Land Information New Zealand
Toitū te whenua

Crown Pastoral Land Tenure Review

Lease name : LONGLANDS
Lease number : PO 260

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.

MARCH 14

PAP_13-04-260

DOC CONSERVATION RESOURCES REPORT ON TENURE REVIEW OF

LONGLANDS PASTORAL LEASE

PAP 13-04-260

UNDER PART 2 OF THE CROWN PASTORAL LAND ACT 1998

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PART 1

INTRODUCTION

1.1 Background

The Longlands Pastoral Lease (PL) tenure review is being undertaken under the provisions of the Crown Pastoral Land Act 1998. As part of the tenure review process, a range of specialists have visited the property. Their reports identifying the significant inherent values on Longlands have been incorporated within this Conservation Resources Report (CRR).

The lessees of Longlands PL, Longlands Station Ltd (Geoffrey Farrar PRESTON and Susan Denise PRESTON) have applied to undertake tenure review. A survey was undertaken 22-23 November 2011. The fish inspection was undertaken on 7 December, when the waterways were sampled by electric fishing.

Longlands Station comprises approximately 2070 ha of pastoral lease and adjoining freehold land. It is located on the western end of the Pigroot Highway (SH 85) approximately 30 km east of the town of Ranfurly. It is bounded by SH85, the pastoral leases of Clover Flats and Islay Downs, with Kakanui Conservation Area at the back of the property (which was previously surrendered out of the PL).

The PL waterways feed two distinct catchments which include the headwaters of the Shag River (Waihemo), and the Swin Burn, a tributary of the Taieri River.

The lease lies across three ecological districts (Dansey, Macraes and Maniototo). These districts have been surveyed as part of the Protected Natural Areas Programme (PNAP). A PNAP report for the Maniototo Ecological District (Grove 1994) was based on an inventory of existing ecological information supplemented with some field investigation. No RAPs were identifed on this property. The Dansey ED was surveyed as part of the PNAP during the summer of 1989/90. The resulting report (Comrie 1992) did not identify any RAPs on the Lease. The Macraes ED was surveyed as part of the PNAP during the summer of 1994/95. The resulting report (Bibby 1997) did not identify any RAPs on the lease.

A more detailed description of the location and landscape setting of the property are given in the following Landscape assessment of this report.

PART 2

INHERENT VALUES: DESCRIPTION OF CONSERVATION RESOURCES AND ASSESSMENT OF SIGNIFICANCE

2.1 Landscape

The landscape assessment of Longlands Station PL was undertaken by 4WD, in weather conditions that were fine and clear.

The assessment includes a description of the property's location, the regional landscape context and the assessment methodology, followed by the landscape analysis and evaluation to identify significance.

METHODOLOGY

The process of landscape assessment includes the following steps:

1. Landscape units of the pastoral lease are defined. The landscape units reflect areas of similar landscape character. Landscape character is based on how the land looks and attributes such as visible geology/formative processes, waterbodies, vegetation type and pattern and any cultural use by humans. The PL has been divided into three landscape units.

2. The landscape character of the landscape unit is then described

3. The visual and scenic values of the property are described

4. An assessment of landscape vulnerability is given.

5. Landscape values are then assessed using the 5 criteria outlined below.

6. From the above, a determination is made about significance.

The definitions of the 5 criteria used to assess individual units are:

Naturalness: Refers to the condition of the natural vegetation, patterns and processes and the degree of modification present.

Legibility: Refers to its expressiveness - how obviously the landscape demonstrates the formative processes leading to it.

Aesthetic Factors: Include criteria such as distinctiveness - the quality that makes a particular landscape visually striking. Frequently this occurs when contrasting natural elements combine to form a distinctive and memorable visual pattern. A further criteria assessed under aesthetic factors is coherence. This is based on characteristics including intactness, unity, continuity, and

	compatibility. Intrusions, alterations, disruptions tend to detract from coherence.
Historic Values:	Refers to historically valued attributes in the context of a high country landscape
Visibility:	Refers to the visibility from public places such as highways, waterways or local vantage points.

LOCATION AND LANDSCAPE CONTEXT

Longlands PL is located on the edge of Central Otago on the entrance to the Pigroot (SH 85) and situated at the eastern end of the Maniototo Plain.

The pastoral lease is divided into two blocks, the home block and the run block. The run block is approximately 2 km east of the home block and extends from SH 85 (Morrisons Kyeburn Road) onto the foothills and mid slope flanks of the Kakanui Mountains. The main block borders 7 km of SH85.

The home block pastoral lease is located on the northern slopes of Swin Burn Peak and is accessed off Preston Road. The area of pastoral lease in the home block is 122 ha and the remainder is freehold.

The run block (approx.1949 ha in area) forms a series of north-east trending side spurs of the Kakanui Mountains separated by a number of streams. The gullies at the southern end drain into the Shag (Waihemo River) and the north streams (Swin Burn and sub tributaries) to the Taieri River.

The Kakanui Mountains form the main dividing range between North Otago and Central Otago and the Pigroot links Eastern Otago - Palmerston to Ranfurly. A broad upland area extends from Kokonga around to the base of the Kakanui Range to merge with Taieri Ridge. Taieri Ridge forms the eastern enclosing range to the Strath Taieri Plain. At the European settlement this upland area was all tussock but has been considerably modified since. A remnant of this tussock upland occurs within the PL and adjoining the Pigroot on SH85.

On the south west of this upland area, forestry has been planted in recent years, which is resulting in a major landscape change to the character of the area. Increasing farm development through subdivision fencing, fertiliser and greater grazing pressure is also changing the character of the land primarily by changes to vegetation.

LANDSCAPE ANALYSIS AND EVALUATION

Three landscape units are defined on the PL. (refer Map 4.2.2: Longlands Landscape Units)

These include the following:
Landscape unit 1 (LU1) - Home Block
Landscape unit 2 (LU2) - Pigroot foothills and alluvial flats
Landscape unit 3 (LU3) - Kakanui dissected hills

LANDSCAPE UNIT 1: HOME BLOCK

Character Description (refer Photos 4.3.1: LU1)

The home block rises above SH 85 onto the northern slopes of Swin Burn Peak up to an elevation of around 500 m. The landscape is undulating, rolling and pastoral in character. Terraces and low hills occur on the lower slopes. Preston Road winds up to the homestead, farm buildings and facilities.

The home block is within a belt of rock of partly volcanic origins in this corner of the plain which differs from the predominantly schist basement rock elsewhere in the Maniototo and this is apparent in the exposed basalt rock and low conical landforms. The home block is subdivided into paddocks and is mainly exotic pasture, lucerne and crops with patchy areas of grey shrubland remaining on uncultivated steeper slopes. The property dates back to the 1860s and there is a strong feeling of history in the old farm buildings (local basalt stone and timber construction) and early plantings of exotic trees and shelterbelts.

Other notable features are a small conifer plantation on terrace landform adjacent to SH85 and a dam to the west of the plantation.

Visual and scenic values
The home block is an attractive pastoral landscape derived from its commanding position overlooking the Maniototo Plain and the mix of pasture, cultivated paddocks, trees, shelterbelts and building and the sense of history associated with it.

Table 1 Summary Evaluation of the Home Block

Criteria	Value	Comment
Naturalness	Low	Natural vegetation highly modified
Legibility	Medium	Basalt basement overlaid by loess material is legible in the landscape
Aesthetic Factors	Medium	An attractive pastoral landscape. A strong cultural imprint
Historic Factors	High	Stone and timber buildings and sense of history are significant and important values
Visibility	Medium	Lower slopes front onto SH 85 and are highly visible. Upper slopes partially obscured by landform and vegetation

Landscape Vulnerability

The mix of natural (landform) and cultural features of the home block form an attractive landscape. The main aspects of vulnerability are wilding tree spread from the conifers present although continued grazing should keep this in check. Protection and restoration of historic buildings and features is an aspect of vulnerability into the future.

LANDSCAPE UNIT 2: PIGROOT FOOTHILLS AND FLATS

Character Description (refer Photos 4.3.1: LU2)
This unit forms the lower foothills and intervening flats of the main (Run) block forming the immediate backdrop to SH 85 along the full length of the highway frontage.

The land to the north of the Swin Burn, at the entrance to the Pigroot comprises terraces associated with the Swin Burn and low hills which give way to dissected hillslopes above. Vegetation patterns are predominantly converted pasture with scattered patchy matagouri shrubland. Snow tussock is reduced to scattered plants. Tussock becomes more prominent together with dense matagouri on the shady face above the Swin Burn with some snow tussock and shrubland coming in on the upper Swin Burn flats.

Oversowing and topdressing appears to have occurred up to about 700-800 m by the degree of pasture conversion below this level.

The Swin Burn at the lower end forms a reasonably broad alluvial flat including low terraces with wet areas associated with the watercourse. Rushes and sedges are common close to the highway. Upstream the stream is tucked against the north side against the steep adjacent hill face. Further still it crosses into a more central location as the valley narrows up. Stream bank erosion in a couple of locations above the stream bed has created distinctive steep near vertical sheet erosion prominent from the highway. Willow is present in places along the stream and patches of broom together with matagouri next to the highway. Scattered wilding conifers also occur on the hill slopes. A farm shed is located on the terrace edge on the true right of the Swin Burn.

South of the Swin Burn the landform assumes a series of hills some with basalt outcrops and dissected gullies extending over to the boundary of the property at the Shag (Waihemo) River.

The vegetation patterns are variable south of the Swin Burn with extensive areas of converted pasture and 'induced' low matagouri shrubland. However there are also considerable tracts of tall tussock. At the base of the foothills, on an alluvial flat (below the high point 684 m) adjacent to the highway, red tussock retains a foothold. This area forms part of the upland area that extends between the Kakanui Mountains and the Strath Taieri. The tall tussock that remains here still provides a more or less continuous cover but has become more fragmented in recent years (based on the assessors observation.) The tall tussock is also present on the road reserve and across the highway onto the adjoining plateau landscape. The overall appearance is still of a tussock grassland although is fragmented and degraded.

The Shag River tributaries (lower sections within LU2) on the south-eastern end of the property are dissected gullies and spurs. Vegetation here is consistent with the rest of the lease within this zone and is converted pasture and dense induced shrubland above the highway but changing to mainly tall tussock/matagouri/pasture mix higher up. The tall tussock is fairly modified and appears to have had a long burning history. Patchy broom and willow associated with streams occurs near the highway and scattered wilding pines on hill slopes are also present.

A recurring feature within this unit are dozed tracks either for new fencing or access tracks, some of which appear poorly sited or involving excessive and unnecessary earthworks which has resulted in scarring on the landscape. Gradual development with new subdivision fencing and increased grazing pressure is also fragmenting the tussock cover which is having detrimental effects on landscape values.

Visual and scenic values

This unit provides the foreground to the Pigroot section of SH 85, an important portal to Central Otago. The Pigroot is a valued scenic route and provides one of the few tussock upland corridors to "Central". The foreground provided by the Pigroot foothills is also an important part of the appreciation of the upper slopes of the Kakanui Range.

The remaining tussock area (including the red tussock on tertiary sediments adjacent to the highway) is important visually to the highway experience especially when travelling towards the Maniototo Plain. The tussock provides a context and appearance of a tussock upland leading into Central Otago and a key indication of what the character of the Pigroot once was. There is also a feeling of wildness and remoteness of passing through this area of SH 85.

Views across this tall tussock to the distant Hawkdun Range are significant and memorable and also important to the entrance to the Maniototo and Central Otago.

The unnecessary scars from earthworks in this unit (referred to above) and subdivision fencing degrades from the visual and scenic values to a degree.

Table 2: Summary Evaluation of the Pigroot foothills, plateau and flats

Criteria	Value	Comment
Naturalness	Medium	Natural vegetation is modified and fragmented and dominated by scattered tussock, induced shrubland and converted pasture. However the tussock still conveys the feeling of a tussock upland
Legibility	Medium	Basalt basement rock and tertiary sediments are legible formative processes
Aesthetic Factors	Medium	The degraded state of the tall tussock and dozed track and fencelines degrades aesthetic values
Historic Factors	Medium	Associated with the early transport route to the Goldfields and Central Otago on the Pigroot
Visibility	Medium	Large part of the unit is visible from SH 85

Landscape Vulnerability

Large areas have been converted and developed into farmland though there is still considerable shrubland and tall tussock remaining which complements the more intact tussockland higher up the range and provides an indication of the original pre-european vegetation. The unit is vulnerable to further loss of indigenous vegetation by increased grazing pressure and farm development and wilding tree spread.

The remaining area of tall tussock including the red tussock zone is vulnerable to further fragmentation from existing management.

LANDSCAPE UNIT 3: KAKANUI DISSECTED HILLS

Character Description (refer Photos 4.3.1: LU3)

In landscape terms the Kakanui dissected hills and the Pigroot foothills and flats form a single landscape unit. However for descriptive purposes they have been described separately. The Kakanui dissected hills essentially includes the upper reasonably steep dissected slopes and rolling hills of the run block loosely from approximately 700 m up to the boundary with the Conservation Land. In the gullies it extends below this altitude.

These are the most intact parts of the lease and the boundary roughly equates with the boundary of developed land and native hill block. Snow tussock is the dominant vegetation within LU3 but also includes low sub-alpine shrubland and native inter - tussock species. Pasture is also present within the tussock especially in the 700-900 m zone. The tall tussock is variable in condition with some areas fragmented and other areas generally clean and continuous. Repeated burns have impacted on the quality of the tussock grassland in places. Green stock camps and seepage areas form small islands of mainly green pasture on shady faces within the tall tussock. A small tarn is present within the Long Gully block.

Pockets of shrubland are present in gullies associated with watercourses including matagouri, coprosma, hebe and mountain flax. Grey shrubland mainly matagouri is also abundant on lower mainly shady faces within this unit.

Clusters of rock outcrops occur on spurs.

As with elsewhere on the run block there are small patches of broom and a scattering of wildings on open hillsides.

Visual and scenic values
These mid slopes complement the upper mountain slopes of the range. The tussock cover is generally intact and provides a continuum with the Conservation land beyond the lease. The mid and upper slopes of the range are identified as outstanding natural landscape (ONL) in the Proposed Central Otago District Plan.

The mid slopes are significant in terms of scenic values from SH 85 and are viewed from the highway. The tussock cover helps to convey the feeling of an upland pass and is also significant in terms of the appreciation of the Kakanui Range as an entity with characteristics of an original New Zealand landscape.

Landscape Vulnerability
Further deterioration of the tall tussock cover from repeated burning and grazing threatens the condition of the tussock which in turn impacts on the landscape character and quality.

Landscape values are also vulnerable to further weed spread (namely wilding conifer and broom) as it is on all of the property, if left unchecked.

Table 3: Summary Evaluation for Kakanui dissected hills

Criteria	Value	Comment
Naturalness	Medium	Tall tussock is generally intact. Most natural processes and patterns are intact
Legibility	Medium	Dissected slopes formed by down cutting and weathering are visible formative processes
Aesthetic Factors	Medium	Typical rather than exceptional tussock lands. Forms part of the mid slopes of the Kakanui Mountains
Historic Factors	Medium	Associated with the early transport route to the Goldfields and Central Otago on the Pigroot. Old water races from mining are present.
Visibility	Medium	Forms the middle ground to views from SH 85. Much of it is very visible from the highway

2.1.1 Significance of Landscape

LU3 and the eastern half of LU2 provide a continuous area that includes the lower foothills and flats from SH 85 to the upper dissected hills of the Kakanui Mountains. This area makes a significant contribution to the Pigroot and is within the area that contains the last vestiges of significant tall tussock that once covered large tracts of the Pigroot. While the tall tussock is seriously fragmented and depleted in places there are still significant areas of tall tussock. The tall tussock is an iconic feature of the Pigroot and signals the entrance to Central Otago. It provides context, atmosphere, sense of wildness/ remoteness and natural character to the Pigroot.

In a national context, retaining this diversity is important to New Zealand's identity and brand.

The tussock is capable of being restored to increase the natural character.

The remaining tracts of tussock are also important in terms of the experience of the range as a whole and in terms of travelling through the Pigroot.

The area of red tussock on tertiary sediments adjacent to the highway is an integral part of this. However on its own the red tussock becomes somewhat meaningless in a landscape sense without the surrounding tall tussock to provide context and continuity.

2.2 Landforms & Geology

This part of the Dansey Ecological District encompasses the Kakanui Mountains and a series of north-east trending side spurs separated by a number of streams that drain into the Shag and Taieri Rivers.

The Kakanui Mountains is one of the block ranges uplifted between the Waihemo and Waitaki fault systems. The PL is on the west facing scarp above the Waihemo Fault. Basement rock is Rakaia terrane greywacke – sandstone, mudstone and semi-schist (textural zone IIB). This forms blocky screes on steeper slopes. Basalt outcrops are frequent on the homestead block, and a complex of basalt and tertiary sediments form much of the low altitude hill country. Flats formed of tertiary sediments overlain by loessial deposits are found in the lower Swinburn catchment. Near vertical cliffs have been cut in these by stream bank erosion.

The summit of the Kakanui Mountains is eroded and in places dissected by recent alluvial processes, so that the wave-cut, nearly planar surface of the Waipounamu Erosion Surface (which preceded uplift of the range) has been mostly obliterated in the PL area. This is in contrast to, for example, the Hawkdun Plateau and summits of other block ranges in central Otago. Marine sediments that would have overlain the Waipounamu Erosion Surface have been stripped off by erosion in the Kakanui Mountains.

2.3 Land Environments of New Zealand (LENZ)

There are two databases that have been used to assess biodiversity protection (Walker et al. 2003).

1. Environmental distinctiveness has been assessed through the Land Environments of New Zealand (LENZ). This is a classification of New Zealand landscapes using a comprehensive set of climate, landform and soil variables chosen for their roles in driving geographic variation in biological patterns (Leathwick et al. 2002 & 2003). It is presented at four levels of detail containing 20, 100, 200 or 500 environments nationally. The most detailed is called LENZ Level IV.

2. The area of unprotected indigenous cover in threatened land environments has been identified in the national land cover database (LCDB).

From the above databases, spatial data depicting indigenous cover and legal protection were overlaid on LENZ Level IV environments to identify biodiversity that is most vulnerable (most likely to be lost). This provides a measure for:

a. percentages legally protected and;
b. percentages of remaining indigenous cover

Based on these two criteria, five categories of threatened environments have been used to identify environments containing indigenous biodiversity at most risk of loss. They are classified as follows:

1. **Acutely threatened:** <10% indigenous cover remaining
2. **Chronically threatened:** 10-20% indigenous cover remaining
3. **At risk:** 20-30% indigenous cover remaining
4. **Critically underprotected:** >30% indigenous cover remaining and <10% protected
5 **Underprotected:** >30% indigenous cover remaining and 10-20% protected
6. **No Threat:** >30% indigenous cover remaining and >20% protected

Three LENZ environments (K, N & Q) (Leathwick et al. 2003) are present on the Lease. At Level IV classification the lease comprises K5.1b, N3.1d, N3.1e, N3.1f, N3.2a, N4.1a, N6.2, Q1.1d, Q2.1a, Q2.1b, Q2.1c, Q3.1a, and Q3.1b. Table 4 presents a full LENZ analysis for the PL.

Table 4: Land Environments of New Zealand (LENZ) Units on Longlands PL

Threat Category	Level 4 LENZ Unit	% Indigenous vegetation cover remaining	%Protected nationally for conservation purposes	Area of LENZ unit as a % of Longlands PL	Approximate Area on Lease (ha)
Acutely Threatened	N3.1f	1	0.07	0.59	12.31
	N3.2a	7	3.60	29.10	602.31
Chronically Threatened	N3.1d	14	0.09	2.61	54.06
	N3.1e	13	0.06	2.76	57.19
	N4.1a	18	0.003	0.04	0.81
	N6.2a	18	0.04	0.32	6.63
At Risk	Q2.1c	25	0.35	14.44	298.81
Critically underprotected	K5.1b	61	2.54	4.84	100.25
	Q2.1a	38	0.40	27.63	571.94
	Q2.1b	66	0.17	2.00	41.31
No Threat Category	Q1.1d	85	0.10	12.20	252.56
	Q3.1a	67	0.002	0.06	1.19
	Q3.1b	35	0.18	3.41	70.63

2.3.1 Significance of LENZ

Attributing significance to LENZ units, while a useful exercise must be treated with caution. Work is currently underway to improve the accuracy of underlying spatial data. For example, soils data is being upgraded, as median patch size for polygons sourced from the Land Resource Inventory is currently between 10,000 and 100,000 hectares, while at Level IV resolution, LENZ units cover areas as small as 10 hectares. Also underway, albeit as lesser priority, is ongoing

work relating to continuous improvements of the underlying classification process which generates LENZ units.

Longlands PL has the following land environments that are significant because the indigenous vegetation has largely been removed, and/or little of the environment is represented in lands protected primarily for conservation purposes.

