Stream. The Waimakariri River is over 20 metres wide and over one metre deep, with several holes over two metres deep, in the vicinity of the property. Ephemeral stream substrates are mostly gravel and mud. Substrates of larger streams are mainly boulders, cobbles and gravels.

Three sites were electro-fished in this area: two in Broad Stream (lower Broad Stream and upper Broad Stream) and one in Bruce Stream. Alpine galaxias and Canterbury galaxias were found at two sites (upper Broad Stream and Bruce Stream). No other species were found and no fish were found at the lower Broad Stream site. Additional species recorded in the NZFFD from areas bordering the property in this area are brown trout, Chinook salmon, koaro, longfin eel, rainbow trout and upland bully.

Macro-invertebrates observed in this area were: *Ameletopsis perscitus*, *Coloburiscus humeralis*, *Deleatidium* spp., *Megaleptoperla grandis*, *Stenoperla prasina*, *Hydrobiosis* sp., *Hydropsychidae* sp. and *Aphrophila* sp.

Cass River Catchment

This area comprises the part of the property in the catchment of the Cass River. Freshwater habitats are a series of ephemeral wetlands and tarns east of Goldney Saddle, the stream and wetland system east and southeast of Mt Horrible (including Pylon Gully stream, Horrible Bog and Misery Swamp), and the steeper gorgy streams in the upper Cass River valley (Misery, Snowslide and McLeod streams).

Streams in this area flow through remnants of mountain beech forest, scrub, shrubland, grassland and patches of gorse and broom. Wetlands support sedgeland and rushland plant communities, with areas of exotic grasses and lotus, and have grassland and shrubland on their margins. The two main wetlands (Horrible Bog and Misery Swamp) have been fenced from stock. Otherwise, stock and wild animal access appears unrestricted except that animals do not appear to be grazed in the upper Cass valley. Vehicle tracks cross some of the waterways by fords and culverts.

Most streams in this area are approximately one metre wide and c.100 mm deep, with pools c.500 mm deep. The outlet stream of Horrible Bog (locally called Waterfall Stream) is c.400 mm deep with pools up to 800 mm deep with a waterfall (c.10 m high) at E2406780-N5796014. Misery Stream is approximately three metres wide, and the Cass River approximately seven metres wide. Horrible Bog covers approximately four hectares and Misery Swamp covers six hectares, however defining the margins of both wetlands is difficult. Other wetlands in this block cover less than one hectare. The tarns east of Goldney Saddle all cover less than 50 m². Stream substrates are generally gravel and cobble, although boulders and bedrock are present in their lower reaches and in the Cass River. Wetland substrates are mud.

Six sites were electro-fished in this area: two in the outlet stream of Horrible Bog (upper Waterfall Stream and lower Waterfall Stream); two in tributary streams of Misery Swamp (Pylon Gully stream and Misery Stream); one in the outlet stream of Misery Swamp (Misery Swamp outlet); and one in the Cass River. Longfin eels were found in three sites (upper Waterfall Stream, lower Waterfall Stream and Pylon Gully stream), brown trout at three sites (Pylon Gully stream, Misery Stream and Misery Swamp outlet), Canterbury galaxias at two sites (Misery Stream and Cass River), upland bully at one site (lower Waterfall Stream) and alpine galaxias and Chinook salmon at one site (Cass River). Longfin eels were also found by hand-netting in the Horrible Bog outlet stream above the waterfall. Additional species recorded in the NZFFD are common bully and koaro.

Macro-invertebrates observed in this area were: *Archichauliodes diversus*, *Coloburiscus humeralis*, *Deleatidium* spp., *Hydrobiosella stenocerca*, *Hydrobiosis* sp., *Hydropsychidae* sp., *Olinga feredayi*, *Pycnocentria* sp., *Triplectides* sp., *Zelandopsycha ingens* and *Neocurupira* sp.

Species Recorded

Six fish species were recorded during this survey of ten freshwater sites on or adjacent to Cora Lynn Pastoral Lease.

Table Four Fish species recorded from Cora Lynn Pastoral Lease.

Fish Species	Threat Status	Known Distribution on Property
alpine galaxias	Not threatened	Braided river and stream channels.
brown trout	Introduced	Streams in the vicinity of Misery Swamp.
Canterbury galaxias	Not threatened	Braided river and stream channels; Misery Stream.
Chinook salmon	Introduced	Cass River.
longfin eel	Gradual decline	Streams in the Cass River catchment.
upland bully	Not threatened	Horrible Bog outlet stream.

Scientific Studies

Areas with scientific value are recognised as significant, particularly sites with a previous detailed and published record of scientific investigation; or sites that have monitoring records held by a recognised scientific institution. There are several sites which become significant for these reasons, given their use by the University of Canterbury and particularly Angus McIntosh and some of his students (Angus McIntosh *Pers. Comm.*). These sites include: Pylon Gully Stream, from the flats below Pylon Gully to the top of this catchment; Misery Swamp and Misery Stream; streams around Corner Knob including Waterfall Stream; tarns around Goldney Saddle; Bruce Stream; and Broad Stream. Details about these scientific values are listed in Table 5. There is further sign of monitoring in Misery Stream, where a water-level gauge appears to be permanently installed, although this appears to be a separate programme to any being undertaken by the University of Canterbury.

Table 5: The details of scientific investigations and monitoring undertaken by the University of Canterbury, with details about some of the published papers for these where appropriate.

Location	Details
Pylon Gully Stream	Interaction effects between <i>Zelandopsyche ingens</i> which are associated with beech forest, and predatory brown trout. This is a co-occurrence not often found. Published papers: McIntosh <i>et. al.</i> (2005). Other ongoing monitoring. Published papers: Nystrom <i>et. al.</i> (2003).
Misery Swamp and Misery Stream	Part of ongoing fish monitoring work. Published papers: McIntosh (2000).
Streams around Corner Knob including Waterfall Stream	Part of a current honours thesis
Tarns around Goldney Saddle	Part of a current PhD thesis.
Broad Stream	Part of ongoing fish monitoring work.
Bruce Stream	Part of ongoing fish monitoring work.

Significance of the Freshwater Fauna

The presence of longfin eel (threat status: gradual decline) in the Cass River valley is significant. Freshwater habitats in the Cass River valley, notably the Horrible Bog-Misery Swamp complex, are significant for species diversity: four native fish species were recorded from this area. Freshwater habitats on the property are generally in good condition. The Waimakariri River catchment is listed as a 'Type I' Waters of National Importance (Chadderton *et al.*, 2004), due to the national significance of the majority of the freshwater ecosystem. Several areas on the property are sites of scientific investigation, notably the Horrible Bog-Misery Swamp system including its tributary streams, the tarns near Goldney Saddle and Bruce and Broad streams.

Insert Aquatic values map here

2.6.5 Terrestrial Invertebrates

The Craigieburn and Cass ecological districts, in which a large part of Cora Lynn Pastoral Lease lies, have been subject to intense biological research (e.g. Cockayne, 1899; Chilton, 1915; Burrows, 1962; Knox, 1968; Burrows 1977). Entomological studies within the Cass/Waimakariri basin include those of Tillyard (1921), Pilgrim (1947), White (1964), Bigelow (1967) and Johns (1970). These authors have collected numerous type specimens, conducted significant ecological studies and contributed to a substantial checklist of the invertebrate species found in the Cass area (Burrows, 1977).

Cora Lynn Pastoral Lease encompasses a diverse range of habitats including riverbed, grassland, tussockland, shrubland, forest, scree and wetlands. Collecting effort was targeted towards endemic taxa of spiders, harvestmen, beetles, grasshoppers, weta, cockroaches, millipedes and centipedes. Species within these taxonomic groups often display local endemism and flightlessness, and many are threatened.

Invertebrates of Cora Lynn Pastoral Lease are described below for the five main parts of the property sampled.

Homestead and McKay Stream Area

Habitats within this area include mountain beech forest, manuka shrubland, regenerating grey scrub, grassland and stonefield (streambed). Intact beech forest habitat is present near Bruce Stream, in the southwest corner of the property. A spider (*Amphinecta mara*) (threat status: data deficient), was found in a pitfall trap within beech forest. *Amphinectid* spiders are nocturnal hunters that roam the forest floor and hide by day in or under logs. The holotype of *A. mara* was collected by John Dugdale from nearby Mt Misery in 1954 with subsequent collections from Cass, Hawdon Valley and Arthur's Pass (Forster and Wilton, 1973). Little is known about the biology or distribution of *A. mara*, though all specimens have been collected in relatively unmodified natural habitats.

Several endemic beetle species were also found in the area, including the metallic green ground beetle (*Megadromus antarcticus*) and two small carabid species within the genus *Bembidion* and *Demetrida*. *Megadromus antarcticus* is a Canterbury endemic and while relatively common it is prone to predation by hedgehogs, rats and possibly cats and stoats. *Mecodema fulgidum* (not threatened) was also recorded. Other native beetle taxa collected from mountain beech forest in this area were *Aleochara* sp. and kekerewai manuka chafer.

Habitat conditions (soft loess for burrows, native flowering plants and north-facing sunny slopes) at this southwest corner of the property are ideal for native bees, two of which (*Leioproctus fulvescens* and *Halictus* sp.) were abundant. This habitat also supports the bush fly (*Scaptia adrel*), native crane flies (*Leptotarsus* sp.) and occasional weta (*Isoplectron calcaratum?*).

Throughout drier open grassland, a suite of typical insects was noted, including the cricket (*Bobilla* sp.), the endemic Campbell's cicada, tussock katydid (*Conocephalus bilineatus*), common copper butterfly and boulder copper butterfly. These grasslands also support many common and endemic spiders, the majority represented by the wolf spider (*Anoteropsis hilaris*), a native species of sheetweb spider (*Laetesia* sp.) and the endemic millipede (*Icosidesmus variegata*). A species of cockroach (*Celatoblatta vulgaris*) was typically abundant beneath the bark of beech trees.

Lower Bruce Stream-Broad Stream Fan

This area, which is predominantly grassland and matagouri shrubland, terminates at the bed of the Waimakariri River. Common Lepidoptera found in the area include the common copper butterfly, southern blue butterfly, tussock ringlet (*Argyrophenaga antipodum*) and common grass moth. Native

flies were well represented by Tachinids (parasites of spiders, beetle larvae and caterpillars), blowflies, and the large hover fly. Common species of Othoptera present were the New Zealand grasshopper, tussock katydid (*Concephalus* sp.) and abundant *Bobilla* crickets.