- 29.69% of the property has Level IV LENZ units that have less than 10% of their land area still in indigenous vegetation cover (whether protected or unprotected). These include two 'Acutely Threatened' Units N3.1f and N3.2a. Some 614 ha is in this category and areas with indigenous vegetation present will be of significance.
- 5.73% of the property has Level IV LENZ Units that have 10-20% of indigenous vegetation cover (whether protected or unprotected). These include four 'Chronically Threatened' Units N3.1d, N3.1e, N4.1a and N6.2a. 119 ha is in this category and areas with indigenous vegetation present will be of significance.
- 14.44% of the property has Level IV LENZ Units that have 20-30% of its land area still in indigenous cover. These include one 'At Risk' Unit Q2.1c.
- 34.47% of the property has Level IV LENZ Units that have 30% of their land area still in indigenous cover and <10% is protected. These include three 'Critically Underprotected' Units K5.1b, Q2.1a and Q2.1b.
- 15.67% of the property has Level IV LENZ Units that have >30% of its land area still in indigenous cover and >20% protected. These include three 'No Threat' Units Q1.1d, Q3.1a and Q3.1b.

Where indigenous cover remains within the first two categories of threatened LENZ units, they attain significance for tenure review. Most of the areas in these categories are modified, but parts still retain indigenous dominant snow tussock, copper tussock and shrublands.

LENZ level IV Map is attached and numbered 4.2.5. Please note the areas on the LENZ map are approximate only.

2.4 Climate

Longlands PL lies in the transition zone between the distinctive Central Otago and Coastal Otago climates.

Annual rainfall varies between 700 mm and 1000 mm depending on the altitude. The winters are cold and snowfalls are common though the snow only lies for any length of time above 1000 m. Summers are mild and affected by cool easterly winds from the coast. Temperatures show a marked seasonal variation and a wide diurnal range. Severe frosts are common during the winter. Frequent north-east fog conditions occur in the higher reaches of the PL, and can last for several days at a time, making a significant contribution to the total precipitation. However, due to rainfall patterns and nor-west winds, plant growth is restricted by moisture deficiency between January and March on the lower country.

2.5 Vegetation

Comrie (1992) suggests the original (pre-human) vegetation of the dominant Dansey Ecological District was predominantly podocarp hardwood forest at lower altitudes and tall tussockland and shrubland at higher altitudes. Forest was dominated by mountain totara (*Podocarpus cunninghamii*), matai (*Prumnopitys taxifolia*), rimu (*Dacrydium cupressinum*) and kahikatea (*Dacrycarpus dacrydioides*), over a canopy of lowland ribbonwood (*Plagianthus regius*), broadleaf (*Griselinia littoralis*), kowhai (*Sophora microphylla*) and marbleleaf (*Carpodetus serratus*). McGlone (2001) suggests that the pre-human vegetation of northeast Otago comprised a mosaic of forests with widely spaced podocarp dominants over low variable angiosperm canopies, with extensive scrub and grassland patches.

These vegetation descriptions are broadly similar to those proposed by Leathwick et al. (2003) in their analysis of the Level III Land Environments on the property. Land Environment N3.2, covering the Home Block and rolling country to the north and south of the Swin Burn (c. 30% of the property), is described as originally supporting forest dominated by totara, matai, broadleaf, lowland ribbonwood, narrow-leaved lacebark (*Hoheria angustifolia*) and kowhai. Land Environment Q2.1, covering higher areas (c. 44% of the property), is also described as originally supporting podocarp hardwood forest, but with additional dominant species (rimu, miro (*Prumnopitys ferruginea*), kahikatea, pokaka (*Elaeocarpus hookerianus*) and tarata (*Pittosporum eugenioides*). Land Environments Q1.1 covering the highest-altitude areas (c. 12% of the property), are described as originally supporting low forest dominated by mountain totara and toatoa (*Phyllocladus alpinus*). Land Environment K5.1, covering toe slope areas adjoining SH85 (c. 5% of the property), is described as originally supporting red tussockland and *Schoenus pauciflorus* (Leathwick et al. 2003).

It therefore appears likely that the pre-human vegetation of the PL was podocarp hardwood forest at lower altitudes, mountain totara and toatoa forest on higher slopes, and red tussockland on frost – prone lower slope swamps with shallow peat. The extent to which forest prevailed in the area prior to human settlement may have been influenced by natural fires (Walker et al. 2003), especially in the east where tussockland and scrub may have occupied formerly forested sites for relatively long periods. Little of this property extended above the natural timberline of c. 1000 m (Allen et al. 1988) so areas of current tall tussockland have likely resulted from the downward migration of these communities following clearance by fires.

SURVEY METHOD

Approximately 15 hours were spent on the property inspecting the botanical values. Much of the property were accessible via internal 4WD tracks but steep terrain, creek beds, and other areas remote from tracks were surveyed on foot. Descriptions were made of the composition of major plant communities. Threatened plants were searched for in potentially suitable habitats. Digital photographs were taken of particular species, communities and landscapes to aid in interpretation. Specimens were collected of noteworthy or uncertain taxa for herbarium accession and determination.

VEGETATION DESCRIPTION

For the purposes of describing the vegetation the property has been divided into three units: Home Block, Swin Burn catchment and Shag River catchment.

Home Block

The small and separate part of the pastoral lease surrounding the Longlands Homestead has been highly modified and has few remaining natural values. Vegetation is predominantly exotic pasture. Other vegetation includes exotic conifer tree lanes, exotic conifer plantation, scattered willows (*Salix* spp.) and scattered low matagouri (*Discaria toumatou*).

Two small areas retain fragmented indigenous vegetation. Exposed basalt rock on a low ridge crest west of Preston Road has relict shrubs of *Melicytus* aff. *alpinus*, *Coprosma crassifolia* and *C. propinqua* often in conjunction with sprawling pohuehue (*Muehlenbeckia complexa*). Drought-prone stony pavements around the basalt outcrops have a small range of native herbs including the rare *Raoulia monroi* and *Einadia allanii*, along with *Crassula colligata* and necklace fern (*Asplenium flabellifolium*). Similar stony pavements and associated vegetation also occur immediately east of the pond.

The south-facing slopes of the small gully that drains west below Preston Road contain a variety of native herbs and grasses amongst the sweet vernal (*Anthoxanthum odoratum*) dominated pasture. Native species present include narrow-leaved tussock (*Chionochloa rigida*), speargrass (*Aciphylla subflabellata*), grassland buttercup (*Ranunculus multiscapus*), Maori onion (*Bulbinella angustifolia*), *Anisotome aromatica, A. flexuosa* and red woodrush (*Luzula rufa*).

Swin Burn Catchment

The vegetation of the Swin Burn catchment strongly reflects a history of development for pastoral farming with the widespread removal of indigenous woody communities at lower altitudes and their replacement with exotic pasture grasses and native short tussock. Early successional matagouri forms a low dense cover on suitable aspects. More varied indigenous riparian shrubland along the Swin Burn and other larger water courses is mostly dead or in poor health following presumed herbicide spraying. These and other small disconnected pockets of shrubland vegetation hint at more widespread woody vegetation in the past. At higher altitudes indigenous tussock grasses are still common but in many sites their inter-tussock flora mostly comprises exotic grasses and/or common pastoral weeds.

Three areas of the catchment are identified as having characteristics and values that stand them apart from the generalised vegetation description above. These are:

<u>Eastern corner</u>

There are intact indigenous vegetation communities in the headwaters of the Swin Burn immediately below the Kakanui Conservation Area. This area shares a common ridge-top boundary with the headwaters of Long Gully and the vegetation is broadly similar to that

described for the equivalent aspect in the Shag River catchment description below. One conspicuous difference however is the much greater concentration of tall wilding conifers which dot the upper slopes of this eastern corner of the Swin Burn catchment.

Copper tussock wetland

A substantial copper tussock (*Chionochloa rubra* subsp. *cuprea*) dominated wetland occupies the toe-slope of the Kakanui Mountains immediately east of State highway 85. Tussock cover is highly variable reflecting micro-site variability and past disturbance/grazing regimes. On better drained interfluves the tall tussock cover has been lost and is replaced by typical dryland species such as hard tussock (*Festuca novae-zelandiae*), patotara (*Leucopogon fraseri*), *Raoulia subsericea*, the orchids *Hymenochilus tanypodus* and *Thelymitra longifolia, Helichrysum filicaule, Coprosma petriei* and mouse-ear hawkweed (*Pilosella officinarum*).

Amongst the copper tussock are a range of wetland herbs including Maori onion, *Ranunculus glabrifolius*, native mint (*Mentha cunninghamii*), *Hydrocotyle novae-zeelandiae*, *Leptinella squalida, Cardamine* spp., marsh willowherb (*Epilobium chionanthum*), *Nertera depressa, Viola cunninghamii, Galium perpusillum*, native dock (*Ranunculus flexuosus*) and *Plantago spathulata*. The rare *Ranunculus ternatifolius* occurs occasionally in the damp shade of tussock bases.

Wet channels within the tussockland support a range of sedges including *Carex gaudichaudiana, Carex kaloides*, bog rush (*Schoenus pauciflorus*), sharp spike sedge (*Eleocharis acuta*) and the exotic oval sedge (*Carex ovalis*). The exotic kneed foxtail (*Alopecurus geniculatus*) dominates some channels.

Shrubs are relatively uncommon and are limited to occasional *Olearia bullata*, matagouri and *Pimelea pseudolyallii*. Matagouri becomes more common on the upland margins of the copper tussock extent. Exotic broom (*Cytisus scoparius*) is common towards the boundary fence along the highway where it is often heavily browsed by stock.

Mountain paddock shrubland

An escarpment of basalt rock in Mountain Paddock, although much modified and fragmented by fire, grazing, and herbicide spraying, supports a diverse dry shrubland. It is most intact at its northern extent where there are many clumps of the uncommon *Coprosma intertexta* along with shrubs of *C. propinqua, C. crassifolia*, porcupine shrub, matagouri, *Olearia odorata* and a 3 m tall kowhai (*Sophora microphylla*). Lianes are also common and include *Clematis marata, Muehlenbeckia australis* and bush lawyer (*Rubus schmidelioides*). Characteristic native dryland herbs include *Arthropodium candidum, Vittadinia australis* and *Senecio quadridentatus*.

To the south, pockets of shrubland are linked by areas of rank grass and low matagouri that are being overtopped by clumps of climbing pohuehue. A small population of the rare daisy *Senecio* aff. *dunedinensis*, occurs in this habitat. Rockland northwest of Trig 654 m has c. 12 conspicuous cabbage trees (*Cordyline australis*), many shrubs of mountain wineberry (*Aristotelia fruticosa*) and hounds tongue fern (*Microsorum pustulatum* subsp. *pustulatum*).

Shag River Catchment

The vegetation of the Shag River catchment also reflects a history of development for pastoral farming with the widespread removal of indigenous woody communities at lower altitudes and their replacement with exotic pasture grasses and native short tussock. Early successional matagouri forms a low dense cover on suitable aspects. More varied indigenous riparian shrubland exists along Long Gully including species uncommon elsewhere on the PL i.e. *Olearia nummulariifolia*. These and other small disconnected pockets of shrubland vegetation hint at more widespread woody vegetation in the past. At higher altitudes indigenous tussock grasses are still common but in many sites their inter-tussock flora mostly comprises exotic grasses and/or common pastoral weeds.

Two areas of the catchment are identified as having characteristics and values that stand them apart from the generalised vegetation description above. These are:

Head of Long Gully & western slopes of Shag Valley

There is intact indigenous vegetation in the headwaters of Long Gully and slopes on the western side of Shag Valley below and contiguous with the Kakanui Conservation Area. This comprises tall tussockland, subalpine shrublands, seeps and flushes, rockland and cushionfield with few exotic species. Low stature narrow-leaved tussock dominates but there is a rich array of intertussock shrubs, herbs and grasses. Common shrubs include coral broom (*Carmichaelia crassicaulis* subsp. *crassicaulis*) with groups of up to 100 individuals, *Acrothamnus colensoi*, *Ozothamnus vauvilliersii*, *Pimelea pseudolyallii*, *P. traversii*, *Dracophyllum rosmarinifolium*, *Coprosma cheesemanii*, *Myrsine nummularia*, *Gaultheria crassa* and *G. depressa*.

Ozothamnus vauvilliersii forms a particularly dense stand on a south-facing slope in the head of Long Gully. Talus slopes amongst tussock have a sparse cover of *Myrsine nummularia*, *Pimelea traversii*, *Acrothamnus colensoi* and locally *Exocarpos bidwillii*.

Non-woody plants are also well represented and include *Celmisia lyallii*, *C. densifolia*, *Brachyglottis bellidioides*, *Raoulia subsericea*, *Scleranthus uniflorus*, *Colobanthus canaliculatus*, *Acaena caesiiglauca*, *Kelleria villosa*, everlasting daisy (*Anaphalioides bellidioides*), feathery tutu (*Coriaria plumosa*) and *Brachyscome sinclairii*. The margins of watercourses have abundant mountain flax (*Phormium cookianum*), giant speargrass (*Aciphylla scott-thomsonii*), mountain astelia (*Astelia nervosa*) and prickly shield fern (*Polystichum vestitum*). The uncommon herb *Anemone tenuicaulis* is prevalent beneath dense tussock on shady aspects.

Mountainside seeps are frequent and sometimes have the uncommon *Lagenifera barkeri* along with the more frequent *Viola cunninghamii*, Maori onion, bog rush, *Uncinia divaricata*, everlasting daisy, white oxalis (*Oxalis magellanica*), white clover (*Trifolium repens*) and exotic pasture grasses.

Coral broom outlier

Coral broom are scattered throughout the property but a particularly dense population occurs on a spur between two small tributaries of Shag River at c. 700 m above sea level. Several hundred robust shrubs up to 2 m tall are present amongst unusually tall and dense narrow-leaved tussock. Matagouri and hard tussock are also prevalent in this tussock-shrubland community.

See 4.5 Appendix 1 for a full list of plant species.

2.5.1 Significance of Vegetation

Vegetation

At least 128 native vascular plant species have been recently recorded from the PL.

Threatened and At Risk species

Of the native vascular plant species present nine are listed as 'At Risk' and one as 'Data Deficient' in the most recent threat classification system listing (de Lange et al. 2009). A list of these species with their threat of extinction status and distribution within the PL is provided below in Table 5.

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

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

Table 5: Threatened, At Risk and Data Deficient plant species found on Longlands PL

Super Category	Threat Category	Species	Location on property
At Risk	Declining	*Aciphylla subflabellata*	Dry interfluves within copper tussock wetland
		Carmichaelia crassicaulis subsp. *crassicaulis*	Patches amongst tall tussock grassland in the east and south of the property.
		Raoulia monroi	Dry basalt outcrops in home Block
	Naturally Uncommon	*Anemone tenuicaulis*	Occasional on shady aspects in tall tussock grassland
		Einadia allanii	Dry basalt outcrops in home Block
		Lagenifera barkeri	Seeps in Long Gully
		Pimelea pseudolyallii	Occasional in tall tussock grassland and around rock bluffs
		Ranunculus ternatifolius	Copper tussock wetland adjoining SH 85
	Relict	*Coprosma intertexta*	Occasional in riparian shrublands
Not evaluated	Data Deficient	*Senecio* aff. *dunedinensis* (CHR 550250;Leatham)	Mountain Paddock shrubland

In addition, three species that are uncommon in Otago (Regionally Significant) were found (Table 6).

Table 6: Regionally significant plants found on Longlands PL

Status	Species	Location on property
Regionally significant	*Coprosma virescens*	Dry basalt outcrops in home Block
	Exocarpus bidwillii	Head of Long Gully
	Pimelea traversii	Amongst subalpine shrubland in Shag Valley catchment

Rare Ecosystems

Terrestrial ecosystems that were rare before human colonisation of New Zealand often have highly specialised and diverse flora and fauna characterised by endemic and nationally rare species. Rare ecosystems are defined as those having a total extent less than 0.5% (i.e. < 134 000 ha) of New Zealand's total area (268 680 km2). A framework has been developed (Williams et al. 2007) based on descriptors of physical environments that distinguish rare

ecosystems from each other and from more common ecosystems. Using this framework 72 rare ecosystems have been defined using pertinent environmental descriptors selected from soil age, parent material, soil chemistry and particle size, landform, drainage regime, disturbance, and climate

On the PL one rare ecosystem was identified in the wetland category (seepages and flushes).

2.5.2 Problem Plants

At least 55 exotic species of plants are present on the PL but relatively few are of conservation concern. Introduced plants that may have an important effect on indigenous plant communities on the property, and that can be controlled or contained, are listed and discussed below. Other ubiquitous naturalised species for which containment or control are probably impractical, such as mouse-ear hawkweed and pasture grasses, are not discussed here but are listed in the vegetation descriptions.

Wilding conifers

Scattered wilding conifer trees, especially *Pinus contorta*, are present in the upper Long Gully and head of Swin Burn. Most wilding trees in the area appear to have spread from plantations at Naseby Forest (Department of Conservation 1998). Given enough time, *Pinus contorta* will form dense, widespread infestations throughout the PL and neighbouring properties that will suppress indigenous plants. Dense stands of contorta pine also have other deleterious effects including the disruption of indigenous insect communities, significant changes in the landscape character and negative impacts on the hydrological balance of the catchment area.

These wildings pose an ongoing threat of suppression to areas of low-stature vegetation on the PL and adjoining land. Removal of wilding trees, and regular checks for new infestations, will be required to protect conservation values on the property.

Broom

An infestation of exotic broom (*Cytisus scoparius*) is present along the boundary fence adjoining SH 85 and the margins of the copper tussock wetland. Ongoing vigilance will be required to prevent its further spread into the copper tussockland.

Gorse

Isolated clumps of gorse are present amongst otherwise indigenous dominated tussock communities at the head of Long Gully. The early eradication of these clumps is essential in retaining the values present at this site.

Elderberry and gooseberry

Both of these bird-dispersed plants are present in the lower altitude parts of the property. Their early detection and control in the 'Mountain Paddock' shrubland would help ensure a favourable successional trajectory towards indigenous woody dominance.

2.6 Fauna

2.6.1 Invertebrate Fauna

The geographic context of the PL suggests the natural pre-human fauna would include locally distinctive assemblages and species as well as regionally typical assemblages. The PL is set in the margin of three ecological districts recognised by McEwan (1987). These include the Maniototo interior downlands of Otago and the Macraes raised rolling lands but is predominantly within the Kakanui Mountains of the Dansey Ecological District (See Comrie 1992 and note vegetation section). The broader context is that the Kakanui Mountains form part of the southern boundary of Mid-Canterbury and part of the northern boundary of Central Otago with the PL being in the Otago side.

Insects of the Dansey ED are discussed in Patrick (1991) which notes for moths that "many genera are represented by a large number of species –*Orocrambus, Eudonia, Scoparia*, (Crambidae), *Glyphipterix* (Glyphipterigidae), *Gelophaula* (Tortricidae), *Asaphodes* and *Notoreas* (Geometridae)". Also noted is that the moth fauna has a strong autumn emerging element with most found in or close to damp areas and wetlands (Patrick 1991). This report also lists wetlands and grasslands on Kakanui Peak as one of nine key sites for the conservation of insects in the Dansey ED.

Tributaries of the Shag River are noted for a few distinctive aquatic insects of east Otago mountains including the local caddis species *Synchorema tillyardi* (Patrick 1997) and remnant shrublands, gully shrublands, natural rocky sites and damp areas are valued for their distinctive and vulnerable moth fauna in the Maniototo and Macraes ED's (Patrick 1994, Patrick 1997). The distribution and habitat associations of other invertebrates are less well documented for the Eastern South Island and the context of the PL.

Stream ecosystem research in the Shag River on the PL and on the adjoining Islay Downs PL pioneered the present interpretation of the nature of ecological interactions (including invertebrate assemblages) with exotic brown trout (Flecker and Townsend 1994).

The invertebrates sampled during a two day period are discussed in this section of the report and other invertebrate associations known from published reports are also cited. This is by no means definitive of the species present, and in fact represents a small subset of the fauna. This is in contrast with the listing of the vascular flora which will be missing few additional records. However, in common with vegetation descriptions, invertebrates are discussed in relation to habitat/ecosystem associations and value.

Survey method

The survey was carried out during mild partly sunny conditions with light winds. In company with the vegetation assessment the property was accessed via 4WD tracks and on foot in steep terrain, creek beds and other remote areas. Work after dark included insect light trapping and local hand search until midnight at the lower Long Gully Block. By day insects were hand collected and swept from vegetation for later identification and were curated for insect collection comparison and reference.

Invertebrate fauna description

The faunal description is divided among Home Block and the Swin Burn and Shag River catchments under Kakanui Peak.

Home Block

The Block is isolated in a setting of highly modified farmlands spanning 440 -520 m and is at least partly influenced by the Central Otago Basin climate. Natural faunal values are few and depleted. However, on a low ridge with minor basalt exposure and remnant shrubland day active moths typical of shrubland and shrub litter included *Helastia cryptica* (Geometridae), *Tingena melinella* (Oecophoridae) and another two Oecophorid species. In very small bare areas and rock exposure nearby were butterflies *Zizina otis* and *Lycaena boldenarum* (Lycaenidae) with the latter feeding on mats of *Muehlenbeckia axillaris*.