Pylon Gully

Pylon Gully supports many noteworthy insect taxa. The threatened grasshopper *Brachaspis* “lowland” was found amongst scree run-out gravel and rock. These medium-sized slate grey grasshoppers are closely related to *Brachaspis nivalis* except they are found at lower altitudes (McGuinness, 2001; Walker, 2003; S. Morris *pers. comm.*). Collection records for *Brachaspis* “lowland” include several locations near Cora Lynn, the Cass River bed at Lake Grasmere and near Ribbonwood Stream. Current threats to this species are population isolation through habitat loss or reduction.

Elsewhere in Pylon Gully a range of invertebrate taxa characteristic of shrubland, wetland and beech forest was collected. The water spider *Dolomedes aquaticus* (data deficient) was found beneath stones near a stream. Chilton’s giant dragonfly and Smith’s dragonfly were observed throughout Pylon Gully, both actively catching pollinators on flowering shrubs. The red damselfly was similarly abundant at wetlands and streams. These same habitats produced high numbers of fungus gnat (*Mycetophila* sp.), seed bug (*Rhyphodes* sp.), native bee (*Leioproctus fulvescens*) and nurseryweb spider. The endemic Campbell’s cicada was abundant throughout.

Invertebrates collected within the beech forest in Pylon Gully were the ground beetle (*Megadromus enysi*), long-legged harvestmen (*Pantopsalis* sp.), kekerewai manuka chafer and moths (*Pseudocoremia* spp.).

Mt Horrible and Lower Cass River

Mt Horrible (1234 m) is the highest point on the property. Below c.900 m, native invertebrate habitat is in poor condition and threatened by grazing and wildfire. However, toward the summit of Mt Horrible, the diversity and naturalness of the alpine vegetation improves. At 1200 m a single specimen of black mountain ringlet was noted flying above scree. While not threatened, this species is an endemic alpine specialist confined to scree, boulder and rocky environments at and above 1200 m. The adults feed on *Dracophyllum* nectar and blue tussock is a larval host plant (Gibbs, 1980).

Other butterflies present on Mt Horrible were the common copper and boulder copper, the presence of both suggesting that *Carmichaelia* and *Muehlenbeckia* host plants are present. The endemic darkling beetle *Artystona rugiceps* was common here, although not found elsewhere on the property.

Orthopteroids were well represented above 900 m on Mt Horrible, with species of cockroach (*Celatoblatta montana*), grasshopper (*Paprides nitidus*) and cricket widespread. On the summit of Mt Horrible, abundant native hover flies were visiting flowers of *Hebe subalpina* and tauhinu. Despite extensive searching, no large *Hemideina* or *Hemiandrus* weta were found, which is unusual because the group is well represented on the neighbouring Black and Craigieburn ranges. The higher elevations of Mt Horrible provide important habitat for subalpine and alpine invertebrate species, and are significant because of the ‘ecological island’ effect.

Cass River Valley

This area includes the lower slopes and terraces in the Cass River valley. The main habitats present are mountain beech forest, river bed, tussockland, matagouri shrubland, grassland and wetland. Invertebrates were collected from three sites in this area and each site produced a distinct suite of taxa. The diversity of invertebrates may be a result of the mosaic of habitats created by burning and grazing.

At a beech forest-grassland ecotone, invertebrate collections were made from decomposing beech trees, forest litter and grassland. All species found were native, the majority of these being beetles represented by a number of prominent taxa, including reticulate stag beetle, elephant weevil, chafer beetle *Odontria halli*, kekerewai manuka chafer and an Elatrid (*Metablax* sp.). Other insects present were the cockroach (*Celatoblatta vulgaris*), *Ctenoneurus hochstetterii*, ant (*Monomorium antarcticum*) and moths (*Pseudocoremia leucelaea* and *Pseudocoremia fascialata*).

At an area of tall manuka scrub the majority of sampled insects were flying species such as the hover fly (*Melangyna* sp.), bee (*Leioproctus* sp.) and ubiquitous copper butterflies (*Lycaena* spp.).

Sweep netting at Misery Swamp and Horrible Bog produced a catch of native insect species, either directly or secondarily associated with still water. Tipulids (*Leptotarsus* sp.) and red damselfly were abundant, and Smith's dragonfly occasionally present. A plethora of other fly taxa make use of the wetland, the most apparent groups being root gnats, robber flies, Muscids and the green blowfly. Lepidoptera were similarly well represented with grass moths (*Orocrambus* sp.) and the tussock ringlet both common. Native spiders noted at the site included a flower spider (*Diaea* sp.) and the nurseryweb spider. Misery Swamp and Horrible Bog are recognised as significant wetlands offering an important historic record of the local vegetation (Moar and Lintott, 1977). Both are fenced from stock.

A small diverse patch of mountain beech forest at the northeast corner of the property beside the lower Cass River includes species such as mountain toatoa. Invertebrate diversity generally reflects host plant diversity, and the forest remnant may support specialists such as the celery pine looper (*Pseudocoremia monacha*).

Species Recorded

Seventy-four invertebrate species representing five classes, 11 orders and 53 families were found on Cora Lynn Pastoral Lease during the two-day January inspection, including one threatened and two data-deficient species.

Table Six Notable invertebrate species recorded from Cora Lynn Pastoral Lease, January 2006.

Species	Threat status*	Distribution on Property
<i>Brachaspis</i> "lowland"	Nationally endangered	Pylon Gully.
<i>Amphinecta mara</i>	Data deficient	Beech forest and manuka shrubland near Bruce Stream.
<i>Dolomedes aquaticus</i> (water spider)	Data deficient	Pylon Gully.

* Threat status from Hitchmough (2002).

Significance of the Terrestrial Invertebrate Fauna

The majority of invertebrate taxa found on Cora Lynn Pastoral Lease are native. One threatened and two data-deficient species were found and there is a high possibility that other rare and/or threatened species are present. Pylon Gully appears the most biologically intact and natural area on the property. It supports a population of *Brachaspis* "lowland" (nationally endangered), has a diverse range of habitats within a confined area, is part of an area recommended for protection (Cass RAP 14) and links invertebrate communities on Mt Horrible and Mt Misery.

Mountain beech forest near Bruce Stream supports a population of the spider *Amphinecta mara* (data deficient). The diverse range of habitats in this area adds to its significance. Mt Horrible, Misery Swamp and the Cass valley beech forest also provide significant habitats for invertebrates. Mt Horrible represents an ecological island supporting endemic alpine insects, Misery Swamp and Horrible Bog support wetland invertebrates and beech forest in the Cass River valley has characteristic species of insects, all of which are endemic.

Insert Invertebrate values map here

2.6.6 Problem Animals

Introduced animal species that may have an important effect on indigenous plant or animal communities on the property, and that can be controlled or contained, are discussed below. Other ubiquitous naturalised species for which containment or control are probably impractical (such as rodents) are not discussed here.

Possum sign was observed on parts of the property, notably around rocky areas. Possums are browsers of palatable indigenous plants and predators of birds, lizards and invertebrates. Possum control was being undertaken in forests in the vicinity of the homestead during the survey. Rabbits and hares are also present on the property.

Red deer sign was observed in some areas of mountain beech forest on the property. Red deer and chamois are likely to be present on the Black Range adjacent to the property.

2.7 HISTORIC

2.7.1 Maori Cultural Values

It appears likely that the Waimakariri valley in the vicinity of Cora Lynn was used by Maori in pre-European times (Dennis, 1986). Rock drawings and charred moa bones at Castle Hill (McLeod and Burrows, 1977) and an umu (earth oven) near the old Bealey Hotel site adjacent to Cora Lynn (Skinner, 1912) are evidence of early human activity in the area.

2.7.2 European Heritage Values

Cora Lynn was first leased for grazing by the Goldney brothers in February 1860. The lease covered 8000 ha (20,000 acres) on the Black Range between the Cass and upper Waimakariri rivers (Acland, 1951). The first homestead was built west of the Cass River below Pylon Gully. The site is now indistinguishable. After 1865 a homestead was built near the present homestead between Broad Stream and Bruce Stream. At about this time a dray road was established around Mt Horrible (Paddys Bend), after which the homestead could be reached from the Cass valley without fording the Waimakariri River. The Bealey Accommodation House and ferry service across the Waimakariri River were established in 1865 to service the newly constructed West Coast Road (McLeod and Burrows, 1977).

The property was sold to John Macfarlane and Thomas Bruce in 1867 who used the property as a convenient place to fatten cattle destined for the West Coast. Macfarlane sold his interest in the property to Bruce in c.1870. Bruce also had the Riversdale Run on the north side of the Waimakariri River and 'The Paddock' at Inchbonnie. Cora Lynn was taken over by NZ Loan and Mercantile in the late 1880s and sold, together with Riversdale, Mt White and Lochinvar to F.J. Savill in 1902. When the lease expired in 1903, Cora Lynn was taken by R McKay. McKay sold the property to S.E. Rutherford in 1907. Rutherford ran Cora Lynn together with Grasmere until he lost the Grasmere leasehold during 1914-18. He sold Cora Lynn to Taylor and Faulkner in 1922 who, in 1927, bought the Grasmere lease back. The two properties were later sold to McLeod and Orbell (Acland, 1951).

Significance of Historic Resources

No significant historic resources are known from the property.

2.8 PUBLIC RECREATION

2.8.1 Physical Characteristics

The property can be divided into five main recreation units:

Waimakariri River Flats

This unit covers the lower altitude river flats, fans and terraces in the Waimakariri valley. The vegetation of the Waimakariri River flats is characterised by grassland and matagouri, short tussock grassland, weedy exotic grassland and cultivated paddocks. The setting for this unit is predominantly cultural due to the farming influence.

Waimakariri River Faces

This unit covers the hill faces from Bruce Stream through to Cornishmans Rise. The vegetation varies from regenerating shrubland, grassland and patches of regenerating beech forest. Vegetation of the northern slopes of Mt Horrible is modified due to fire. Charred remnants of shrubland and forest are scattered across these slopes. Pylon Gully slopes support beech forest. The setting for this unit is predominantly cultural due to the farming activities, the effects of fire and the presence of power utilities.

Lower Cass Valley

This unit covers the small hill east of Goldney Saddle in the lower Cass River Valley. It is bound by the Waimakariri River, the lower Cass River, the highway and the straight-line boundary of the Corner Knob and Goldney Hill Government Purpose Reserve. It supports low-stature manuka shrubland, grassland and a small patch of beech forest. Grassland is more prevalent on the sunnier slopes overlooking the Waimakariri River. There is a wide scattering of tauhinu and matagouri, and occasional sedgeland communities in small flushes. Gorse is present but has been contained by weed control. The setting for this unit while showing signs of modification has natural vegetation and is visually significant.

Central Cass Valley

This unit encompasses the central eastern part of the property in the Cass River valley. It includes the distinctive Corner Knob, the eastern flanks of Mt Horrible, and the broad terraces and flats of the Cass valley. The eastern flanks of Mt Horrible and Mt Misery dominate the unit, with the upper slopes featuring areas of steep rock. Lower down the terrain is undulating or flat with valley-floor wetlands, terraces and fans.