A tributary of the Swin Burn crosses below this ridge and is highly modified with a high light environment and loss of vegetation cover. Flowing only seasonally, it has a soft sediment base and cuts through a shallow gully of clays and gravels. Insects such as red coat damsel *Xanthocnemis zealandica* and blue damsel *Austrolesthes colensonis* can survive and recolonise in such conditions. The vivid day active moth *Dasyuris transaurea* has an unexpected relict streamside population here with larvae on *Anisotome*.

Upper Swin Burn and tributary Shag River Catchments

Typical of many parts of the region, the natural character and quality of faunal habitats has been depleted in terms of soil litter, vegetation cover and wetland hydrology. While exotic grasses and seral native vegetation shape faunal assemblages in many areas there remain some habitats of inherent value. These include:

Upland tussockland with associated native herbs

Along spurs at 850 m. and above a representative tussockland fauna begins to be apparent including large tussock weevil *Anagotis lewisi*, grasshopper *Sigaus australis*, tussock case moth *Orophora unicolor* and day active moths such as *Notoreas* spp. on *Kelleria* spp. and *Pimelea pseudolyallii*.

Locally on sunny and partly eroded spur tops also above 850 m. are patches of open low heath community characterised by lichens and *Dracophyllum rosmarinifolium*. This is typical singing habitat for alpine black cicada *Maoricicada* spp. Two are known from the Kakanui Mountains area with *Maoricicada clamitans* feeding in remnant shrubland and most likely on *Aciphylla* species (Dugdale and Fleming 1978, Patrick 1991).

Steeper and often east facing slopes or gullies between 800 -950 m and steep creek margins down to 600 m include a richer remnant flora and combinations of woody species, exposed rock and flush or seep. In shrublands moths noted included *Asaphodes chlamydota* (larvae eat Clematis), *Chloroclystis filata* and *C. inductata* (both with larvae on flowers), *Pseudocoremia rudisata* (larvae eat *Olearia bullata* and *O. odorata*), *Graphania phricas* (larvae eat *matagouri*), *Meterana coeleno* and *M. stipata* (both with larvae on *Muehlenbeckia* spp.). Also in such places, moth *Helastia cinerearia* has larvae on rockface mosses and moth *Erechthias* sp. nr. *fulguritella* has larvae in dead wood. Characterising mossy tumbling streams, the black caddis *Zelolessica* species was noted.

Wetland complexes 540 -620 m.

Extensive toe slope and terrace wetlands are located on the lower boundary of this block under Kakanui Peak. Copper tussock is the more easily recognised component but sedge and rush flushes and wet channels are also important. There is also some value to the invertebrate community of better drained but uncultivated soils in the margins. A range of wetland moths were netted and trapped at light here. These include; ubiquitous moth *Orocrambus aethonellus* and the more local *Orocrambus lectus*. Several moths with larvae feeding in tussock were noted and *Protosynaema questuosa* has larvae feeding in *Carex* species. Others noted are more generalist in damp soils such as *Tmetolophota alopa* and ghost moth *Wiseana copularis*. The autumn emerging moth *Heloxycanus patricki* is known from sphagnum moss in the region (Patrick 1991, Dugdale 1994) but it is ranked 'Declining' and it is uncertain whether these wetlands remain suitable habitat.

Low hill and basalt escarpment in Mountain Paddock 620 -654 m.

A remnant example of semi-dry shrubland and distinctive basalt rock outcrop yielded a few representative day active moths. Basking on warm bare soils were *Arctesthes catapyrrha* (with larvae on open area herbs), *Lycaena boldenarum*, and *Eurythecta* sp. (larvae eat *Raoulia* and other dryland herbs). The delicate plume moth *Pterophorus innototalis* is common here and nearby dry areas with larvae on *Dichondra brevifolia*. Moths having larvae associated with foliage and litter of trees and shrubs such as cabbage tree and *Coprosma* can be expected here. However, species with larvae on kowhai may well have disappeared since only a very few individual host trees are left. The moth *Theoxina* 'non-pectinate' noted nearby during the survey is Nationally ranked 'Data Deficient'. It is known from mid-Canterbury Basin and one other nearby site at Rock and Pillar Range. Its habitat is unknown but could include sites such as this.

2.6.2 Significance of Invertebrate Fauna

No particular sites on the PL have been listed as significant in survey reports associated with the Protected Natural Areas Programme or in other reports known to the author. The faunal assemblages and ecosystem of Shag River along the adjoining Islay Downs PL boundary can be said to be of scientific significance as a former research site for the impacts of trout in New Zealand streams (See Flecker and Townsend 1994 and subsequent research articles).

82 invertebrate taxa including 62 moths and butterflies are noted in 4.5 Appendix 2 from the inspection.

No threatened or at risk invertebrates are known from the PL. However in the circumstance of the location, the condition of some habitats and incomplete recording of species there is a possibility some occur. One Data Deficient moth –*Theoxina* 'non-pectinate' was recorded at light 590 m. on the property between Swin Burn tributaries and Shag River.

The New Zealand Threat Classification System provides a tool for assigning a threat status to candidate taxa. The latest revision (Townsend et al. 2008) of the 2002 system retains the 'Data Deficient' category. Where information is so lacking that an assessment is not possible, the taxon is assigned to the 'Data Deficient' category. Collection of sufficient demographic data to allow evaluation is a high priority as such data may confirm whether these taxa are 'Threatened' or 'At Risk'.

One regionally significant invertebrate is noted. The moth *Pseudocoremia rudisata* while not threatened has larvae feeding specifically on small leaved *Olearia* spp. tree daisy a host plant and habitat much diminished in the region and continuing to decline.

Rare Ecosystems

The rare ecosystems discussed in the vegetation assessment are equally of significance for regionally endemic invertebrate assemblages. The representative criterion analysing the regional representation of Lepidoptera in support of improved protection for natural rocky exposures, wetlands, gully shrublands and streams and indigenous dominated shrublands in general is discussed in a range of reports (Patrick 1991, Patrick 1994, Patrick 1997, Derraik et. al. 2001). Thus the range of invertebrates recorded in the Appendix 2 together with published information identify significance for remnant shrubland associations in confined gullies and associated with basalt exposures and associated talus or colluvium. Small areas of exposed soils and associated herbs among the shrublands are an important habitat component. Areas of wetland that retain an indigenous vegetation component below 700 m. under Kakanui Peak are also significant invertebrate habitats. Elsewhere areas of tussockland and associated shrubs or native herbs and lichens are typical and representative north Otago habitats of indigenous invertebrates recorded in Appendix 2. Areas above 850 m and also areas on east facing slopes below Kakanui Peak are richer habitats with better soil cover and litter for ground dwelling invertebrates.

2.6.3 Herpetofauna

While the PL lies within the historic range of several threatened skink species, no recent observations of these have been made in the immediate area. Local habitat similar to that found on the property typically supports a range of more common lizard species.

Survey Method

A survey for herpetofauna was carried out alongside botanical and invertebrate surveys. The survey was carried out in prevailing weather conditions, which varied from mediocre to good for observation of basking animal. Visual search was augmented by careful rock turning, a technique much less affected by conditions. Search included rock outcrops, exposed ground surface and both shrubby and low-lying vegetation.

Description of Values

McCann's skinks (*Oligosoma maccanni*) were found at widespread locations across the property, although densities did not appear to be high. Large Otago geckos (*Woodworthia* sp 'Otago Southland') were found in rocky habitat at higher altitudes. Green skinks *(Oligosoma chloronoton)* were found at one location, where the other two species were also present. Details can be found in table 7.

Table 7: Lizard sightings on 22 November 2011.

Species (number)	**Block**	**Habitat**
Woodworthia (x 3)	Long gully	Rock
O. chloronoton (x2)	Long gully	Rock
O. maccanni (multiple)	Long gully, Gravel pit, Home	Rock, *Muehlenbeckia*, Ground (tussock),
Woodworthia (multiple)	Long gully	Rock
O. maccanni	Shrubland	

2.6.4 Significance of Herpetofauna

Both *Woodworthia* sp 'Otago Southland' and *O. chloronoton* are classified as "At Risk – Declining" (Hitchmough 2009). The *O. chloronoton* sighting is noteworthy because although widespread it is sparsely distributed.

2.6.5 Avifauna

A wide range of bird species, both indigenous and introduced, have been recorded throughout the ED. During the first inspection, a New Zealand falcon *(Falco novaeseelandiae)* was sighted.

Other bird species noted are listed in the table below

Table 8: Birds Noted on inspection. Exotic species are denoted by an asterisk.

Species	Common Name	Threat Status
*Gymnorhina tibicen**	Magpie	
*Turdus philomelos**	Thrush	
*Sturnus vulgaris**	Starling	
*Meleagris gallopavo**	Turkey	
Circus approximans	Australasian Harrier	
*Alauda arvensis**	Skylark	
Vanellus miles novaehollandiae	Spur-winged plover	
*Anas platyrhynchos**	Mallard duck	
*Carduelis chloris**	Greenfinch	
Tadorna variegata	Paradise Shelduck	
*Turdus merula**	Blackbird	
Gergone igata	Grey Warbler	
Haematopus finschi	New Zealand pied oystercatcher	Declining
*Emberiza citrinella**	Yellowhammer	
Larus dominicanus dominicanus	Southern Black-backed gull	
Anthus novaeseelandiae	New Zealand Pipit	Declining
Falco novaeseelandiae	New Zealand Falcon	Nationally Vulnerable
*Callipepla californica**	Californian quail	
*Carduelis flammea**	Redpoll	
Himantopus himantopus leucocephalus	Pied stilt	Declining

2.6.6 Significance of Avifauna

Only one of these species, New Zealand falcon *(Falco novaeseelandiae)*, is classified as being "Threatened - Nationally Vulnerable" (Miskelly 2008). The pied oystercatcher, pied stilt and pipit are classified as "At Risk - Declining".

2.6.7 Aquatic Fauna

Longlands PL encompasses the watershed between the Shag River and the Swin Burn, a tributary of the Taieri River. Both these catchments drain the south-western slopes of the Kakanui Mountains. The diversity of geology and topography generate a variety of different in stream habitats available to freshwater fauna.

The Swin Burn has a catchment area of 34 km², and an annual water flow range of 25 – 228 l/s (Otago Regional Council 2011). The majority of the Swin Burn catchment is situated within the PL and a marginal strip complements the entire main stem within the property boundary. The

upper Taieri River including the Swin Burn is considered by the Waters of National Importance (WONI) criteria as a "*Type 1*", this being among the most valuable rivers for sustaining freshwater biodiversity (Department of Conservation 2004a).

There is currently only one record in the New Zealand Freshwater Fish database (NZFFD) from the main stem of the Swin Burn (NZFFD record 3269) situated downstream of the PL. At this site brown trout, longfin eel (*Anguilla dieffenbachii*), upland bully (*Gobiomorphus breviceps*) and unidentified galaxias species were observed. Central Otago roundhead galaxias (*Galaxias anomalus*) have been observed from tributaries of the Swin Burn on the neighbouring property, Glen Rowan Station (NZFFD records 7737 and 7742). Brown trout have also been observed at other sites in these tributaries (NZFFD 7738, 7740, 7743 and 7744).

The drainage area of the Shag River is 544 km², however only a small proportion of the upper most catchment resides within the PL. The distribution of Taieri flathead galaxias are tributaries of the mid to upper reaches of the Taieri River and two eastward draining catchments of the Shag and Waikouaiti Rivers (McDowall 2010). One record of the Taieri flathead galaxias (NZFFD record 12780) and eight records of brown trout (NZFFD records 1661 – 1662, 12780 and 14522 – 14526) exist within the boundary of the PL in the Shag River catchment. The main stem of the Shag River has a marginal strip which extends from the state highway upstream to the Kakanui Conservation Area.

Methods

The freshwater fauna was surveyed pursuant to the guidelines specified in "*Non-migratory galaxiid survey methods*" (Department of Conservation 2007), using backpack electro-fishing methods. A total of 50 m² was fished at all sites to sample a variety of instream habitat types targeting riffle/run and pool habitats. Where possible the up-stream limits of fish species were determined by fishing either side of potential barriers. All fish species were identified in the field using morphological characters derived from "*The Reed Field Guide to New Zealand Freshwater Fishes*" (McDowall 2000) and measured, then released. A fin clip (3 - 4 mm of tissue) was collected from a single fish captured in each independent waterway to confirm species identity and ascertain lineage. The presence of benthic invertebrate taxa was identified to a genus and where distinguishable in the field, to a species level using "*Guide to the Aquatic Insects of New Zealand*" (Winterbourn et al. 2006). Macroinvertebrate Community Index (MCI) scores for individual taxa based on Stark (1998) were used to assess water quality. Interpretation of MCI values for stony streams: Clean water > 120, doubtful quality 100 – 119, moderate pollution 80 – 99, severe pollution < 80. Specific conductivity (μS/cm), salinity (ppt) and total dissolved solids (TDS) (mg/l) were taken using an YSI EC300 probe and dissolved oxygen (%) using a YSI 200 to provide an indication of water quality.

Results

Foothills Block

The main stem of the Swin Burn meanders through well developed pasture and was characterised by sequences of run and riffle/rapid habitats flowing over cobble and gravel substrates. The relative abundance of Central Otago roundhead galaxias was high in the faster flowing riffle rapid habitat (n = 30, size range 49 – 85 mm, mean 62.8 ± 1.8 S.E.). Low numbers of juvenile galaxias were observed occupying quiet backwater habitat. Below the confluence with the unnamed tributary galaxiids were observed occupying riffles and submerged vegetation. No trout were captured in these areas however deeper pool and run habitat wasn't surveyed. This section of the stream was bordered by well developed pasture, with occasional depositions of gravels and cobbles from high flow events.

Flat Top

A small tributary which drains the Flat Top Block was surveyed directly above the confluence with the main stem of the Swin Burn. This tributary was overgrown with pasture grass, dominated by mud substrate, fast flowing and highly turbid. Of note was a high specific conductivity and TDS readings of 397.5 μS/cm and 0.258 mg/l respectively. No fish species were observed and invertebrate diversity was low.

Nelsons Gully

Brown trout were the only fish species observed in the main stem of the Swin Burn and the unnamed tributary draining Nelsons Gully. Smaller fish were common in the tributary draining Nelsons Gully (n = 6, size range 28 - 170 mm, mean 114.8 ± 21.8 S.E.) and larger fish were mainly in the main stem of the Swin Burn (n = 6, size range 97 – 130 mm, mean 111.8 ± 4.9 S.E.). Both stream reaches contained numerous deposits of mobile course gravels and cobbles. The course gravel depositions appeared suitable as brown trout spawning habitat. The riparian vegetation of the main stem, predominately matagouri, was in a state of dying back due to the effects of what appeared to be chemical spraying. Nelsons Gully contained areas of thick matagouri, native broom, *Olearia bullata*, snow tussock and various pasture grasses.

Mountain Paddock

The major true left tributary of the Swin Burn adjacent to Mountain Paddock contained low numbers of Central Otago roundhead galaxias (n = 1, size 31 mm). The creek cuts through a large vein of green / brown siltstone topped with alluvial gravels and the banks appear prone to erosion. Most riparian woody shrubs have been removed; even where marginal strips exist, leaving only rough pasture grasses, clover and rushes. Instream water conditions were slightly turbid and tannin stained, with large sections of the stream running over siltstone bedrock. Total dissolved solids and salinity readings were high in this area. No invertebrate species were observed.

Gravel Pit

The unnamed true left tributary of the Swin Burn runs parallel to the state highway and then branches into several small creeks. The main stem of the tributary drains low lying tussock wetlands from the neighbouring property on the opposite side of the state highway and was strongly tannin stained. Crack willow dominated the riparian area. Fishing conditions were poor due to low visibility and therefore numbers of fish captured were low (n = 1, size 75 mm) however several other Central Otago roundhead galaxiids were observed. Stream invertebrate fauna was dominated by snails (*Potamopyrgus antipodarum*).

A broad flat area of developed pasture partially disconnects the upper reaches of two creeks from the main tributary. The surface water of both creeks appears to percolate into the gravels and the channels become undefined and choked with pasture grasses, which suggest they may become ephemeral during low flow conditions. One Central Otago galaxias was captured in this area (size 75 mm), occupying the outlet of a culvert, a small scored out pool covered with watercress (*Rorippa nasturtium-aquaticum*).

Swin Burn

A significant waterfall, *circa* 3 metres high, is situated in the main stem of the Swin Burn. The barrier was located at the edge of the Nelsons Gully and Swin Burn blocks where an unnamed tributary enters the Swin Burn from the true left. The waterfall barrier appears to be stable; water flowing over a large partially incised buttress of exposed bedrock. Central Otago galaxias were observed in high numbers (n = 36, size range 40 - 108 mm, mean 68.9 ± 3.4 S.E.) throughout the main stem and tributaries of the Swin Burn above the waterfall up into the Kakanui Conservation Area. Juvenile galaxiids, less than 30 mm, were regularly observed occupying low velocity backwater habitat. Most woody vegetation in this area had either been removed by burning or was in state of dying back due to the effects of what appeared to be chemical spraying. As the stream topography steepened the Swin Burn became dominated by boulders and rapid habitat.

Brown trout were captured in the large pool and riffle below the waterfall (n = 5, size range 92 - 102 mm, mean 96.8 ± 1.8 S.E.). A small number of Central Otago roundhead galaxias (n = 3, size range 55 - 77 mm, mean 66.7 ± 6.4 S.E.) were also observed.

Short Gully

The upper catchment of a small unnamed true left tributary which runs into the Gravel Pit block originates from within this gully. The surface flow of the creek appears permanent and was contained within an incised mud and gravelly channel. The riparian vegetation consisted of rough pasture grasses, sedges and matagouri. Central Otago galaxias were common throughout the creek (n = 5, size range 55 - 100 mm, mean 81 ± 7.5 S.E.) and many juveniles observed in pools. The ephemeral nature and unfavourable instream condition of the lower reach of this creek appears to restrict brown trout colonisation. The other tributary on the true right draining this block was infilled and choked with pastoral grasses and appeared ephemeral.

Long Gully

A moderate sized unnamed tributary draining Long Gully enters the Shag River from the true right. Both the tributary and main stem of the Shag River were characterised by clear flowing large run and riffle sequences, dominated by loose gravel substrates. Riparian vegetation was mainly comprised of thick band of exotic broom and matagouri. Taieri flathead galaxias were prevalent in riffles of the main stem of the Shag River (n = 7, size range 54 - 100 mm, mean 66.3 ± 6.0 S.E.) but absent in the lower section of the unnamed tributary. Brown trout were observed occupying this area (n = 2, size range 100 - 150 mm, mean 125 ± 25 S.E.).

Stream invertebrates and water quality

There was a moderate number of common benthic invertebrate fauna observed throughout the Swin Burn catchment. Taxa diversity was greatest amongst mayflies with four genera indentified however the overall genera diversity was low (Table 9). The mayflies *Deleatidium*, *Oniscigaster* and *Coloburiscus humeralis* were widely dispersed throughout the Swin Burn catchment. The benthic invertebrate taxa observed throughout the PL were reflective of the diversity of freshwater environments which included pond and stream dwellers. Water quality, according to individual MCI taxa scores (Stark 1998) was variable (10 *Oniscigaster* - 1 Oligochaetes). Variation was also notable in water quality readings (Table 2) particularly TDS, (n = 12, range 0.047 – 0.258 mg/l, mean 0.068 ± 0.016 S.E.) and specific conductivity (n = 11, range 72 – 398 μS/cm, mean 133 ± 28 S.E.). Geology may account for some of the environmental variation (e.g. Mountain Paddock, Nelsons Gully and Short Gully) however several sites registered salinity readings (0.1) and notable levels of turbidity which may be associated with land use practices.

Table 9: The distribution of benthic invertebrate fauna (mainly genera and families) and the MCI score based on Stark (1998) in parentheses, observed during the freshwater fauna survey of the PL.

Invertebrate taxa - Distribution on property	
Ephemeroptera, mayflies	
Deleatidium (8)	Foothills, Nelsons Gully, Swinburn, Long Gully
Coloburiscus humeralis (9)	Foothills, Swinburn, Long Gully
Nesameletus (9)	Foothills, Nelsons Gully, Swinburn
Oniscigaster (10)	Nelsons Gully
Trichoptera, caddisflies	
Olinga (9)	Foothills
Plecoptera, stoneflies	
Stenoperla prasina (10)	Swinburn, Long Gully
Zelandoperla (10)	Swinburn

Chironomid larvae (3)	Gravel Pit
Gastropoda	
Potamopyrgus antipodarum (4)	Gravel Pit
Dystiscid, diving beetles (5)	Gravel Pit
Oligochaete worms (1)	Nelsons Gully, Gravel Pit, Short Gully

Table 10: Summary of surface water quality readings taken during the freshwater fauna survey of the PL.