The ground cover is a mosaic of modified grassland, successional shrubland and pockets of strongly-regenerating beech forest. Much of this unit has been affected by fires, especially the eastern flank of Mt Horrible. A large proportion of the unit supports modified grassland, though shrubland and forest are rapidly regenerating on the hummocky terrain near Corner Knob. Relatively extensive areas of rushland are present in wetlands. Patches of gorse are present near Misery Swamp, and extensive infestations of gorse and broom are present on and east of the bed of the Cass River. The setting for this unit is modified but one that still has natural vegetation and is visually significant due to Mt Horrible and Corner Knob.

Upper Cass Valley

This unit covers the southern part of the property in the upper Cass River valley. It comprises the lower southeast slopes of Mt Misery. These slopes are an important component of the V-shaped valley that encloses the Cass River. They are typified by an alternating pattern of straight-sided slopes and eroding gullies. Pockets of beech forest extend down to the margins of the Cass River, while the balance of the unit supports grassland and shrubland. The setting is predominantly natural due to the absence of structures and lack of intensive land uses.

2.8.2 Legal Access

Roads

The West Coast Road (State Highway 73) runs through or alongside the northern and eastern parts of the property. Cora Lynn Road runs through the property near the homestead, providing access from the West Coast Road to freehold parts of Cora Lynn and beyond to Craigieburn Conservation Park on the Black Range. An unformed legal road just east of Broad Stream provides legal access from the West Coast Road across freehold parts of the property to Cora Lynn Pastoral Lease north and south of the West Coast Road.

Adjoining Crown and Public Conservation Land

Crown land (hydro) is present within or adjacent to the property on the beds of Bruce, Broad and McKay streams and the Waimakariri and Cass rivers.

Cora Lynn Pastoral Lease adjoins Craigieburn Conservation Park to the south on the Black Range, Bealey Spur Conservation Area across Bruce Stream to the west, Waimakariri Riverbed Conservation Area to the northwest, Arthur's Pass National Park across the Waimakariri River to the north, Hawdon Flats Government Purpose Reserve across the Waimakariri River to the northeast, and Corner Knob and Goldney Hill Government Purpose Reserve at Goldney Saddle.

Marginal Strips

No marginal strips appear to be present along streams on or within the property boundaries.

2.8.3 Activities

Cora Lynn Road and the bed of the Cass River adjacent to the property provide access to the popular Cass-Lagoon Saddle tramp. Cora Lynn Road is part of the proposed Te Araroa (The Long Pathway), a proposed foot trail from top to bottom of the country. A roughly-marked route from the West Coast Road west of Paddys Bend provided (before the 2001 wildfire) access to Pylon Gully and the summit of Mt Horrible. This part of the property has considerable potential for walking. The summit of Mt Horrible offers spectacular views of the Waimakariri valley and Cass basin. There is a track from the Mt White road up the hill (Point 680) to the east of Goldney Saddle, providing good views of the river and the basin.

Short tracks developed by the lessee in the vicinity of the homestead, notably the Rainbow Valley Nature Walk and McKay Moa Forest Walk provide very good opportunities for walking and nature study. The Waimakariri Valley track provides an opportunity for mountain biking as well as running and walking. The property forms a prominent part of the mountain scenery viewed by travellers on the West Coast Road and Midland Railway (Tranz-alpine Express), providing opportunities for passive recreation such as scenery viewing. There are opportunities on the pastoral lease for passive forms of recreation including picnicking, photography and scenic appreciation.

Significance of Recreation

There are significant opportunities for recreation including the walks close to the Wilderness Lodge, longer walks on Mt Horrible and tramping access to the adjoining Craigieburn Conservation Park. The Cass- Lagoon Saddle Track can be accessed from two points on or adjacent to the lease. This track is proposed as part of Te Araroa (The Long Pathway). There are opportunities on the pastoral lease for passive forms of recreation including picnicking, photography and scenic appreciation.

PART 3 OTHER RELEVANT MATTERS AND PLANS

3.1 CONSULTATION

Information-gathering meetings were held with representatives of non-governmental organisations (NGOs) at Christchurch on 5th September 2005 and at Geraldine on 6th September 2005. Comments made at those meetings are summarised below.

- Areas of matagouri shrubland adjacent to the Waimakariri River are notable and warrant protection; ideally a sequence of vegetation should be protected to link these shrublands with the riverbed.
- The existing area of conservation land at Goldney Saddle should be extended down to the Cass River.
- The large wetland (Misery Swamp) should be protected.
- Mt Horrible should be protected as conservation land.
- The area on the west side of the upper Cass Valley should be protected to avoid creating an enclave of farmland within Craigieburn Conservation Park.
- Broad Stream is an interesting area which supports threatened skinks; it is now relatively weed free and should be protected.
- Public access to the Bealey Hut (along the legal road) should be protected.
- Public access should be provided along the vehicle track near Misery Swamp from Cass River to Pylon Gully.
- Public foot access should be provided to the Black Range, via Mt Misery, from the northwest or from Misery Swamp.
- The protection of practical foot access up the Cass River to Hamilton Hut as part of the Cass-Lagoon Saddle Trip is important.

3.2 DISTRICT PLANS

Cora Lynn Pastoral Lease lies within the High Country Area of the Rural Zone of the Selwyn District. All parts of the property except lower-altitude flats in the Cass valley are within an Area of Outstanding Landscape.