	Total dissolved solids (mg/l)	Specific conductivity (µs)	Dissolved oxygen (%)	Salinity (ppt)
Flat Top	0.2582	397.5		0
Foothills Block	0.0873	134.3	105.6	0.1
Mountain Paddock	0.1003	154.2	104	0.1
Gravel Pit	0.0788	121.1	102.6	0.1
	0.0567	87.0	60.9	0
Swin Burn	0.0633	97.5	104.5	0
	0.0596	91.6	100.3	0
	0.0468	72	101.6	0
	0.0582	89.5	100.9	0
Short Gully	0.0797	122.5	96.3	0.1
Long Gully	0.0539	83.1	93	0
Nelsons Gully	0.0715		100.2	0.1
	0.0781	109.7	100.1	0.1

2.6.8 Significance of Aquatic Fauna

The Swin Burn catchment contains the eastern most extent of Central Otago galaxias distribution (McDowall 2000). This species has recently been reclassified under new criteria (Department of Conservation 2008) and considered '*Nationally vulnerable*' due to the ongoing and predicted decline of the total population (Allibone et al. 2010). Irrigation relies on significant amounts of water from the Taieri and Manuherikia Rivers (Otago Regional Council 2006a, b). Central Otago roundhead galaxias are particularly prone to displacement due to a tendency to occupy

low gradient streams (Allibone and Townsend 1997), adversely effected by water abstraction (Allibone 2000) and undergo extreme population fluctuations (Department of Conservation 2004b) which may increase the vulnerability to localised extinction.

The conservation status of Taieri flathead galaxias is currently considered by Allibone et al. (2010) as not threatened with a classification of '*Conservation Dependent*' where it is likely to shift into a higher threat category if present management discontinues (Department of Conservation 2008). The Taieri flathead galaxias demonstrates considerable genetic variation throughout the Shag River catchment (McDowall 2006b). Genetic analysis using mitochondrial DNA techniques has been undertaken to assist in the determination of whether the Shag River population has genetic distinction. Evidence suggests that a "hybrid swarm" has occurred with the Canterbury galaxias (*Galaxias vulgaris*) in the lower Shag River (G. Wallis, University of Otago, pers. com) and a hybridization of several separate Taieri flathead galaxias clades has occurred in upper Shag River (McDowall 2010). Results are far from conclusive and therefore require further work

2.6.9 Problem Animals

Rabbits and hares are present on the PL. Pigs and the odd red deer appear periodically. There was some pig rooting noted but neither animal represents a problem unless numbers build up. These animals are subject to ongoing control by recreational hunters.

2.7 Ecological Sustainability and Carbon Storage

Sustainability and Ecosystem Services

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

Analysis of LUC for the PL reveals that the land at highest altitude (above c. 900 m) in the upper Swin Burn, Long Gully and Shag Valley fall into class VII land. This land has severe physical limitations and consequently it is high risk land requiring active management to achieve sustainable production (Lynn et al. 2009). This class has a subclass 'e' which indicates that erodibility is the main kinds of physical limitation or hazard to use that have been identified. Most of the remainder of the PL is classified as class VI indicating low suitability for pastoral grazing or production forestry but with less severe limitations than class VII. This class also has a subclass 'e' indicating erosion limitations. The main valley floors and easy terrain around the Home Block fall into class IV indicating severe limitations for arable cropping but good suitability for pasture, tree crops and production forestry

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

1. Gas Regulation and Carbon Storage

Much of the existing tussockland and shrubland has potential for further carbon sequestration. The full potential of lower altitude tussocklands to increase in density and stature and ultimately to succeed to indigenous woody cover, is currently retarded by stock grazing, spraying and burning. The succession of montane shrublands to forest is also limited by stock grazing, shrubland clearance and very limited seed sources.

Carbon storage in regenerating shrublands, forest and tall tussocklands makes a modest contribution to ameliorating the current anthropogenic induced rise in atmospheric carbon dioxide levels.

Carbon storage varies depending on the vegetation cover present (Table 11).

Table 11: Carbon stock estimates for broad vegetation cover classes in the Vegetation Cover Map (VCM) found on the PL, derived from Tate et al. (1997) with estimates for forest classes used in this study, as derived from Hall et al. (2001). (Source: Carswell et al. 2008)

Vegetation class	Carbon (t ha^{-1})
Unimproved pasture	2.1
Snow tussock grassland	27.2
Mixed indigenous scrub	99.4
Manuka/kanuka scrub or fern	50.5
Beech forest & scrub	179.8
Wetland communities	31.5

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

2. Climate Regulation

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

3. Water Regulation and Water Supply

Swinburn:

Primary water allocation for the Taieri Catchment is considered over-allocated. There is a need to manage the stream for its natural values while allowing access to the water resource for the local community.

The importance of the Kye Burn and Swin Burn to supporting natural and human use values downstream is recognised. These tributaries naturally contribute a significant amount of water, which helps to meet the needs and interests of the community dependent on the water of the Taieri catchment. Any mechanism that allows greater taking by any group in periods of typical low flows, would adversely affect others relying on flows downstream.(Land and Water New Zealand)

Shag River:

The Shag River catchment provides ground and surface water for residential water supplies and irrigation in the Shag Valley. Further development in the valley is somewhat limited though by severe water shortages during droughts, which have occurred regularly in the past.

The Shag River has its source at the northwest end of the Kakanui Mountains and flows south eastwards to enter the sea approximately 8km downstream of Palmerston, draining an area of approximately 544 km^2. The Shag River catchment is bounded to the north by the Kakanui Mountains and the Horse Ranges (elevation approximately 900-1500 m), and to the southwest by lower hills extending from Macraes Flat to Bushey Park (elevation approximately 400-800 m).

The Shag River has been investigated for irrigation and a storage dam to provide water to about 2000ha.

Table 12: Allocated primary takes of surface water in the Shag catchment

Site	Irrigation (l/s)	Stockwater (l/s)	Municipal (l/s)	Industrial (l/s)
Shag River	254	-	38	-

By far the largest allocation of water is for irrigation purposes. Municipal use is mainly smaller supplies for rural townships and accounts for 13% of consumptive water use. Three active community water supplies are listed in the Water Plan within the catchment (Dunback, Palmerston and Goodwood) but these are not subject to minimum flow restrictions. (Land and Water NZ)

i) Limiting Flood Runoff

Fahey and Jackson (1991a) note that bogs are important water-holding areas for the headwaters of many streams. They help reduce flood peaks and sustain flows. Also important are the

shallow unconfined aquifers holding ground water on the colluvium mantled slopes; thereby damping environmental fluctuations from floods and droughts.

ii) Water Yield

High altitude tussock grassland areas are known to yield unusually high proportions of precipitation as runoff, therefore play a significant role in determining catchment flows , snow-tussock catchments have less variable flows than degraded (eg: burnt) tussock, oversown tussock or improved pasture; flows are steadier on a monthly basis and are less variable in the summer-autumn period; and to maximise water yield it is necessary to maintain tall, unmodified tussock vegetation over the headwater catchments. This is best achieved by completely destocking these areas, preventing fires of any kind and controlling wilding pine tree growth.

Studies have found that modification of snow tussocks by clipping or burning will reduce water yield (Mark & Rowley 1976), with the greatest decreases in catchment summer runoff being measured in the first two years following burning (Duncan and Thomas 2004). It can be implied from this and other studies that if burning and grazing persist, then so will reductions in water yield.

Fahey and Jackson (1991b) estimate that in Deep Creek and Deep Stream, which form part of the Dunedin water supply, restoration of tussock cover to nil depletion could lead to water yield increases in the order of 42%-52% at the water intakes for the three summer months in dry years. These catchments now lie within Te Papanui Conservation Park and continue to provide water to Dunedin City.

Change in land use can reduce water yield from snow tussock catchments. Fahey and Watson (1991) assessed the impact of afforestation of tussocklands in the Glendhu catchments near Lawrence on water yield and stream flow. They found that establishing pine forest reduced annual runoff by 20% in comparison to an adjacent lightly grazed tussock catchment. A longer running study in the same area found that as plantations mature, interception of rainfall increased to 31% and were expected to increase further (Fahey 2004). Interception rates are particularly high where rain falls as many small events, as is the case on the Kakanui Mountains (Waugh 2005). Fahey (2004) found that in the 13 years from canopy closure in 1991 to 2003, the annual reduction in runoff has averaged 252 mm or 31% less than the tussock catchment. Reduction in water yield reduces hydro capacity year round and in summer, impacts on the demand for water for irrigation and recreation.

Duncan and Thomas (2004) found that catchments with depleted tussock cover yielded lower water flows. Fahey and Jackson (1991b) attribute this in part to the higher transpiration rates from exotic pasture species.

5 Erosion control and sediment retention

Snow tussock catchments monitored for sediment yield studies were shown to have very low sediment yields by New Zealand standards (Waugh 2005).

6. Nutrient cycling

Nutrient Cycling Storage, Internal Cycling, Processing and Acquisition of Nutrients (nitrogen fixation, N, P and other elemental or nutrient cycles)

Studies have shown that tussock covered catchments yield very good water quality (ORC 1999) characterised by:

- Cool water temperatures
- High levels of dissolved oxygen
- Approximately neutral pH values
- Low conductivities
- Low total nitrogen levels
- Low $NH_4 + NH_3$ levels
- Low total phosphorous levels
- Low turbidity
- Low faecal coliform levels

MCI (Macro-invertebrate Community Index) values also recorded by ORC (1999) indicate water quality and good habitat condition in tussock catchments.

On the PL, as outlined in the Aquatic Faunal section of this report, water quality based on Macroinvertebrate Community Index score (MCI = 142) reflected a healthy water quality for stony streams. A small selection of pollution intolerant freshwater invertebrate taxa was present throughout the majority of streams (Table 9). There was a notable variation in TDS, (n = 12, range 0.047 – 0.258 mg/l, mean 0.068 ± 0.016 S.E.) and specific conductivity (n = 11, range 72 – 398 μS/cm, mean 133 ± 28 S.E.). Geology may account for some of the variation (Mountain Paddock, Nelsons Gully and Short Gully) however several sites (Flat Top and Gravel Pit) registered salinity readings of 0.1 mg/l and notable levels of turbidity which may be associated with land use practices.

Significance of Sustainability and Ecosystem Services

Given its relatively small size, the PL makes only a modest contribution to ecosystem services such as water yield in the Shag and Taieri River catchments and has an equally modest potential for carbon storage. However this property is one of many on the Kakanui Range and when combined with potential gains on the range as a whole, benefits are significant.

Large portions of the PL have been developed for pastoral use by the conversion of tall tussocks and shrublands to short tussock and exotic pasture. This may have resulted in a consequent loss of water quality in some places as was measured at inspection.

The PL waterways feed the Shag and the Taieri catchments, both of which are over allocated waterways. Potential for increased water yield and in particular a reduction in the number of annual low flow days are possible with the destocking of parts of the PL and allowing for tall tussock to improve in quality.

2.8 Historic

Historic records and Previous Archaeological Surveys

The original Longlands Run was much bigger than the current Longlands PL. As such the historic section of this report will refer to the original Run in order to distinguish from the current PL.

The history of Longlands Run and the Preston family is supplied by Frances Preston (1978) 'A Family of Woolgatherers', Robert Pinney (1981) 'Early Northern Otago Runs', and E. Spiers (1987) 'Preston Runholding in the Maniototo and the MacKenzie 1858 – 1917'. Previous historic work has been undertaken on the PL by Hamel (2000: 8 - 13) for the Protected Natural Areas Survey. Hamel's report, east of the Taieri River, provides a concise history of the station and its buildings primarily taken from two farm diaries, Longlands (Run) 1871-2 and Puketoi 1858 -1869. James Murison was the first to write in the Puketoi dairy, 1 December 1858, followed by others including William Ogilvy, W.D. Murison, John French, Adolphus Oliver, Noel Buchanan, and Alfred Dick (Beattie 1947: 74).

Following the site inspection it was noted that one archaeological site listed with the NZ Archaeological Association is located within the current bounds of the PL, the Shag River Water Race (I42/121) diverting from the Swin Burn. This race is described in further detail below.

Pre-contact Maori Sites

There is a record of 10 oven depressions with Moa bone and artefacts (NZAA I42/1: ArchSite) located north of Swinburn Peak by P. George in 1962 but this area may no longer be within the bounds of the PL (see 4.3.2 Figure 1). The wider area of Macraes was used for eeling, birding, and resources such as cabbage trees, tikumu for weaving, and taramea (Anderson 1998: 120 cited in Hamel 2000: 7).

Pastoral Farming history

Run 203 was the very first depasturing license applied for under the Waste Lands Board applications dated 2 June 1858 (Cowan 1978: 16 - 17). Sinclair (2003: 88) notes Run 203 was applied for by William Alfred Blundell in 1857 and was sold to Joseph Farrar Preston in 1858. Beattie (1979:321) notes the date as 1859 being sold for £300. Johnny Jones refused to supply Preston with sheep to stock the run, a condition of occupying Waste Lands within twelve months from sale. Longlands Run imposed a limit on land available by setting a boundary on Frederick Jones' Coal Creek station (Pinney 1981: 108). Preston travelled to Nelson where he bought 200 hoggets and drove them on an epic journey overland to Longlands Run. Stone corrals were built to house the sheep at night with shepherds and their dogs near by as wild dogs were a problem in the early years. Joseph brought English Leicesters out by ship from England to stock another property called Centrewood, which he crossed with fine merino to provide half-breds for Longlands Run. The Leicester-merino cross did extremely well with water available from water races that cross the PL (Spiers 1987: 42). By 30 September 1871 Run 203 is recorded (Supplied by Cargill and McLean) as running16000 sheep (over 20810 ac).

Joseph Preston applied for five pre-emptive rights in January 1864 to occupy Run 203, the homestead, two outstations close by, a boundary hut on the Houndburn, and one close to the northern boundary. Three of those rights were granted February 1867 and two January 1871 (Spiers 1987: 35 – 36, SO 16207 dated 18th June 1869: Figure 3, Swinburn Crown Grant Index Record map).

Pastoral licences were non renewable and they were auctioned in 1882 for the terms of 5 – 7 years to commence on 1st March 1883 (The illustrated New Zealand Herald 1882). Run 203 was split and Joseph Preston succeeded in bidding for 302A and 302B (Reid and Duncans got 203C), being a total of 14060 acres (approx 5460 ha). It is interesting to note that the current Longlands PL is Run 203C. The progression of titles has not been investigated.

A small cob house, stone barns and stables were built on the station probably in 1860. The Preston family lived at Longlands Run in the working season and at Centrewood, Goodwood, Waikouaiti, for the winters (Preston 1978: 26). Joseph was appointed a Justice of the Peace in 1870. In December 1880, Joseph became a Receiver for Maniototo County under the Property Assessment Act (Preston 1978: 57, Spiers 1987: 57).

Hugh Cameron worked on Longlands Run from 1865 and married Joseph's daughter Sarah on 14 June 1867. Hugh Cameron managed Longlands till John Edward Preston took over in 1871 (Preston 1978: 55). Longlands had sufficient fences by 1871 to manage the flocks at the washpool on the Swinburn and around the shearing shed. In September 1872, enough fencing was installed to divide the cultivated paddocks from the uncultivated. Fencing materials included 200 kowhai posts brought up from Goodwood.

John Edward Preston and his shepherd drowned in the Houndburn November 1877 and Hugh Cameron was asked to return to manage Longlands Run. James Henry Preston took over Longlands Run in 1887 (Pinney states 1883: 109 and Spiers states 1882: iii - iv). James was active in the community as a County Councillor, Chairman and Treasurer of the Naseby Library Committee (1900), involved with the hospital, and supported the church. James managed an aggregation of runs, Haldon, Ben Ohau, Black Forest, Aviemore, and Glen Lyon (Spiers 1987: iv). James married Margaret Pringle in March 1890 and it was Maggie (Margaret) who oversaw the farm work on Longlands in James's absence (Preston 1978: 60 - 61, 64, 67, 76, 99).

Longlands Run was divided between James and Joseph Junior upon Joseph Preston's death July 1891. They diversified into agriculture and frozen meat (Spiers 1987: 184). Joseph Junior bought James's interest in Longlands Run in 1900. Joseph Junior took his son, Thorp Preston, into partnership (Preston and Co.) and gave him management of Longlands Run. Joseph was a director of the Waitaki Farmers Freezing Company ca.1919 (Preston 1978: 87, 91, 94). In 1940, James brother-in-law R.R.C. Thompson took over management of the run. Later his son Peter Preston Thompson took up the lease. A family syndicate ran the lease until 1964 when it was auctioned to Stanleys Properties Ltd. Christopher Thorp Preston, son of James Thorp Preston, bought Longlands in 1965 (Pinney 1981: 111 - 112).

Gold mining

Pinney (1981: 109) notes prospectors digging holes on the Longlands run. The Longlands diary notes prospectors holes were measured (26 March 1886: cited in Spiers 1987: 31) and Joseph Preston allowed miners to work small areas of his land although it is not known if this occurred within the current PL boundaries. The diary states miners holes were filled in 17 April 1891 (cited in Spiers 1987: 31).

The Preston's did not undertake gold mining but sold meat, wheat, and other food direct to gold miners and were paid in gold.

SURVEY METHOD

In order to provide value judgements on the historic heritage within the Longlands pastoral lease more data on the archaeological evidence remaining in the landscape was required. Historic records provided some information on the identification of areas of interest. One day was set aside to conduct a survey of known historic resources on the PL. GPS coordinates taken to locate archaeological/historic features are depicted in 4.3.2 Figures 1 - 2. A list of waypoint coordinates will be held in the Otago Conservancy's historic database.

HISTORIC HERITAGE DESCRIPTION

The archaeological/historic features include a woolshed, stone stables, mud brick cottage, 19th century fence lines, two water races, and associated site artefacts (Table 13).

Table 13: Key historic resources on Longlands PL;

GPS ID	comments	NZAA No.
041	Shag River water race	I42/121
048	Shag River water race diversion	I42/121
049	Flat standards and stone alignment	I42/121
052-55	6 hole bored posts	I42/176
056	Water race	
057	Schist slab wrapped with 10mm wire	
058	Drafting race below woolshed	I42/176
060	Woolshed	I42/176
061	Old yards or fence line	I42/176
062	McLaughlan's mud brick cottage	I42/175
063	Stables	I42/174
064	Tractor shed	I42/174

Pre-contact Maori Sites

No sites of Maori origin were noted on the PL. Ngai Tahu will comment to LINZ on cultural values of the PL separately.

Pastoral Farming (Figure 1)

The location of key significant pastoral sites within the bounds of the PL is provided in Figure 1 and named in Table 13. The standing buildings are located outside the bounds of the original pre-emptive rights granted to Joseph Preston in 1858. Survey Office plan SO 9100 (dated 1938) and Google earth (2011: 4.3.2 Figure 3) provide views of the station buildings scattered over a much wider area compared to other 19th century pastoral stations (Hamel 2000: 10).

Stables (NZAA I42/174 photos 4.3.2)

Hamel (2000) provides a description and sketch of the stables noting the structure has been built like a miner's cottage using well trimmed basalt blocks (GPS 063). The main section contains an upper hay loft with a loft door. The floor of the main section contains a scored concrete floor but it was not ascertained if it contained rock cobbling beneath. The floor of the lean-to is concrete over rock cobbling. The roofing iron may have been replaced at some point. New timber boards have been replaced under the lean-to roof with new wire tying down to the rear stacked wall. Concrete has been used to restore some of the packing between stones on the rear wall of the lean-to. An outside corral has been added to the front of the stables since Hamel's report. The north facing front wall stacking has split apart. Decorative blocks set into the front wall either side of the door may be Moeraki agate. Artefacts related to a pastoral use are scattered throughout the stables and on the ground outside the stables along the north facing wall.

Joseph Preston had more permanent stone barns and stables built during the early 1860's (Hamel 2000: 8, Preston 1978: 26). Watson and Heggie received £24 for building a stable in 1877 (Spiers 1987: 64) and a new stable was built at Longlands in 1889 by Semple, a stonemason, at a cost of £25 (Preston 1978: 67). It is not confirmed whether the stables were built in the 1860's, 1877, or 1889.

There was no trace of a separate stone barn mentioned by Spiers (1987: cited in Hamel 2000: 11) and no sign of the pig sty recorded in the 1860 - 1870 diary (Spiers 1987: 59). A barn is noted on SO 7292 (dated April 1891) on Section 27 at the north-western extent of the PL directly south of the main highway on the true right of the Swin Burn. An early 1860's barn would have been built on the old road line which suggests this barn was built when the woolshed was moved to face the new highway alignment. There is currently no trace of a barn in this locality. The survey plan is J. Macnamara's application to purchase the section although this may not have occurred as the land is still within the PL.

There is no trace of the corrugated lean-to housing the iron smithy located beside the driveway to the main house. The lessee, Geoff Preston (pers comm.), mentioned the lean-to had been removed due to disrepair. The leather forge bellows (Photo 4.3.2) currently resides in the rear

room of the stables although an anvil noted by Hamel as being moved into the stables from the smithy was not recorded. Hamel (2000: 11) notes the following maker's mark on the bellows 'Alldays and Onions, Makers, Birmingham, London' on an oval stamp. Alldays and Onions Ltd formed by the merger of William Allday and Sons Ltd with John C. Onions Ltd in 1885 (Alldays and Onions LTD). Alldays Peacock & Co was established in 1625 with a virtual monopoly in the manufacture of forge and bellows. Hamel (2000: Hamel's Figure 8) provides a photograph of the bellows and smithy within the original building prior to its removal.