3.3 CONSERVATION MANAGEMENT STRATEGIES

Cora Lynn Pastoral Lease lies within the Waimakariri Place Unit of the Canterbury Conservancy. Relevant priority objectives for this unit listed in the CMS (Department of Conservation, 2000) are:

- To identify the significant indigenous vegetation and threatened plant and animal species of the Waimakariri Unit.
- To use a range of effective methods to protect the indigenous biodiversity of the Waimakariri Unit.
- To protect and enhance the viability of priority threatened species' populations and their habitat(s) in the Waimakariri Unit.
- To support land management practices that will maintain natural ecosystems, landscape and indigenous species populations.

- To encourage recreational use compatible with the protection and enhancement of indigenous species and habitats.
- To contain and/or remove wilding trees in the area generally.
- To manage visitors in a way that is not inconsistent with the conservation of natural and historic resources, through the maintenance and development of suitable facilities, information and services.
- To assist public appreciation of natural and historic values, and foster appropriate facility development, adjacent to State Highway 73 between Porters and Arthur's passes.
- To install and maintain high quality recreational facilities and interpretive panels at roadside rest areas managed by the Conservancy along State Highway 73 between Porters and Arthur's passes, and further west in conjunction with the West Coast Conservancy.
- To protect the natural, historic and cultural values of the landforms and associated habitats of the Waimakariri basin.
- To foster recreation and allow commercial usage of the land managed by the Department in the basin in a manner that protects its unique natural, historic and cultural values.

3.4 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. This strategy is a blueprint for managing the country's diversity of species and habitats. It sets a number of goals to achieve this aim. Of particular relevance to tenure review is Goal 3, 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 systems 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.

PART 4 ATTACHMENTS

4.1 ADDITIONAL INFORMATION

4.1.1 Scientific Names of Species

Plant Species referred to in text

Species names follow those in the published volumes of New Zealand Flora and the name changes listed in A Checklist of Indigenous Vascular Plants of New Zealand, 10th Revision (*Unpublished Document*, S. Courtney, Department of Conservation, Nelson). Maori names are included for taonga species listed in Schedule 97 of the Ngai Tahu Claims Settlement Act 1998. Naturalised species are indicated by an asterisk (*).

<u>Common name</u>	<u>Scientific name</u>
beech/tawhai.....	<i>Nothofagus</i> spp.
blackberry*.....	<i>Rubus fruticosus</i>
blue tussock.....	<i>Poa colensoi</i>
blue wheatgrass.....	<i>Elymus solandri</i>
bog rush.....	<i>Schoenus pauciflorus</i>
bracken.....	<i>Pteridium esculentum</i>
bristle tussock.....	<i>Rytidosperma setifolium</i>
broadleaf/kapuka.....	<i>Griselinia littoralis</i>
broom*.....	<i>Cytisus scoparius</i>
browntop*.....	<i>Agrostis capillaris</i>
bush snowberry.....	<i>Gaultheria antipoda</i>
cabbage tree/ti rakau.....	<i>Cordyline australis</i>
Californian thistle*.....	<i>Cirsium arvense</i>
catsear*.....	<i>Hypochoeris radicata</i>
Chewings fescue*.....	<i>Festuca rubra</i>
cocksfoot*.....	<i>Dactylis glomerata</i>
common pennywort.....	<i>Hydrocotyle novae-zeelandiae</i>
cotton daisy/tikumumu.....	<i>Celmisia spectabilis</i>
crack willow*.....	<i>Salix fragilis</i>
creeping buttercup*.....	<i>Ranunculus repens</i>
creeping mapou.....	<i>Myrsine nummularia</i>
creeping pohuehue.....	<i>Muehlenbeckia axillaris</i>
dainty daisy.....	<i>Celmisia gracilentia</i>
Douglas fir*.....	<i>Pseudotsuga menziesii</i>
edelweiss.....	<i>Leucogenes grandiceps</i>
everlasting daisy.....	<i>Helichrysum bellidioides</i>
fescue tussock.....	<i>Festuca novae-zelandiae</i>
foxglove*.....	<i>Digitalis purpurea</i>
golden speargrass/taramea.....	<i>Aciphylla aurea</i>
gorse*.....	<i>Ulex europaeus</i>
hanging spleenwort.....	<i>Asplenium flaccidum</i>
harebell.....	<i>Wahlenbergia albomarginata</i>
haresfoot trefoil*.....	<i>Trifolium arvense</i>

holly*	<i>Ilex aquifolium</i>
inaka	<i>Dracophyllum uniflorum</i>
jointed rush*	<i>Juncus articulatus</i>
kanuka	<i>Kunzea ericoides</i>
Kentucky bluegrass*	<i>Poa pratensis</i>
king devil hawkweed*	<i>Hieracium praealtum</i>
kohuhu	<i>Pittosporum tenuifolium</i>
korokio	<i>Corokia cotoneaster</i>
koromiko	<i>Hebe salicifolia</i>
kowhai	<i>Sophora microphylla</i>
lancewood	<i>Pseudopanax crassifolius</i>
lawyer	<i>Rubus</i> sp.
Lindsay's poa	<i>Poa lindsayi</i>
little hard fern	<i>Blechnum penna-marina</i>
Lombardy poplar*	<i>Populus nigra</i>
lotus*	<i>Lotus pedunculatus</i>
manuka	<i>Leptospermum scoparium</i>
marsh thistle*	<i>Cirsium palustre</i>
matagouri	<i>Discaria toumatou</i>
midribbed snow-tussock	<i>Chionochloa pallens</i>
mingimingi	<i>Coprosma propinqua</i>
mint*	<i>Mentha spicata</i>
mountain akeake	<i>Olearia avicenniifolia</i>
mountain beech	<i>Nothofagus solandri</i> var. <i>cliffortioides</i>
mountain clubmoss	<i>Lycopodium fastigiatum</i>
mountain flax/wharariki	<i>Phormium cookianum</i>
mountain oat grass	<i>Deyeuxia avenoides</i>
mountain toatoa	<i>Phyllocladus alpinus</i>
mountain totara	<i>Podocarpus hallii</i>
mountain wineberry	<i>Aristotelia fruticosa</i>
mouse-ear chickweed*	<i>Cerastium fontanum</i>
mouse-ear hawkweed*	<i>Hieracium pilosella</i>
native broom	<i>Carmichaelia australis</i>
native violet	<i>Viola cunninghamii</i>
oxeye daisy*	<i>Leucanthemum vulgare</i>
patotara	<i>Leucopogon fraseri</i>
pohuehue	<i>Muehlenbeckia australis</i>
poplar*	<i>Populus</i> sp.
porcupine shrub	<i>Melicetyus alpinus</i>
prickly shield fern	<i>Polystichum vestitum</i>
pukio	<i>Carex secta</i>
purging flax*	<i>Linum catharticum</i>
raupo	<i>Typha orientalis</i>
rautahi	<i>Carex coriacea</i>
red beech	<i>Nothofagus fusca</i>
red clover*	<i>Trifolium pratense</i>
red woodrush	<i>Luzula rufa</i>
Russell lupin*	<i>Lupinus polyphyllus</i>
scabweed	<i>Raoulia australis</i>
Scotch thistle*	<i>Cirsium vulgare</i>
scrub pohuehue	<i>Muehlenbeckia complexa</i>
selfheal*	<i>Prunella vulgaris</i>
sheep's sorrel*	<i>Rumex acetosella</i>
short tussock	<i>Festuca</i> sp.
silver tussock/wi	<i>Poa cita</i>

snowberry	<i>Gaultheria depressa</i>
snow daisy	<i>Celmisia laricifolia</i>
snow totara	<i>Podocarpus nivalis</i>
soft rush*	<i>Juncus effusus</i>
southern rata	<i>Metrosideros umbellata</i>
sphagnum moss	<i>Sphagnum</i> sp.
spike sedge	<i>Eleocharis acuta</i>
star sedge	<i>Carex echinata</i>
stonecrop*	<i>Sedum acre</i>
swamp kiokio	<i>Blechnum minus</i>
sweet brier*	<i>Rosa rubiginosa</i>
sweet vernal*	<i>Anthoxanthum odoratum</i>
tauhinu	<i>Ozothamnus leptophyllus</i>
thousand-leaved fern	<i>Hypolepis millefolium</i>
toetoe	<i>Cortaderia richardii</i>
turpentine shrub	<i>Dracophyllum uniflorum</i>
tussock hawkweed*	<i>Hieracium lepidulum</i>
tutu	<i>Coriaria sarmentosa</i>
wall lettuce*	<i>Mycelis muralis</i>
weeping mapou	<i>Myrsine divaricata</i>
white clover*	<i>Trifolium repens</i>
white fuzzweed	<i>Vittadinia australis</i>
willow*	<i>Salix</i> sp.
woolly moss	<i>Racomitrium pruinosum</i>
woolly mullein*	<i>Verbascum thapsus</i>
yarrow*	<i>Achillea millefolium</i>
yellowwood	<i>Coprosma linariifolia</i>
Yorkshire fog*	<i>Holcus lanatus</i>

Animal Species referred to in text

Species names follow King (1990) for mammals, the June 2003 version of the New Zealand Recognized Bird Names list (compiled by C.J.R. Robertson and D.G. Medway for the Ornithological Society of New Zealand Inc.) for birds, Whitaker (1998) for lizards and McDowall (2000) for fish. Common names for invertebrates are those listed in the Entomological Society of New Zealand's Handbook of New Zealand Insect Names (Scott and Emberson, 1999). Maori names are included for taonga species listed in Schedule 97 of the Ngai Tahu Claims Settlement Act 1998. Naturalised species are indicated by an asterisk (*).

<u>Common name</u>	<u>Scientific name</u>
alpine galaxias	<i>Galaxias paucispondylus</i>
Australasian bittern	<i>Botaurus poiciloptilis</i>
Australasian crested grebe/kamana	<i>Podiceps cristatus australis</i>
Australasian harrier/kahu	<i>Circus approximans</i>
Australian magpie*	<i>Gymnorhina tibicen</i>
banded dotterel	<i>Charadrius bicinctus bicinctus</i>
bat	see South Island long-tailed bat
bellbird/korimako	<i>Anthornis melanura melanura</i>
black-billed gull	<i>Larus bulleri</i>
blackbird*	<i>Turdus merula</i>
black-fronted tern	<i>Sterna albostrata</i>
black mountain ringlet	<i>Percnodaimon merula</i>
black shag/koau	<i>Phalacrocorax carbo novaehollandiae</i>