Woolshed (NZAA I42/176)

Hamel (2000: 11-12) notes it likely the woolshed (GPS 060: Photo 4.3.2) dates to the 1870's and was shifted to its present site once a good dray road was formed on the line of the current highway although no date is known for this shift. The current woolshed is part timber (older section 20 x 19 m) and part corrugated iron (12 x 19 m) with the newer corrugated section thought to have been built in 1920 using some of the old iron. The woolshed held 6 shearing stands and a wool press is present that may be the screw wool press bought by James in 1886 (Spiers 1987: 100). A Redcliffe brand of corrugated iron (manufactured 1887 – 1888: Miles Lewis 2009) is present on the timber section of the woolshed.

The woolshed is an integral part of a working farm that has been well maintained and preserved. The current stock yards are relatively new replacing the early yards which had a semi-circular drafting race (C. Preston pers. comm.: cited in Hamel 2000: 12).

Part of an old fence line consisting of wood posts and flat metal standards remains to the south-west of the woolshed (GPS 061) this may be part of earlier stock yards. Drafting yards with a concrete pad and a collapsed shed is located in a gully below, north, of the woolshed (GPS 058). Dates have not been verified for use of these features. Stone corrals mentioned in Preston (1978: 26) for holding sheep overnight during the 1860's have not been located.

Mud brick cottage (NZAA I42/175)

A mud brick cottage (GPS 062: Photo 4.3.2) was built July 1872 thought to be McLaughlan's cottage (Hamel 2000: 9 - 12). McLaughlan (McLachlan) was a boundary keeper for Longlands (Spiers 1987: 63). The cottage is a single gable construction measuring 8 m x 4.42 m externally with walls consisting of a double row of mud bricks mounted on a foundation of stone. The internal walls have been plastered with wallpaper still evident on the west wall. The cottage originally contained two rooms but the internal wall has been removed. The external walls are painted roughcast. The author assumes the east facing wall has been altered to hang double doors to allow easy entry to the cottage. Artefacts and miscellaneous items are stored within the cottage.

Tractor shed (NZAA I42/174)

The tractor shed (GPS 064) is located beside the driveway close by the stables (Photo 4.3.2). The shed is a single gable structure with painted roughcast plaster over netting and board cladding (GPS 064). A corrugated maker's mark, MINERVA BEST with a crown, present on

the roofing iron. SO 9100 (dated 1938) appears to name the structure a byre. Either the building functioned as a cow byre or a byre was located between the tractor shed and the stables. The building is still in use by the lessee

Joseph Preston had an Abbott buggy to travel between Longlands and Centrewood which required housing in a shed. The altered Mclaughlan's cottage, the stables, and the tractor shed could all have housed the buggy, the chaffcutter (Spiers 1987: 48), and later the Cadillac owned by Joseph Junior (Preston 1978: 37, 95).

Fencing

Four six hole bored posts from a remnant pre-1900 fence line runs alongside the main highway between GPS 052 - 055 (Table 13). One post retains a single strand of wire pushed through each of the bored holes to thread each of the six wires. The Longlands ledger to March 1885 notes £300 to fence the Shag River boundary (Spiers 1987: 164).

Twenty miles of rabbit-proof fencing was installed before the First World War. Hamel (2000: Figure 7) recorded a kowhai post and flat standard fence line along the Longlands driveway but this was not noted by the author on the site inspection.

Gold mining

Two water races were recorded during the survey. A previously unrecorded section of the Shag River Water Race Company's water race (NZAA I42/121) diverts from the true right bank of the Swin Burn at GPS 048. The water race has been noted by Hamel (2000: 51 - 52) during previous surveys. Alfred Keene, Mining Surveyor, first reported the water race in 1865 as being constructed to work the Fullarton deposits at Hyde (AJHR 1865: 4a page 18). The race was estimated at 48 km in length although Hamel (2000: 52) suggests the race is closer to 60 km. Hamel describes this race as long and tortuous with local tradition saying the engineer shot himself when he realised the race could not pass through the Mount Highlay Station Saddle. The Shag River Water Race Company wound up July 1872 (AtoJs Online 1872: Session I, G-43). Richard Creeth is the manager named on the company's registration application and shareholders included John McGlashan, Edward Barber, James Hamilton, John Laverty, and William Fuller (Shag River Water Race Company: 8 January 1866).

The Shag River Water Race Company took up ground adjoining the very rich claim of the Star of Otago Mining Company (Otago Daily Times 1865: 4). The Shag River Water Race Company (registered 17th September 1867) laid out £15,000 in an attempt to supply water to the two mining companies mentioned above. This venture was a failure owing to various causes, mismanagement amongst others (The New Zealand Tablet 11 February 1876: 11).

A stacked rock alignment and two metal standards of an unknown function are located close by the water race diversion on the true left bank of the Swin Burn (GPS 049). The water race has been damaged in part by track construction.

The second water race (at GPS 56) leads to a reservoir on the Swin Burn to the north of the homestead. It is not known whether the reservoir was used for gold mining outside the PL boundaries. A schist slab wrapped with 10 mm thick wire lies beside the race where the race drops water into a gully above the reservoir (GPS 57).

Only one pit was recorded during the survey on a terrace on the true left of the Swin Burn at GPS 051. An uneven small channel leads to this pit suggesting modification from flooding.

2.8.1 Significance of Historic

The above review of records and archaeological sites observed during the field survey of the PL illustrate some of its history. Of most historic significance is the remaining fabric of sites related to early pastoral history of the run and the record of gold mining, primarily as a source of water for activity undertaken off the PL.

The archaeological and historic evidence present on the PL resides within a wider historic landscape rather than existing as individual or isolated sites. The archaeological/historic pastoral landscape includes stone stables, a mud brick cottage, woolshed, tractor shed, fence lines, and associated site artefacts. The forge bellows are a significant reminder of early work undertaken on the PL in order to maintain a working farm. The stables may require re-mortaring of walls to halt water ingression and collapse.

There is a rare family continuity on Longlands as being one of the few Otago pastoral runs still owned by descendants of the original holders (Pinney 1981: 112, Preston 1078: 23). The Preston's were innovative famers introducing quality crossbred stock and new farm machinery and techniques to Otago (Spiers 1987: 184). Notable people involved in the running of the property include Joseph Farrar Preston (Justice of the Peace and Receiver for Maniototo County), James Henry Preston (County Councillor and Chairman and Treasurer of the Naseby Library Committee), Hugh Cameron (later of Aviemore), Joseph Junior Preston (a director of the Waitaki Farmers Freezing Company) and Thorp Preston (Preston and Coy.).

The Shag River Water Race Company, supplying water to rich deep sinking mining claims at Fullartons, is significant for being a major failure in early gold mining in Otago (Hamel 2000: 51 – 52). Prominent shareholders of the company include John McGlashan (Provincial Solicitor and Secretary of the Otago Provincial Council 1855 – 1859 and Deputy Superintendent 1858: Thomson 1998: 303), Edward Barber (owner of Union hotel and store at Hamiltons until 1871: Thomson 1998: 22 - 23), James Hamilton (Captain James Hamilton of Run 204 Sowburn in 1860 and Run 109 Waihemo Grange in 1862: Pinney 1981: 217 – 219, Sinclair 2003: 43), John Laverty (founding County Councillor for Hyde), and William Fuller.

Archaeological sites are subject to the protection of the Historic Places Act (1993).

2.9 Public Recreation

2.9.1 Physical Characteristics

There are opportunities for public recreation on Longlands PL due to:

- Convenient location between the population centres of Coastal and Central Otago.
- Existing recreational use of the Kakanui Mountains means that the general locality is already known to recreationists.
- Opportunities to embark on cross country traverses linking with tracks on adjoining land.
- Existing conservation land in the Kakanui Mountains with a significant area adjoining the back of Longlands.

Although somewhat out of date, in 1992, DOC compiled a Recreation Opportunity Spectrum (Harper 1992) for the entire Otago Conservancy whereby all areas regardless of land tenure were classified and mapped accordingly to setting, activity and recreational experience characteristics.

The Kakanui Mountains are zoned "Backcountry Accessible". This recreation opportunity may have many human elements but there is an equal probability that users will at times experience isolation from the sights and sounds of humans.

In 1988, Federated Mountain Clubs compiled an outdoor recreation plan for Central Otago's Block Mountains (Mason 1988) which included the Kakanui Mountains. The PL is zoned 'Open Space' and 'Natural Experience'.

2.9.2 Legal Access

An unformed legal road bisects the property from SH 85 to the public conservation land behind. It appears unsurveyed and could possibly be bought onto a more feasible line on survey.

Existing marginal strips are located on the Shag River on the eastern boundary and on the Swin Burn. Both of these potentially provide access through the property, but neither is particularly direct as they wind through the valleys following the creeks. They may also be impeded by riparian vegetation, which would make for impractical public access.

2.9.3 Activities

Hunting:
The area provides recreational hunting opportunities for deer and pig.

Tramping, horse riding and mountain biking:
Due to the physical nature of the four wheel drive tracks, a high level of public vehicle use is inappropriate. The PL is however well suited to foot, mountain bike and horse access with potential to embark on significant cross country traverses linking with tracks on adjoining land. The route from the highway near the eastern end of the property provides one of the shortest and

best access routes to Kakanui Peak. It provides good access to Kakanui Peak and views of the extinct volcanic cones of Mt Dasher and Kattothyrst.

2.9.4 Significance of Recreation

The existing conservation land at the back of Longlands has poor access which could be enhanced with a marked route along an existing formed track. This may also provide access to any new conservation land resulting from this review. Access would add to the network of tracks proposed over the length of the Kakanui Mountains most of which will cater for horse, bike and foot access.

PART 3

OTHER RELEVANT MATTERS & PLANS

3.1 Consultation

The following comments were made at the meetings with NGO's in Alexandra on 22 September 2011 and 18 April 2012.

- Prior land classifications may indicate remaining Longlands land has the potential to be ecologically sustainable and suitable for freehold disposal.
- Protection of shrubland remnants under covenant
- Historic interest in water races could be protected under covenant without excluding grazing.
- Secure legal access foot and bike, to the Kakanui Peak Conservation Area from the Pigroot.
- Access up ridge west of Shag River seen as a possibility.

A full copy of written submissions received from NGO's are attached as Appendix 3.

3.2 Regional Policy Statements & Plans

Regional Policy Statement

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

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

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

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

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

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

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

3.3 District Plan

The portion of the PL within the southeast facing slope directly above the Shag River (Waihemo) is within Waitaki District, and is identified in the fully operative Waitaki District Plan (the WDC Plan) as being in the Rural Scenic Zone.

Any earthworks and erection of buildings above 900 m require a resource consent; as do earthworks which exceed 100 m^3 in volume or 50 m^2 in area; any forestry within the Rural Scenic Zone and/or the clearance or modification of areas of indigenous vegetation which met specified thresholds. Note however that the indigenous vegetation provisions do not apply to land that is freeholded via tenure review.

There are no registered archaeological sites, or areas of significant indigenous vegetation and/or habitats of significant indigenous fauna identified either within the WDC Plan or on the accompanying maps.

Subdivisions of lots less than 20 hectares in the Rural Scenic zone, requires a consent.

The remainder of the PL is within the Central Otago District and is identified in the fully operative Central Otago District Plan (CODC Plan) as being within the Rural General Zone. With the exception of approximately 50 ha immediately bordering SH 85 on the south-western part of the PL, the PL is within an area zoned as Outstanding Natural Landscape (ONL).

Subdivisions which create lots which on average are less than 8 ha or any lot that individually is less than 2 ha requires a resource consent, as does the construction of buildings within 20 m of any waterbody; while a consent is required for any earthworks, deposition of sediment, earthworks greater than 20 m^3 and the removal of vegetation within 10 m of any waterbody. Earthworks exceeding 2000 m^2 and/or 3000 m^3 from any one site also require consent.

The clearance of indigenous vegetation of specified areas and/or types and the establishment of exotic woodlots requires a consent, but note these provisions do not apply to land that is freeholded via tenure review.

Within the area identified as ONL consent is required for earthworks that breach specified thresholds, activities including but not limited to cutting new roads etc, subdivision (except for the creation of legally protected areas) and the planting of exotic plantation species. Again note these provisions do not apply to land that is freeholded via tenure review following the district plan becoming operative in 2008.

Within the Otago Regional Council Regional Plan: Water for Otago, there are no significant wetlands identified on the PL, but note that consent is required to modify any wetlands above 800 m (ORC 2004).

3.4 Conservation Management Strategy & Plans

The Otago Conservancy of DOC has prepared a Conservation Management Strategy (CMS) which was approved by the New Zealand Conservation Authority in August 1998. The CMS identifies 41 special places of conservation interest in Otago Conservancy.

The Longlands PL is incorporated in the Kakanui Special Place. The CMS objectives for the Kakanui Special place relevant to the PL include:

To maintain the natural resources contained within the existing protected areas on the Kakanui Mountains while taking opportunities that may arise through pastoral lease tenure review to negotiate protection of and access to areas of high natural and recreational value.

Priorities for Kakanui Special Place are:

In this Special Place, tenure review negotiations and wilding tree control will be the priority method for implementing the objective during the course of this CMS.

The key implementation methods relevant to the PL are:

- Control wilding conifers that threaten natural resources on the Kakanui Mountains, including liaison and cooperation with neighbours.
- Foot access negotiated at key points for the public to areas managed by the department, with public vehicular access having a lower priority.
- Co-siting of future telecommunications buildings and towers will be advocated on the Kakanui Mountains.
- Resource information that assists management of existing areas administered by the department or assists pastoral lease tenure review discussions will be gathered.
- Protection of key areas for natural and historic resources will be sought through pastoral lease tenure review negotiation opportunities.
- Advocate against burning of native grasslands or shrublands where its effect is to degrade significant natural and historic resources, especially landscape and soil and water, in the context of Resource Management Act and other statutory processes.

3.5 New Zealand Biodiversity Strategy

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

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

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

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

3.6 Protecting Our Places

Introduction

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

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

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

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

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

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

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

These national priorities have relevance beyond conservation initiatives on private land. For example they are used to help assess applications for grants under the government funded Community Conservation Fund which funds conservation projects on public land by community groups.

The national priorities also provide a useful measure for assessing tenure review recommendations and outcomes.

3.6.2 Significance of Protecting our Places

National priority 1: Level IV land environments on Longlands PL N3.1f, N3.2a, N3.1d, N6.2, N4.1a, and N3.1e have less than 20% indigenous vegetation remaining nationally. The main areas where these environments occur on the PL are in the Home Block and western half of the main block. With the exception of the Mountain Paddock shrubland, the little indigenous vegetation that remains is fragmented, early successional, and impractical to manage and sustain its values.

National Priority 2: These areas are represented by a substantial copper tussock dominated wetland adjacent to SH 85 and seeps and flushes in the headwaters of Long Gully.

National Priority 3: On the PL one rare ecosystem was identified in the wetland category (seepages and flushes).

National Priority 4: Although the classification methodology has changed we can interpret that the following acutely threatened species have habitats on the PL:

The Central Otago galaxias and the New Zealand falcon are classified as "*Nationally vulnerable*".

A number of "at risk – declining" species fit into the "Chronically threatened" category. These are: the plants *Aciphylla subflabellata*, *Carmichaelia crassicaulis* subsp. *crassicaulis*, *Raoulia monroi; the lizards, Woodworthia* sp 'Otago Southland' and *O. chloronoton*; the birds, pied oystercatcher and pied stilt.

PART 4

ATTACHMENTS

4.1 Additional Information

4.1.1 References

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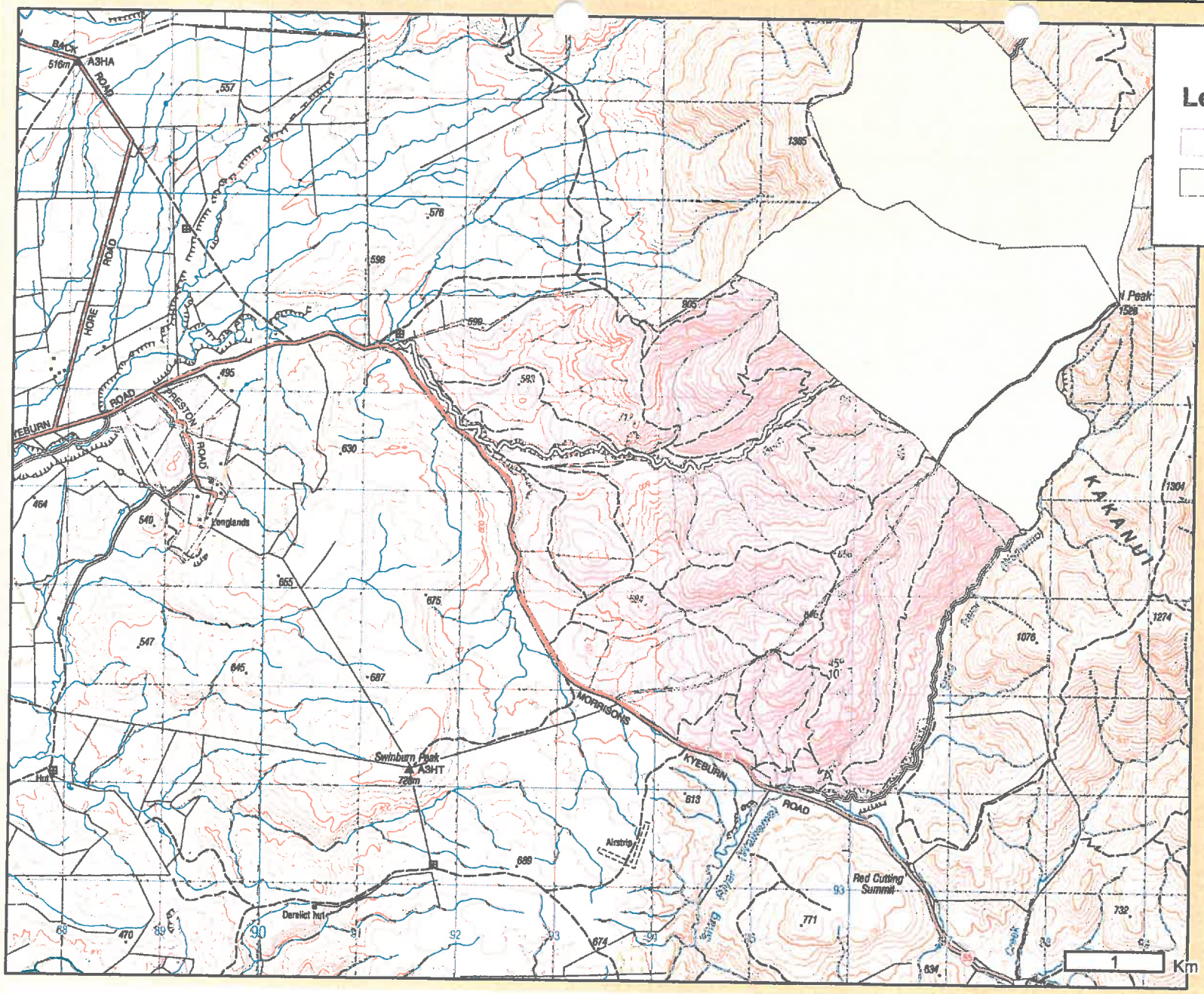
4.2 Maps

4.2.1 Topographic and Cadastral
4.2.2 Landscape Units
4.2.3 Values – Botanical
4.2.4 Fish Sites
4.2.5 LENZ Level IV Map



4.2.1 LONGLANDS TOPOGRAPHICAL AND CADASTRAL

ArcGIS Lite
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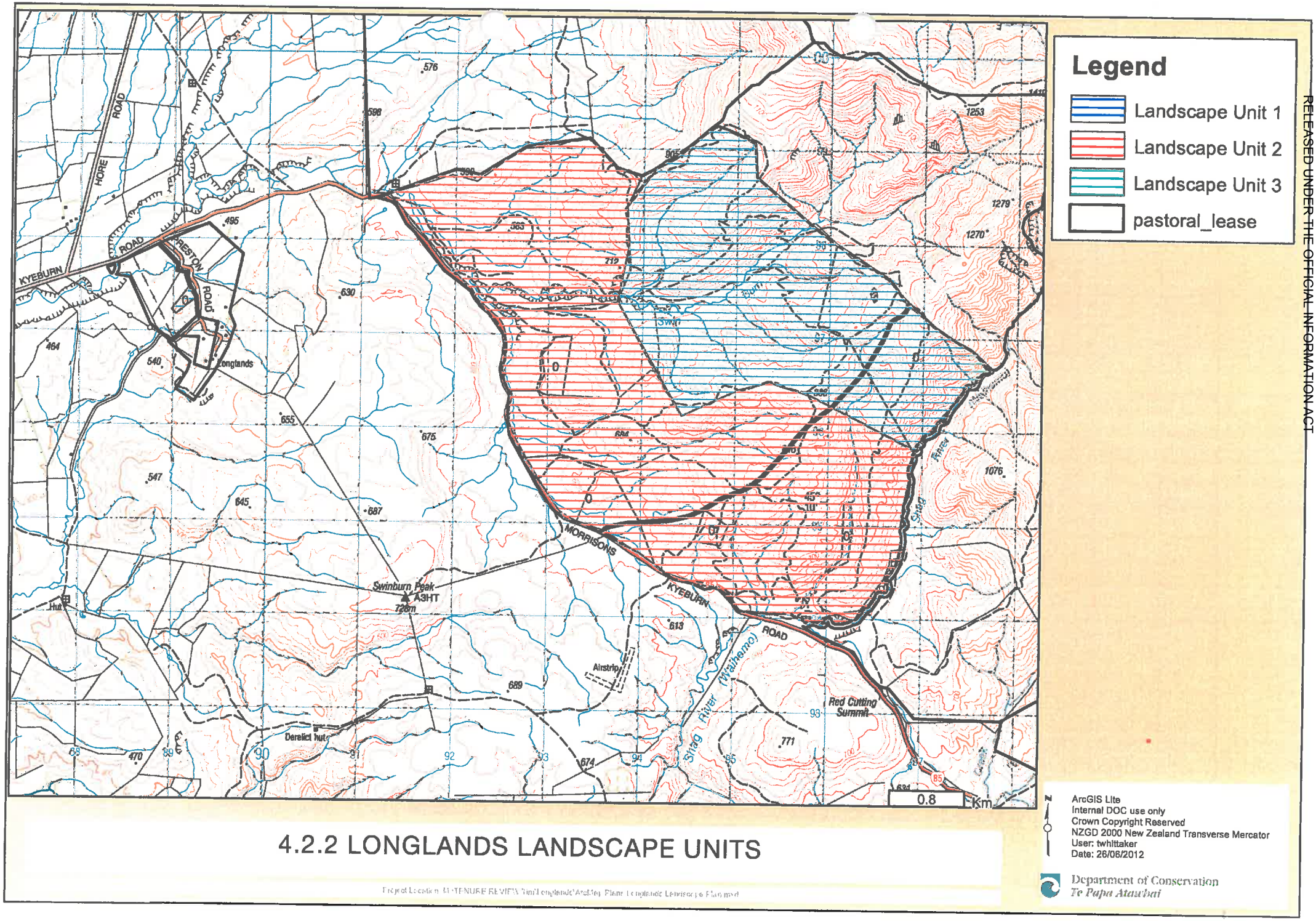
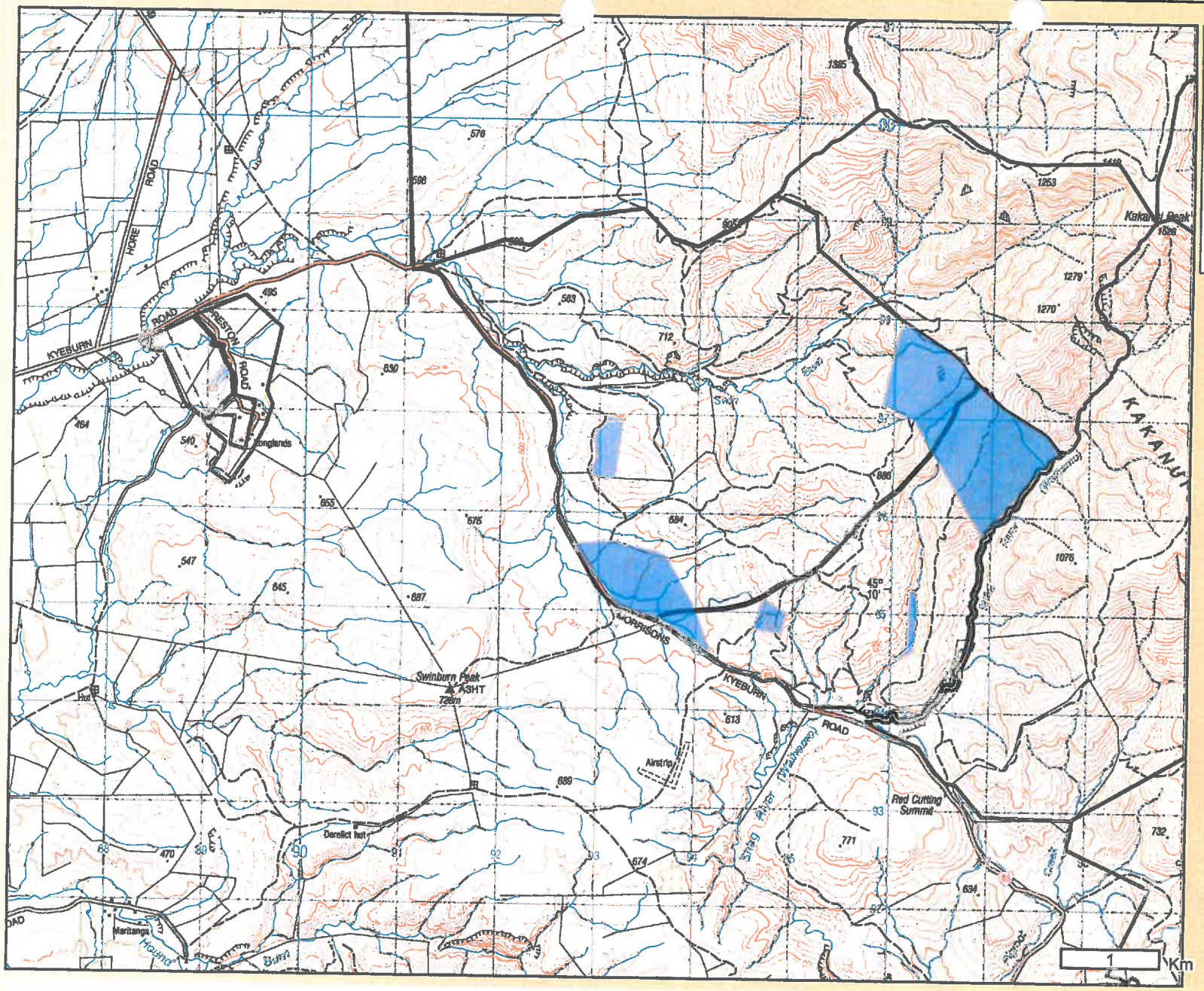
NZGD 2000 New Zealand Transverse Mercator
User: twhittaker
Date: 26/06/2012

Department of Conservation
Te Papa Atawhai



4.2.2 LONGLANDS LANDSCAPE UNITS

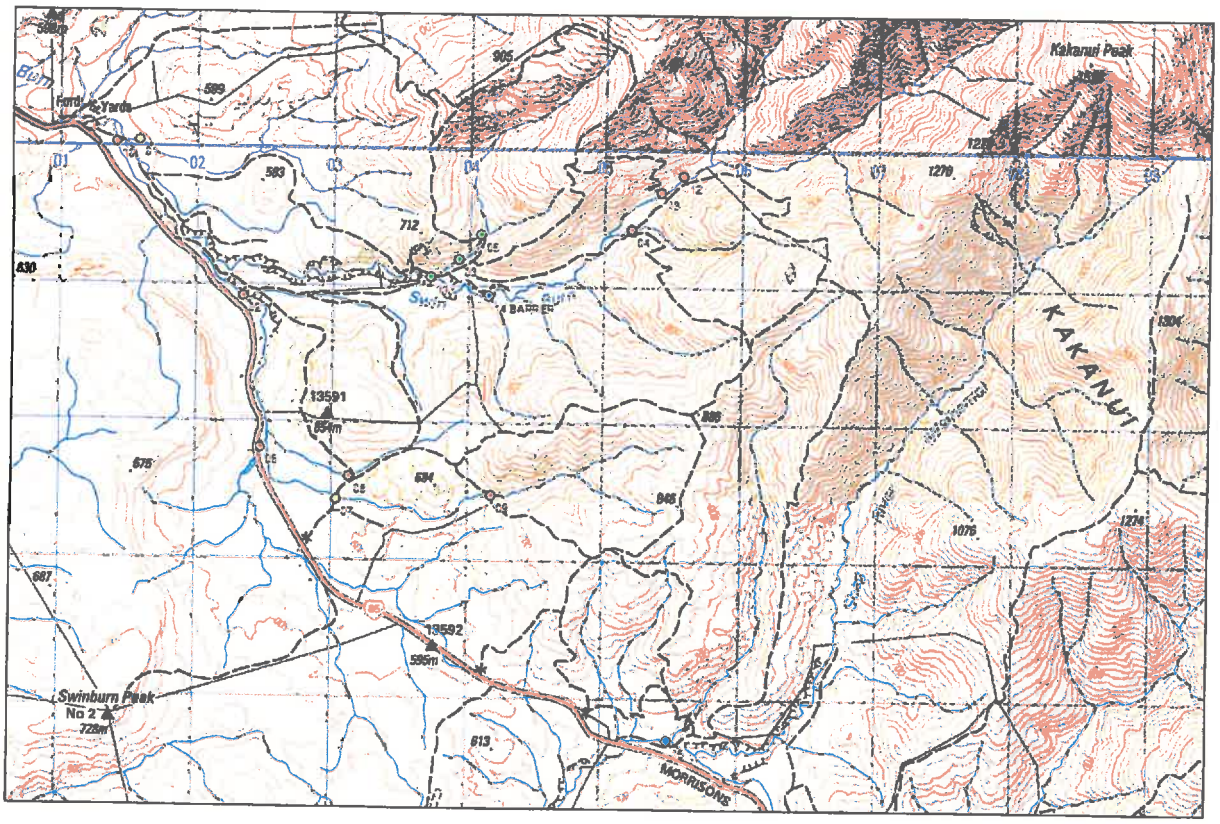
Project Location: G:\TENURE REVIEWS\Tmt\Longlands\ArcMap Plans\Longlands Landscape Units.mxd



4.2.3 LONGLANDS BOTANICAL VALUES

4.2.4

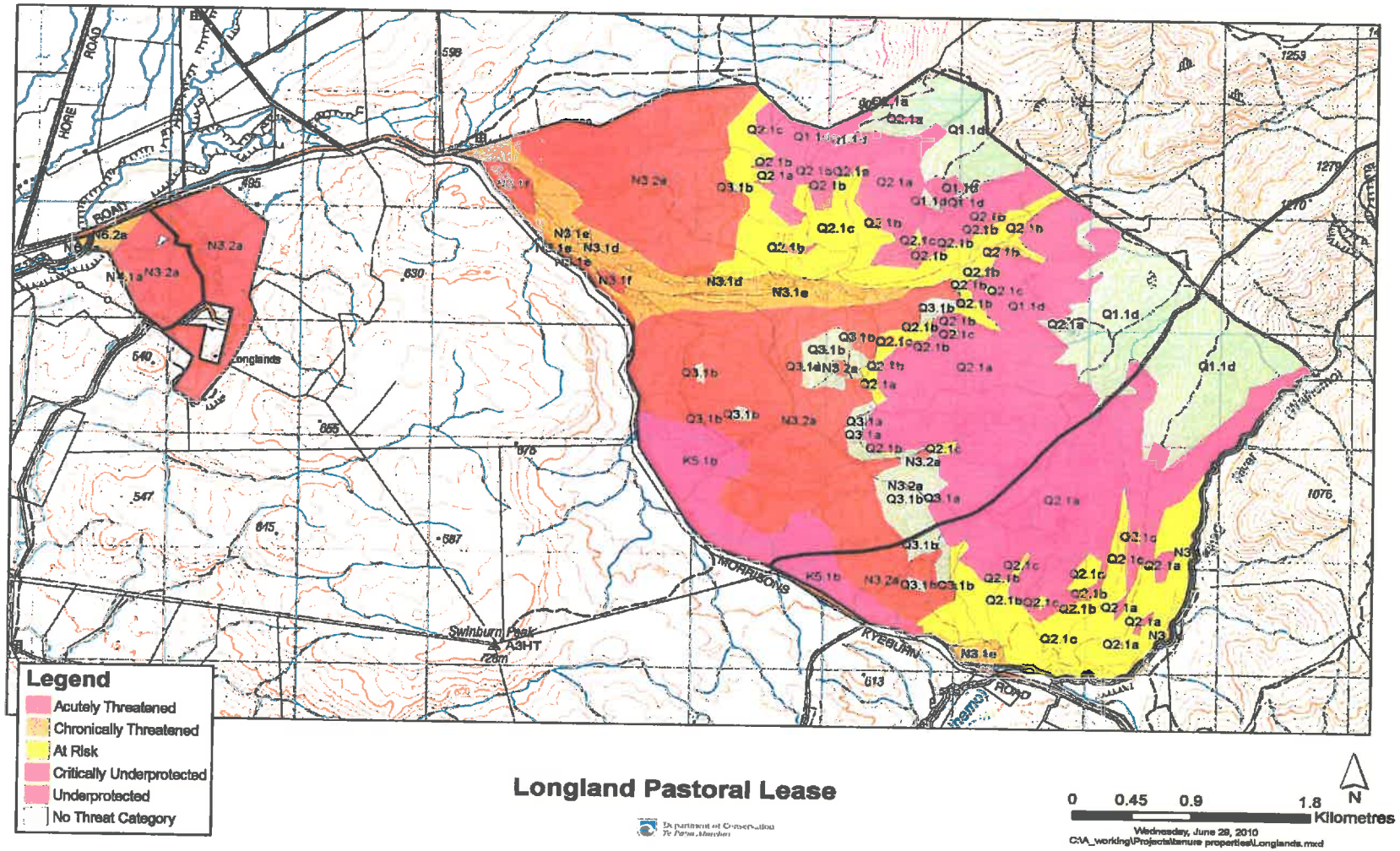
The distribution of Central Otago roundhead galaxias and brown trout in the Swin Burn and Shag River.



Red markers indicate the presence of galaxiids only; blue markers indicate the presence of trout and galaxiids, green markers indicate the presence of trout only and yellow markers indicate no species observed.

4.2.5

LENZ Level IV Map



4.3 Photographs

4.3.1 Landscape Unit Photos
4.3.2 Historic Plans and Photos

4.3.1 Landscape Photos

Landscape Unit 1 (LU1)

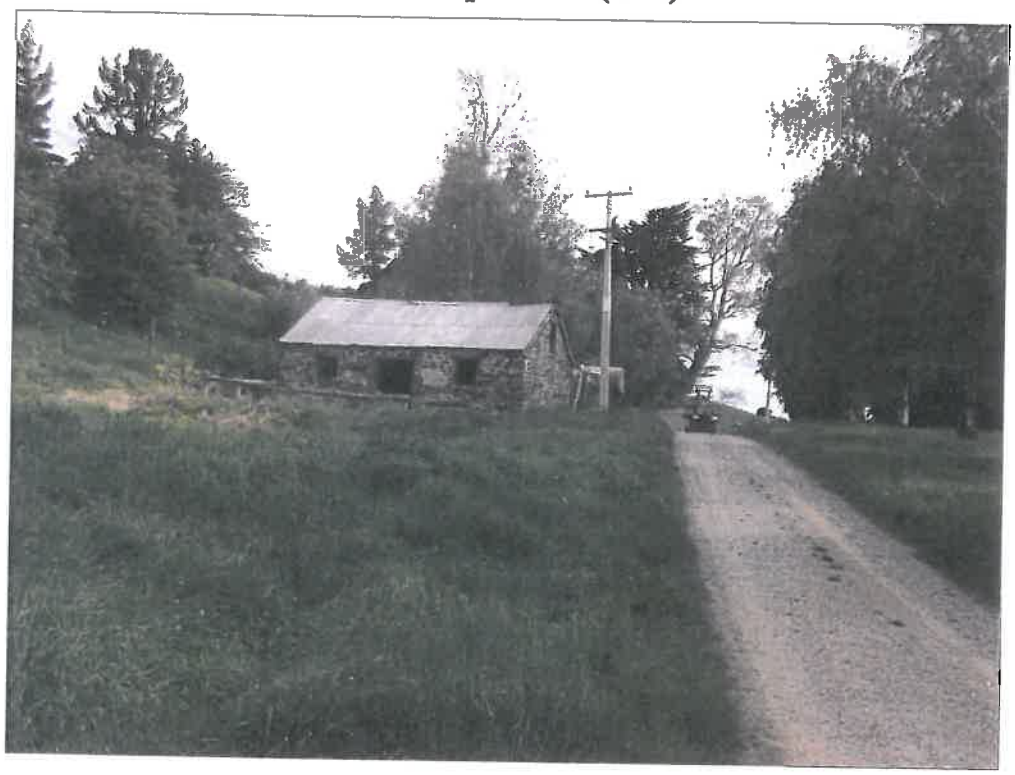


Photo 1: One of the historic stone buildings within the station complex.

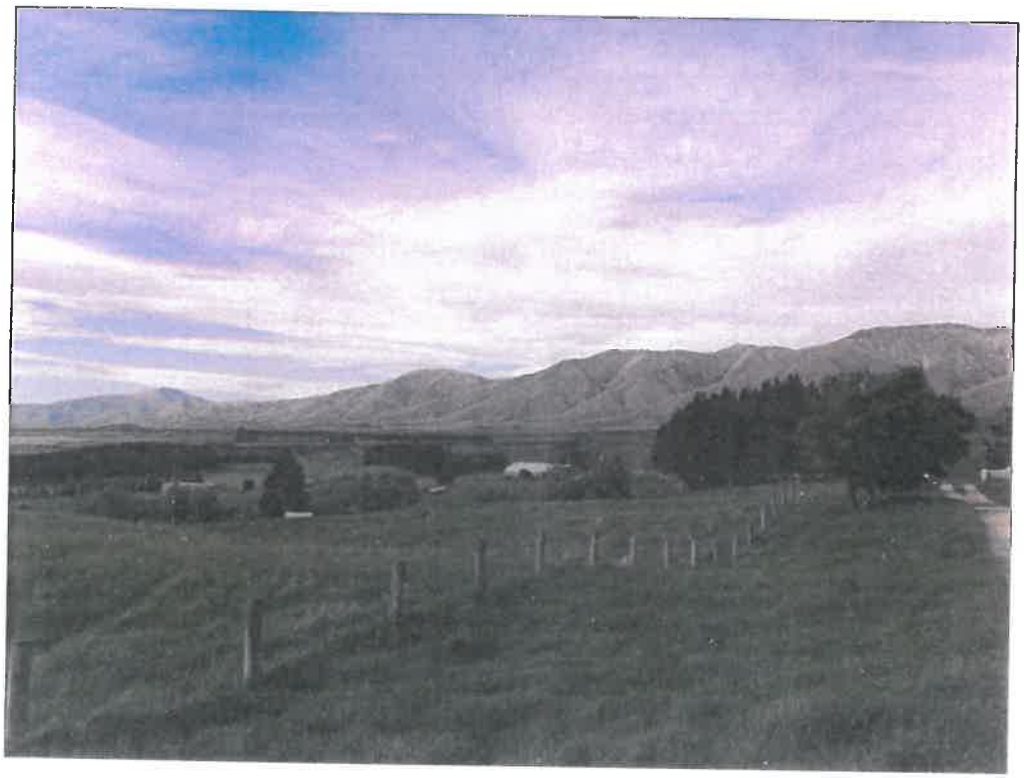


Photo 2: Home block is predominantly developed pasture surrounding the station buildings with views of the Maniototo Plain

Landscape Unit 2 (LU2)

Photo 3: Swin Burn Flats

Photo 4: Swin Burn Flats looking towards Point 583m. Converted pasture and scattered native shrubland and tussock are the main vegetation components.

Photo 5: View north across Swin Burn Flat terraces and foothills. SH85 at rear.

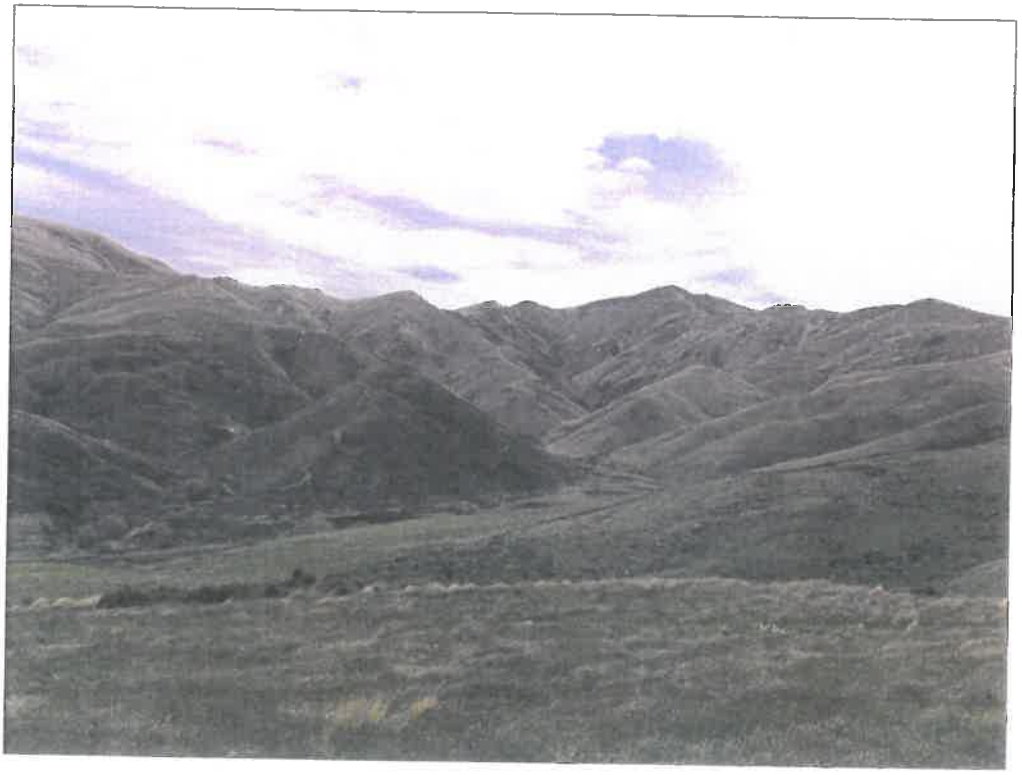


Photo 6: View of upper Swin Burn with Kakanui Peak in the background.