black stilt/kaki	<i>Himantopus novaeseelandiae</i>
blue duck/kowhiowhio	<i>Hymenolaimus malacorhynchos</i>
boulder copper butterfly	<i>Lycaena boldenarum</i>
brown creeper	<i>Mohoua novaeseelandiae</i>
brown hare*	<i>Lepus europaeus occidentalis</i>
brown trout*	<i>Salmo trutta</i>
brushtail possum*	<i>Trichosurus vulpecula</i>
Campbells' cicada	<i>Maoricicada campbelli</i>
Canterbury galaxias	<i>Galaxias vulgaris</i>
Caspian tern	<i>Sterna caspia</i>
cat*	see house cat
chaffinch*	<i>Fringilla coelebs</i>
chamois*	<i>Rupicapra rupicapra rupicapra</i>
Chilton's giant dragonfly	<i>Uropetala chiltoni</i>
Chinook salmon*	<i>Oncorhynchus tshawytscha</i>
common bully	<i>Gobiomorphus cotidianus</i>
common copper butterfly	<i>Lycaena rauparaha</i>
common grass moth	<i>Orocrambus flexuosellus</i>
common skink	<i>Oligosoma nigriplantare polychroma</i>
dunnock*	<i>Prunella modularis</i>
elephant weevil	<i>Rhyncodes ursus</i>
European hedgehog*	<i>Erinaceus europaeus occidentalis</i>
European rabbit*	<i>Oryctolagus cuniculus cuniculus</i>
goat*	see feral goat
goldfinch*	<i>Carduelis carduelis</i>
great spotted kiwi/rotoa	<i>Apteryx haastii</i>
greenfinch*	<i>Carduelis chloris</i>
green blowfly	<i>Lucilia sericata</i>
green skink	<i>Oligosoma chloronoton</i>
grey duck/parera	<i>Anas superciliosa superciliosa</i>
grey warbler/riroriro	<i>Gerygone igata</i>
hare*	see brown hare
hedgehog*	see European hedgehog
house cat*	<i>Felis catus</i>
house sparrow*	<i>Passer domesticus</i>
kea	<i>Nestor notabilis</i>
kekerewai manuka chafer	<i>Pyronota festiva</i>
koaro	<i>Galaxias brevipinnis</i>
kowhai moth	<i>Uresiphita polygonalis maoralis</i>
lamprey/kanakana	<i>Geotria australis</i>
large hover fly	<i>Melangyna novaezealandiae</i>
longfin eel/tuna	<i>Anguilla dieffenbachii</i>
long-tailed cuckoo/koekoea	<i>Eudynamys taitensis</i>
McCann's skink	<i>Oligosoma maccanni</i>
marsh crake	<i>Porzana pusilla affinis</i>
metallic green ground beetle	<i>Megadromus antarcticus</i>
New Zealand falcon/karearea	<i>Falco novaeseelandiae</i>
New Zealand grasshopper	<i>Phaulacridium marginale</i>
New Zealand pipit/pihoihoi	<i>Anthus novaeseelandiae novaeseelandiae</i>
nurseryweb spider	<i>Dolomedes minor</i>
orange-fronted parakeet	<i>Cyanorhamphus malherbi</i>
paradise shelduck/putakitaki	<i>Tadorna variegata</i>
possum*	see brushtail possum
rabbit*	see European rabbit
rainbow trout*	<i>Oncorhynchus mykiss</i>

red damselfly	<i>Xanthocnemis zealandica</i>
red deer*	<i>Cervus elaphus scoticus</i>
redpoll*	<i>Carduelis flammea</i>
reticulate stag beetle	<i>Paralissotes reticulatus</i>
rock wren	<i>Xenicus gilviventris</i>
short-tailed bat	<i>Mystacina tuberculata</i>
silvereve	<i>Zosterops lateralis lateralis</i>
Smith's dragonfly	<i>Procordulia smithii</i>
song thrush*	<i>Turdus philomelos</i>
Southern Alps gecko	<i>Hoplodactylus</i> aff. <i>maculatus</i> "Southern Alps"
southern black-backed gull/karoro	<i>Larus dominicanus dominicanus</i>
southern blue butterfly	<i>Zizina labradus oxleyi</i>
South Island fantail/piwakawaka	<i>Rhipidura fuliginosa fuliginosa</i>
South Island kaka	<i>Nestor meridionalis meridionalis</i>
South Island long-tailed bat	<i>Chalinolobus tuberculatus</i>
South Island pied oystercatcher	<i>Haematopus ostralegus finschi</i>
South Island rifleman/titipounamu	<i>Acanthisitta chloris chloris</i>
South Island tomtit/miromiro	<i>Petroica macrocephala macrocephala</i>
spotted skink	<i>Oligosoma lineocellatum</i>
spur-winged plover	<i>Vanellus miles novaehollandiae</i>
starling*	<i>Sturnus vulgaris</i>
stoat*	<i>Mustela erminea</i>
tussock butterfly	<i>Argyrophenga</i> sp.
tussock ringlet	<i>Argyrophenga antipodum</i>
upland bully	<i>Gobiomorphus breviceps</i>
upland longjaw galaxias	<i>Galaxias prognathus</i>
water spider	<i>Dolomedes aquaticus</i>
welcome swallow	<i>Hirundo tahitica neoxena</i>
western weka	<i>Gallirallus australis australis</i>
wrybill	<i>Anarhynchus frontalis</i>
yellow-crowned parakeet/kakariki	<i>Cyanoramphus auriceps auriceps</i>
yellowhammer*	<i>Emberiza cintrenella</i>
yellowhead/mohua	<i>Mohoua ochrocephala</i>

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