Photo 7: Red tussock and narrow leaved snow tussock next to highway forms a reasonable intact and coherent area.

Photo 8: View down an unnamed tributary north of Shag (Waihemo) River.

Landscape Unit 3 (LU3)

Photo 9: Upper Swin Burn is significantly more natural with shrubland and snow tussock.

Photo 10: Snow tussock in reasonable condition on rolling hills south of Swin Burn.

Photo 11: Recent earthworks detract from landscape values.

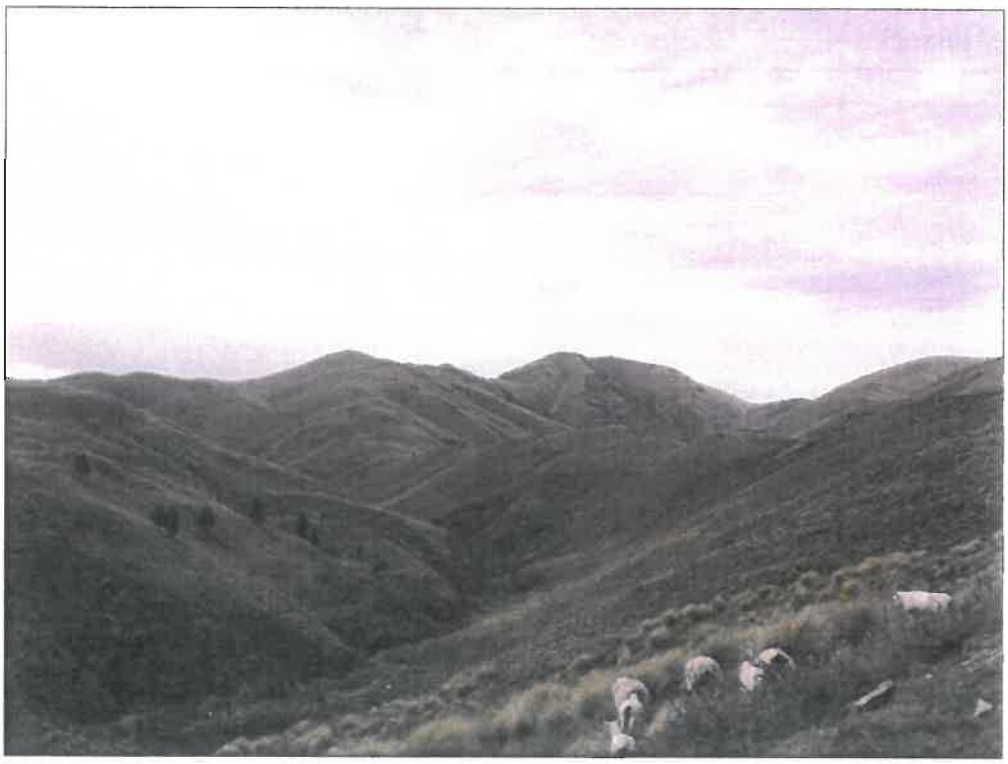


Photo 12: Unnamed tributary north of Shag River. Lower portion is within LU2. Naturalness increases with altitude

Photo 13: South face near upper boundary with conservation area.

Photo 14: Upper slopes have a high degree of natural character (approx 950m)

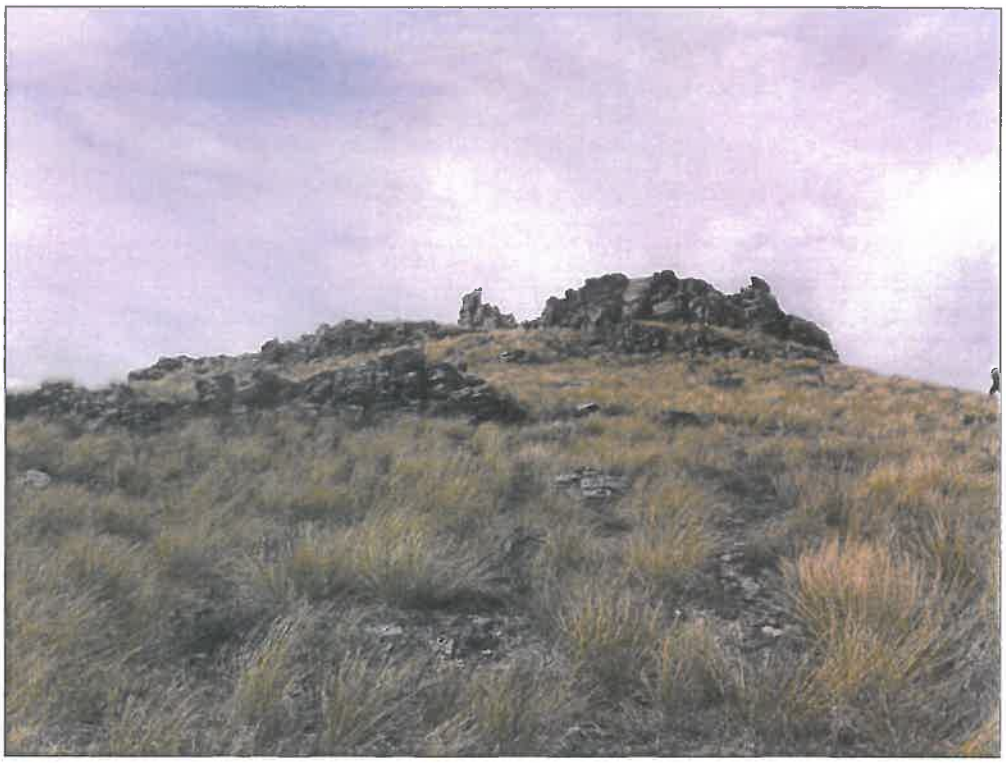


Photo 15: Rocky outcrop high on spur between the Shag River and the northern unnamed tributary.

Photo 16: View down unnamed tributary north of Shag (Waihemo) River. Plantation forestry encroaching on the upland plateau to the S.W.

4.3.2 Historic Plans and Photos

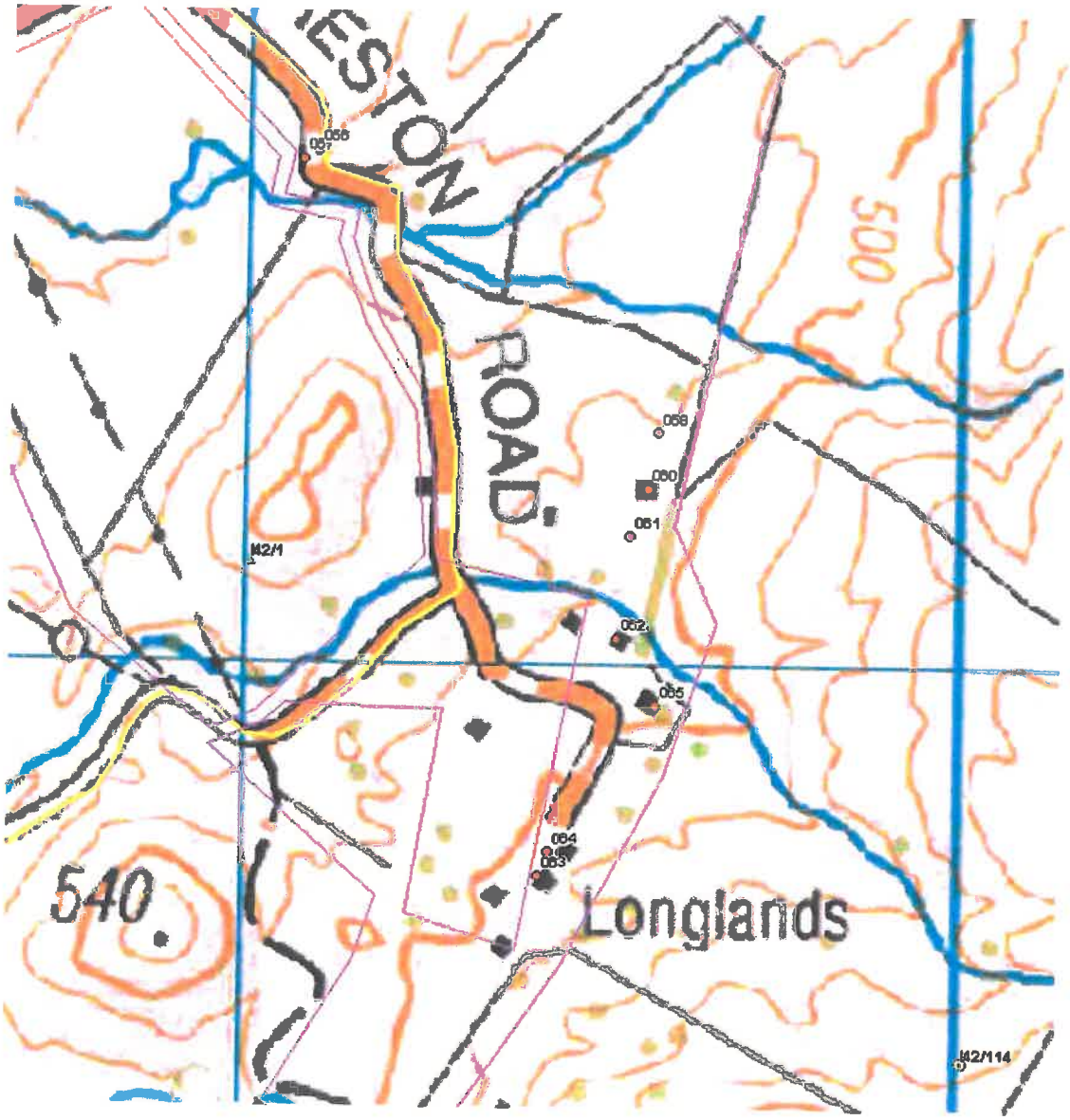


Figure 1. Key historic features on Longlands station around the farmstead.

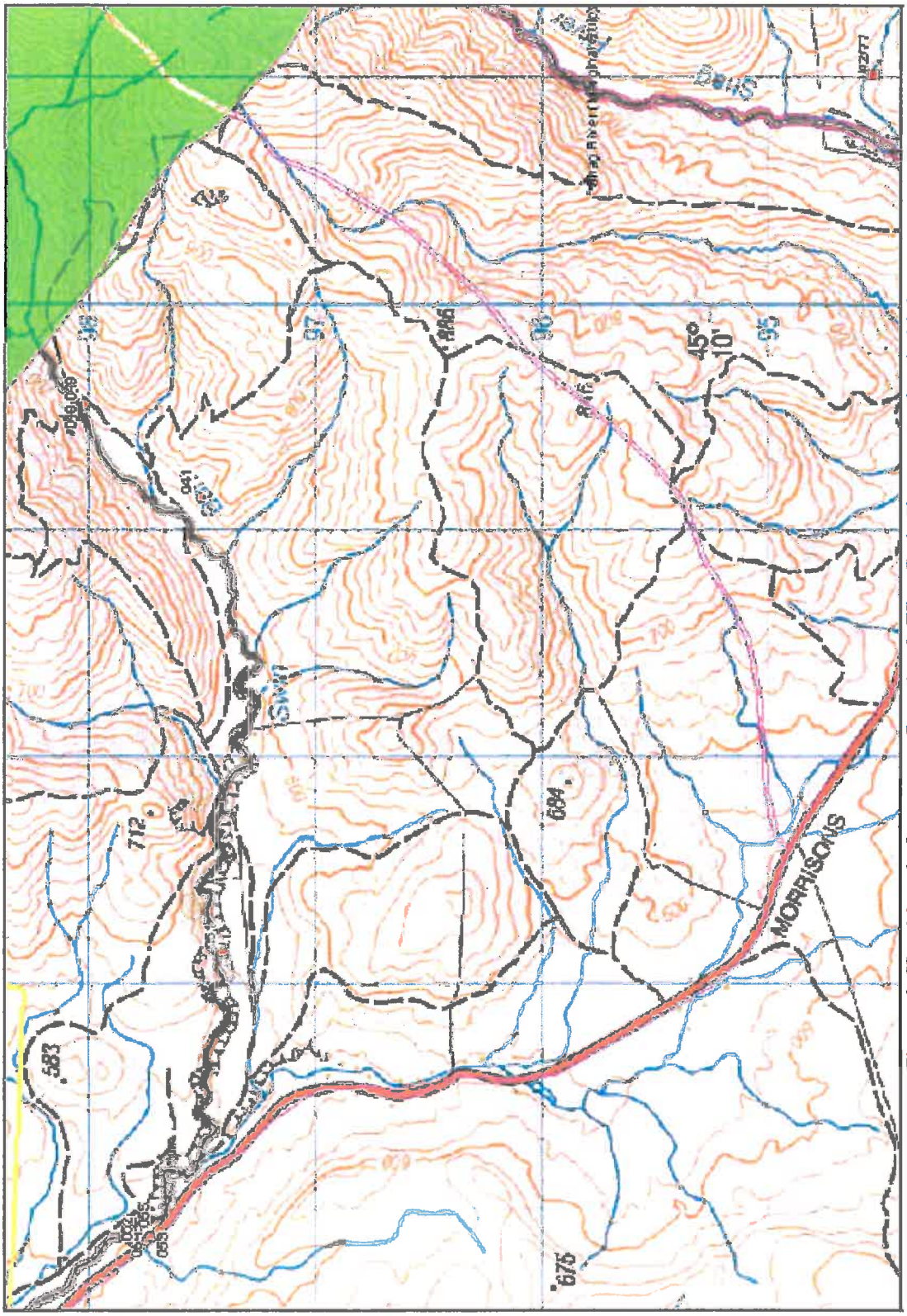


Figure 2. Key historic features on Longlands PL – Swin Burn east of main highway.

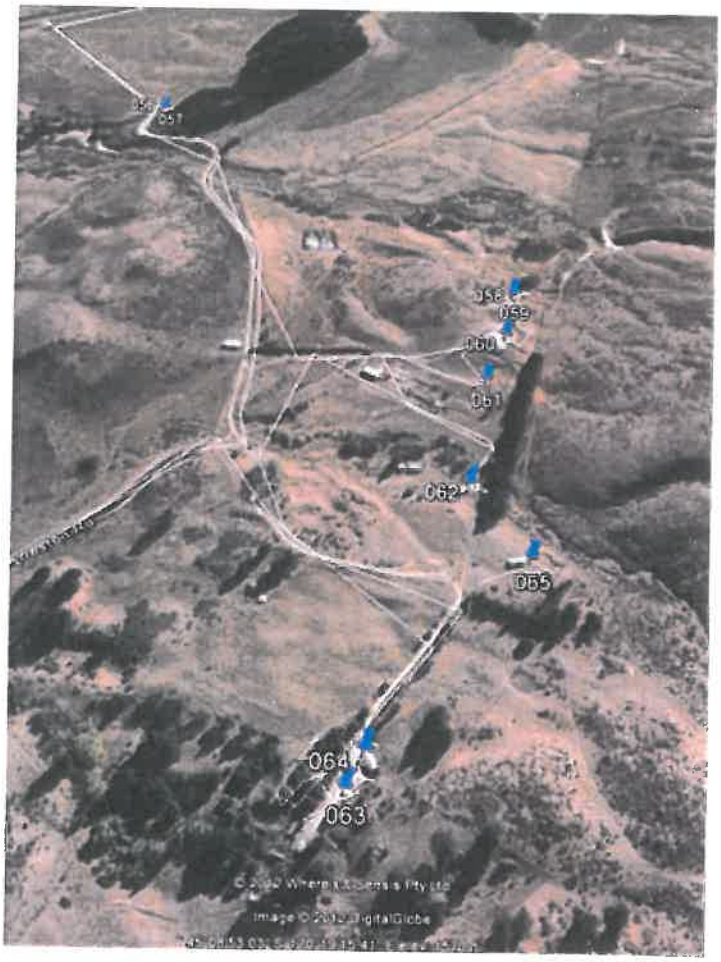


Figure 3. Aerial view over Longlands station (Google earth 2011).

Woolshed

View of McLaughlin's mud brick cottage (GPS 062)

Tractor shed beside stables

Bellows in back room of stables

Stone stables – front room on right.

4.5 Appendices

Appendix 1 List of Plant Species

Appendix 2 Invertebrate Species List

Appendix 1 Vascular plant species recorded from Longlands Pastoral Lease

Current name	Family (Tribe)	Threat ranking (2009)	Common name
Acaena agnapila var. *aequispina*	Rosaceae	Exotic	
Acaena buchananii	Rosaceae	Not threatened	Buchanan's bidibid
Acaena caesiiglauca	Rosaceae	Not threatened	bidibid
Acaena inermis	Rosaceae	Not threatened	bidibid
Achillea millefolium	Asteraceae	Exotic	yarrow
Aciphylla aurea	Apiaceae	Not threatened	spaniard
Aciphylla scott-thomsonii	Apiaceae	Not threatened	spaniard
Aciphylla subflabellata	Apiaceae	Declining	
Acrothamnus colensoi	Ericaceae	Not threatened	
Agrostis capillaris	Poaceae	Exotic	browntop
Alopecurus geniculatus	Agrostidinae	Exotic	kneed foxtail
Anaphalioides bellidioides	Asteraceae	Not threatened	
Anemone tenuicaulis	Ranunculaceae	Naturally Uncommon	
Anisotome aromatica	Apiaceae	Not threatened	
Anisotome flexuosa	Apiaceae	Not threatened	
Anthoxanthum odoratum	Phalaridinae	Exotic	sweet vernal
Aphanes arvensis	Rosaceae	Exotic	parsley piert
Aristotelia fruticosa	Elaeocarpaceae	Not threatened	small-leaved wineberry
Arthropodium candidum	Liliaceae	Not threatened	
Asplenium flabellifolium agg.	Aspleniaceae	Not threatened	necklace fern
Asplenium richardii	Aspleniaceae	Not threatened	
Astelia nervosa	Asteliaceae	Not threatened	
Blechnum penna-marina subsp. *alpina*	Blechnaceae	Not threatened	
Brachyglottis bellidioides var. *bellidioides*	Asteraceae	Not threatened	
Brachyscome montana	Asteraceae	Not threatened	
Bromus diandrus	Bromeae	Exotic	ripgut brome
Bromus hordeaceus	Bromeae	Exotic	soft brome
Bromus mollis		Exotic	
Bromus tectorum	Bromeae	Exotic	downy brome
Bulbinella angustifolia	Asphodelaceae	Not threatened	maori onion
Callitriche stagnalis	Callitrichaceae	Exotic	starwort
Capsella bursa-pastoris	Brassicaceae	Exotic	shepherd's purse
Cardamine (i) (CHR 312950; "scree race")	Brassicaceae	Not threatened	
Cardamine debilis agg.	Brassicaceae	Not threatened	
Carex breviculmis	Cyperaceae	Not threatened	
Carex buchananii	Cyperaceae	Not threatened	

Carex coriacea	Cyperaceae	Not threatened	
Carex gaudichaudiana	Cyperaceae	Not threatened	
Carex kaloides	Cyperaceae	Not Threatened	
Carex ovalis	Cyperaceae	Exotic	oval sedge
Carex secta	Cyperaceae	Not threatened	niggerhead
Carex testacea	Cyperaceae	Not threatened	
Carmichaelia crassicaulis subsp. *crassicaulis*	Fabaceae	Declining	coral broom
Carmichaelia petriei	Fabaceae	Not threatened	Desert broom
Celmisia densiflora	Asteraceae	Not threatened	
Celmisia gracilenta agg.	Asteraceae	Not threatened	
Celmisia lyallii	Asteraceae	Not threatened	false spaniard
Cerastium fontanum subsp. *vulgare*	Caryophyllaceae	Exotic	mouse-ear chickweed
Chaerophyllum ramosum	Apiaceae	Not threatened	
Chionochloa rigida subsp. *rigida*	Gramineae (Danthonieae)	Not threatened	narrow-leaved snow-tussock
Chionochloa rubra subsp. *cuprea*	Gramineae (Danthonieae)	Not threatened	copper tussock
Chionochloa rubra subsp. *cuprea* X *C. rigida* subsp. *rigida*	Gramineae (Danthonieae)	Not threatened	
Cirsium arvense	Asteraceae	Exotic	Californian thistle
Cirsium vulgare	Asteraceae	Exotic	Scotch thistle
Clematis marata	Ranunculaceae	Not threatened	
Colobanthus acicularis	Caryophyllaceae	Not threatened	
Colobanthus strictus	Caryophyllaceae	Not threatened	
Coprosma cheesemanii	Rubiaceae	Not threatened	
Coprosma crassifolia	Rubiaceae	Not threatened	
Coprosma intertexta	Rubiaceae	Relict	
Coprosma propinqua var. *propinqua*	Rubiaceae	Not threatened	
Coprosma rugosa	Rubiaceae	Not threatened	
Coprosma tayloriae	Rubiaceae	Not threatened	
Coprosma virescens	Rubiaceae	Regionally Significant	
Cordyline australis	Laxmanniaceae	Not threatened	cabbage tree, ti
Coriaria plumosa	Coriariaceae	Not threatened	feathery tutu
Crassula colligata subsp. *colligata*	Crassulaceae	Not threatened	
Crataegus monogyna	Rosaceae	Exotic	hawthorn
Crepis capillaris	Asteraceae	Exotic	hawksbeard
Critesion murinum	Hordeeae	Exotic	barley grass
Cystopteris tasmanica	Dryopteridaceae	Not threatened	bladder fern
Cytisus scoparius	Fabaceae	Exotic	broom
Dactylis glomerata	Poeae	Exotic	cocksfoot
Dichondra brevifolia	Convolvulaceae	Not threatened	
Discaria toumatou	Rhamnaceae	Not threatened	matagouri

Dracophyllum rosmarinifolium	Ericaceae	Not threatened	
Einadia allanii	Chenopodiaceae	Naturally Uncommon	parahia
Eleocharis acuta	Cyperaceae	Not threatened	sharp spike-sedge
Epilobium komarovianum	Onagraceae	Not threatened	
Epilobium melanocaulon	Onagraceae	Not threatened	
Erodium cicutarium	Geraniaceae	Exotic	storksbill
Erodium moschatum	Geraniaceae	Exotic	musky storksbill
Exocarpos bidwillii	Santalaceae	Regionally Significant	
Festuca novae-zelandiae	Poeae	Not threatened	hard tussock
Festuca rubra subsp.	Poeae	Exotic	red fescue
Galium aparine	Rubiaceae	Exotic	cleavers
Galium perpusillum	Rubiaceae	Not threatened	
Gaultheria (a) (*G. depressa* var. *novae-zelandiae*)	Ericaceae	Not threatened	snowberry
Gaultheria crassa	Ericaceae	Not threatened	snowberry
Gaultheria macrostigma	Ericaceae	Not threatened	prostrate snowberry
Gentianella sp.	Gentianaceae	Not threatened	
Geranium (d) (aff. *G. microphyllum*; "mainland")	Geraniaceae	Not threatened	
Geranium brevicaule	Geraniaceae	Not threatened	
Geranium molle	Geraniaceae	Exotic	dove's foot cranesbill
Geum leiospermum	Rosaceae	Not threatened	
Gonocarpus incanus	Haloragaceae	Not threatened	
Hebe buchananii	Plantaginaceae	Not threatened	
Helichrysum filicaule	Asteraceae	Not threatened	
Hieracium lepidulum	Asteraceae	Exotic	tussock hawkweed
Hieracium pilosella subsp.	Asteraceae	Exotic	mouse-eared hawkweed
Hieracium praealtum	Asteraceae	Exotic	king devil
Holcus lanatus	Poaceae	Exotic	Yorkshire fog
Hydrocotyle novae-zeelandiae	Araliaceae	Not threatened	
Hymenochilus tanypodus	Orchidaceae	Not threatened	
Kelleria dieffenbachii	Thymelaeaceae	Not threatened	
Kelleria villosa var. *villosa*	Thymelaeaceae	Not threatened	
Lagenifera barkeri	Asteraceae	Naturally Uncommon	
Leptinella squalida	Asteraceae	Not threatened	
Leucopogon fraseri complex (mountain ecotype)	Ericaceae	Not threatened	
Lolium perenne	Poeae	Exotic	perennial ryegrass

Luzula banksiana var. *banksiana*	Juncaceae	Not threatened	coastal woodrush
Luzula rufa	Juncaceae	Not threatened	woodrush
Lycopodium fastigiatum	Lycopodiaceae	Not threatened	mountain clubmoss
Malva neglecta	Malvaceae	Exotic	dwarf mallow
Marrubium vulgare	Lamiaceae	Exotic	horehound
Melicytus alpinus agg.	Violaceae	Not threatened	porcupine shrub
Mentha cunninghamii	Lamiaceae	Not threatened	NZ mint
Microsorum pustulatum	Polypodiaceae	Not threatened	hound's tongue fern
Mimulus moschatus	Scrophulariaceae	Exotic	musk
Montia fontana subsp. *montana*	Montiaceae	Not threatened	blinks
Montia sessiliflora	Montiaceae	Not threatened	
Muehlenbeckia australis	Polygonaceae	Not threatened	large-leaved pohuehue
Muehlenbeckia axillaris	Polygonaceae	Not threatened	
Muehlenbeckia complexa agg.	Polygonaceae	Not threatened	small-leaved pohuehue
Mycelis muralis	Orchidaceae	Not threatened	
Myosotis discolor	Boraginaceae	Exotic	grassland forget-me-not
Myrsine nummularia	Myrsinaceae	Not threatened	
Olearia bullata	Asteraceae	Not threatened	
Olearia nummulariifolia	Asteraceae	Not threatened	
Olearia odorata	Asteraceae	Not threatened	
Ophioglossum coriaceum agg.	Ophioglossaceae	Not threatened	adder's tongue
Oxalis exilis	Oxalidaceae	Not threatened	creeping oxalis
Oxalis magellanica	Oxalidaceae	Not threatened	native oxalis
Ozothamnus leptophyllus	Asteraceae	Not threatened	tauhinau
Parahebe decora	Plantaginaceae	Not threatened	
Pentachondra pumila	Ericaceae	Not threatened	
Phormium cookianum subsp. *cookianum*	Hemerocallidaceae	Not threatened	mountain flax
Pimelea pseudolyallii	Thymelaeaceae	Naturally Uncommon	
Pimelea traversii	Thymelaeaceae	Regionally Significant	
Pinus contorta	Pinaceae	Exotic	contorta
Pinus radiata	Pinaceae	Exotic	radiata pine
Plantago spathulata subsp. *spathulata*	Plantaginaceae	Not threatened	
Poa cita agg.	Gramineae (Poeae)	Not threatened	silver tussock
Poa colensoi s.l.	Gramineae (Poeae)	Not threatened	blue tussock
Poa pratense	Gramineae (Poeae)	Exotic	Kentucky bluegrass

Polystichum vestitum	Dryopteridaceae	Not threatened	prickly shield fern
Ranunculus amphitrichus	Ranunculaceae	Not threatened	waoriki
Ranunculus cheesemanii	Ranunculaceae	Not threatened	
Ranunculus multiscapus	Ranunculaceae	Not threatened	
Ranunculus ternatifolius	Ranunculaceae	Naturally Uncommon	
Raoulia monroi	Asteraceae	Declining	fan-leaved mat daisy
Raoulia subsericea	Asteraceae	Not threatened	
Ribes uva-crispa	Grossulariaceae	Exotic	gooseberry
Rosa rubiginosa	Rosaceae	Exotic	sweet briar
Rubus schmidelioides var. *schmidelioides*	Rosaceae	Not threatened	bush lawyer
Rubus schmidelioides var. *subpauperatus*	Rosaceae	Not threatened	bush lawyer
Rumex acetosella	Polygonaceae	Exotic	sheep's sorrel
Rumex crispus	Polygonaceae	Exotic	curled dock
Rumex flexuosus	Polygonaceae	Not threatened	native dock
Sagina apetala	Caryophyllaceae	Exotic	pearlwort
Salix fragilis	Salicaceae	Exotic	crack willow
Sambucus nigra	Caprifoliaceae	Exotic	elder
Schoenus pauciflorus	Cyperaceae	Not threatened	bog-rush
Scleranthus uniflorus	Caryophyllaceae	Not threatened	
Senecio aff.*dunedinensis* (CHR 550250; Leatham)	Asteraceae	Data Deficient	
Senecio quadridentatus	Asteraceae	Not threatened	cotton fireweed
Sophora microphylla	Fabaceae	Not Threatened	kowhai
Stellaria gracilenta	Caryophyllaceae	Not threatened	
Stellaria media	Caryophyllaceae	Exotic	chickweed
Stellaria parviflora	Caryophyllaceae	Not threatened	New Zealand chickweed
Thelymitra longifolia agg.	Orchidaceae	Not threatened	sun orchid
Trifolium arvense	Fabaceae	Exotic	haresfoot trefoil
Trifolium dubium	Fabaceae	Exotic	suckling clover
Trifolium repens	Fabaceae	Exotic	white clover
Ulex europaeus	Fabaceae	Exotic	gorse
Urtica urens	Urticaceae	Exotic	nettle
Verbascum thapsus	Scrophulariaceae	Exotic	woolly mullein
Veronica arvensis	Scrophulariaceae	Exotic	field speedwell
Veronica serpyllifolia	Scrophulariaceae	Exotic	turf speedwell
Viola arvensis	Violaceae	Exotic	field pansy
Viola cunninghamii	Violaceae	Not threatened	
Vittadinia australis agg.	Asteraceae	Not threatened	white fuzzweed
Wahlenbergia albomarginata subsp. *albomarginata*	Campanulaceae	Not threatened	harebell

Appendix 2 - Invertebrate species recorded from Longlands Pastoral Lease. 22-23 November 2011

Taxon (under Order & Family)	Location	Elevation	Notes
Lepidoptera -moths and butterflies			
Crambidae			
Eudonia chalara	trib. Swinburn	480 m	Inhabits grasslands
	trib. Swinburn	460 m	
	wetland Swinburn Kakanui Pk.	580 m	
	trib. Shag R. Kakanui Pk.	850 m	
	trib. Shag R. Kakanui Pk.	950 m	
Eudonia critica	Spot 654 m Swinburn	650 m	Inhabits rockface mosses
Eudonia crypsinoa	trib. Shag R. Kakanui Pk.	590 m	I42 057558 light trap
Eudonia diptheralis	trib. Shag R. Kakanui Pk.	590 m	Sod web-worm. I42 057558 light trap
Eudonia sabulosella	trib. Shag R. Kakanui Pk.	590 m	I42 057558 light trap
	trib. Swinburn	480 m	
Mnesictena flavidalis	trib. Swinburn	460 m	Larvae polyphageous on herbs in damp grassland
	trib. Swinburn	500 m	
	trib. Shag R. Kakanui Pk.	590 m	I42 057558 light trap
Orocrambus aethonellus	trib. Shag R. Kakanui Pk.	620 m	widespread & local in damp grasslands to alpine zone
	wetland Swinburn Kakanui Pk.	580 m	
	trib. Swinburn	440 m	
Orocrambus crenaeus	trib. Shag R. Kakanui Pk.	590 m	widespread and common in alpine zone; larvae in *Chionochloa*. I42 057558 light trap
Orocrambus lectus	trib. Swinburn Kakanui Pk.	480 m	local inhabiting mossy flushes of upland wetlands in Central Otago
	Spot 654 m Swinburn	650 m	
Scoparia exilis	trib. Shag R. Kakanui Pk.	620 m	Inhabits open areas
	wetland Swinburn Kakanui Pk.	580 m	
	trib. Shag R. Kakanui Pk.	850 m	
Elachistidae -leaf mining moths			
Elachistidae sp.	trib. Shag R. Kakanui Pk.	620 m	Leaf mining or stem boring habit
Geometridae			

Arctesthes catapyrrha	Spot 654 m Swinburn	650 m	small bare areas among basaltic rock outcrop
Asaphodes chlamydota	trib. Shag R. Kakanui Pk.	590 m	Larvae eat *Clematus* spp. I42 057558 light trap
Chloroclystis filata	trib. Shag R. Kakanui Pk.	590 m	Larvae eat a range of flowers, commonly *Senecio*. Tasmania and New Zealand. I42 057558 light trap
Chloroclystis inductata	trib. Shag R. Kakanui Pk.	590 m	Larvae polyphagous on flowers. I42 057558 light trap
Dasyuris transaurea	trib. Swinburn	440 m	Larvae eat *Anisotome*. Noted in pasture herbs adjacent stream
Declana floccosa	trib. Shag R. Kakanui Pk.	590 m	Larvae polyphageous. I42 057558 light trap
Helastia cinerearia	trib. Shag R. Kakanui Pk.	590 m	Larvae eat rockface mosses. I42 057558 light trap
Helastia corcularia	trib. Shag R. Kakanui Pk.	590 m	widespread & common lowland to montane; larvae on rock mosses. I42 057558 light trap
Helastia cryptica	trib. Swinburn	500 m	larvae inhabit shrubland litter. Remnant shrubland at basalt exposure
Notoreas sp.	trib. Swinburn Kakanui Pk.	950 m	Larvae eat *Pimelea* or *Kellaria* (Thymelaeaceae)
Paranotoreas brephosata	trib. Swinburn Kakanui Pk.	950 m	Larvae eat *Epilobium* species
Pseudocoremia rudisata	trib. Shag R. Kakanui Pk.	590 m	Larvae feed on *Olearia odorata* & *O. bullata*. I42 057558 light trap
Theoxena sp. "non-pectinate"	trib. Shag R. Kakanui Pk.	590 m	National threat classification -Data Deficient. Local intermountain species of mid Canterbury. Second record from Otago. I42 057558 light trap
Xanthorhoe semifissata	trib. Shag R. Kakanui Pk.	590 m	Larvae eat herbs. I42 057558 light trap
Glyphipterigidae			
Glyphipterix chionophora	trib. Swinburn	480 m	Larvae associated with *Poa*
Hepialidae -ghost moths			
Wiseana copularis	trib. Shag R. Kakanui Pk.	590 m	widespread & common at low altitude larvae subterranean. I42 057558 light trap
Lycaenidae -a butterfly family			
Lycaena boldenarum	trib. Swinburn	500 m	

	Spot 654 m Swinburn	650 m	Boulder butterfly. Larvae feed in *Muehlenbeckia axillaris and adults bask* small bare areas among basaltic rock outcrop and shrubland
Lycaena salustius	Spot 654 m Swinburn	650 m	Copper butterfly. Larvae feed in *Meuhlenbeckia complexa* among shrublands
Zizina otis	wetland Swinburn Kakanui Pk.	580 m	Blue butterfly. Larvae eat low growing fabaceae, *Carmichaelia* and clover.
	trib. Swinburn	440 m	
Noctuidae			
Aletia moderata	trib. Shag R. Kakanui Pk.	590 m	Larvae eat *Raoulia*. I42 057558 light trap
Aletia' sollennis	trib. Shag R. Kakanui Pk.	590 m	I42 057558 light trap
Graphania disjungens	trib. Shag R. Kakanui Pk.	590 m	I42 057558 light trap
Graphania insignis	trib. Shag R. Kakanui Pk.	590 m	Larvae polyphageous on herbs. I42 057558 light trap
Graphania lithias	trib. Shag R. Kakanui Pk.	590 m	Larvae eat *Melicytus alpinus* grp. I42 057558 light trap
Graphania mutans	trib. Shag R. Kakanui Pk.	590 m	Larvae polyphageous. I42 057558 light trap
Graphania paracausta	trib. Shag R. Kakanui Pk.	590 m	Larvae eat grasses. I42 057558 light trap
Graphania phricias	trib. Shag R. Kakanui Pk.	590 m	Larvae eat *Discaria toumatou* (matagouri) I42 057558 light trap
Graphania plena	trib. Shag R. Kakanui Pk.	590 m	Larvae polyphageous on herbs. I42 057558 light trap
Graphania ustistriga	trib. Shag R. Kakanui Pk.	590 m	Larvae polyphageous. I42 057558 light trap
Ichneutica ceraunias	trib. Shag R. Kakanui Pk.	590 m	Larvae eat *Chionochloa* spp. I42 057558 light trap
Meterana coeleno	trib. Shag R. Kakanui Pk.	590 m	Larvae eat *Meuhlenbeckia* spp. I42 057558 light trap
Meterana stipata	trib. Shag R. Kakanui Pk.	590 m	Larvae eat *Meuhlenbeckia* spp. I42 057558 light trap
Persectania aversa	trib. Shag R. Kakanui Pk.	590 m	Larvae eat grasses. I42 057558 light trap
Rhapsa scotoscialis	trib. Shag R. Kakanui Pk.	590 m	Larvae eat leaf litter. I42 057558 light trap
Rictonis comma	trib. Shag R. Kakanui Pk.	590 m	Larvae polyphageous in grasslands. I42 057558 light trap
Tmetolophota acontistis	trib. Shag R. Kakanui Pk.	590 m	Larvae in grasses. I42 057558 light trap
Tmetolophota alopa	trib. Shag R. Kakanui Pk.	590 m	Inhabits wetlands. I42 057558 light trap

Nymphalidae -a butterfly family			
Argyrophenga antipodum	wetland Swinburn Kakanui Pk.	580 m	Tussock ringlet butterfly. Larvae eat *Poa cita, Chionochloa* and other grasses
Oecophoridae			
? Eutorna sp.	trib. Shag R. Kakanui Pk.	620 m	
? Oecophoridae	trib. Shag R. Kakanui Pk.	850 m	
Leptocroca sp.	trib. Swinburn	480 m	
	trib. Swinburn	500 m	
Tingena melinella	trib. Swinburn	480 m	Larvae on shrubland litter
Tingena sp.	trib. Swinburn	480 m	Litter feeding habit
Plutellidae			
Protosynaema questuosa	trib. Shag R. Kakanui Pk.	620 m	Larvae eat Carex species.
Proditrix megalynta	trib. Shag R. Kakanui Pk.	590 m	Larvae in *Chionochloa* tillers. I42 057558 light trap
Psychidae -case moths			
Orophora unicolor	trib. Swinburn Kakanui Pk.	850 m	Tussock bag moth
Pterophoridae -plume moths			
Pterophorus innototalis	Spot 654 m Swinburn	650 m	A plume moth. Larvae eat *Dichondra*
	trib. Swinburn	460 m	I42 990590
Tineidae			
Erechthias sp. nr. *fulguritella*	trib. Shag R. Kakanui Pk.	590 m	Larvae in dead wood. I42 057558 light trap
Tortricidae			
Capua semiferana	trib. Shag R. Kakanui Pk.	590 m	Larvae in leaf litter. I42 057558 light trap
Eurythecta sp.	Spot 654 m Swinburn	650 m	Larvae eat Raoulia and other dryland herbs in bared soil areas
Tortricid sp.	trib. Shag R. Kakanui Pk.	620 m	
Taxon (under Order & Family)	**Location**	**Elevation**	**Notes**
Araneae -Spiders			
Tetragnathidae			
Tetragnatha sp.	trib. Shag R. Kakanui Pk.	950 m	A long jaw spider. Inhabits rushland/grassy wetland
Coleoptera -beetles			
Carabidae -ground beetles			
Holcaspis sp.	trib. Swinburn Kakanui Pk.	850 m	A ground beetle. Otago and Canterbury
Megadromus sculpturatum grp.	trib. Shag R. Kakanui Pk.	950 m	A ground beetle species complex. Southland and Otago

	wetland Swinburn Kakanui Pk.	580 m	
Curculionidae -weevils			
Anagotus lewisi	trib. Swinburn Kakanui Pk.	950 m	Tussockland large weevil
Melyridae -flower beetles			
Melyridae sp.	trib. Swinburn Kakanui Pk.	850 m	A flower beetle
Scarabaeidae -chafers			
Odontria sp.	trib. Shag R. Kakanui Pk.	590 m	A chafer beetle, I42 057558 light trap
Pyronota festiva	Spot 654 m Swinburn	640 m	Manuka chafer
Tenebrionidae -darkling beetles			
Artystona sp.	trib. Shag R. Kakanui Pk.	850 m	A darkling beetle
	trib. Swinburn Kakanui Pk.	850 m	
Diptera -all flies			
Acroceridae			
Ogcodes sp.	Spot 654 m Swinburn	640 m	A fly species, Larvae parasitise spiders
Asilidae -robber flies			
Neoitamus sp.	trib. Swinburn	440 m	A predatory robber fly
Therividae -stilleto flies			
Anabarhyncus sp.	trib. Swinburn Kakanui Pk.	540 m	A stilleto fly species, dry loam in stream margin
Hemiptera -bugs, aphids and cicada			
Lygaeidae			
Lygaeidae sp.	trib. Shag R. Kakanui Pk.	620 m	A bug species.
Nysius huttoni	trib. Swinburn	440 m	A bug species. Inhabits open and often stony areas
Pentatomidae -sheild bugs			
Dictyotus caenosus	trib. Swinburn	460 m	A sheild bug, likely exotic
Odonata -dragonflies & damselflies			
Coenagrionidae -a damselfly family			
Xanthocnemis zealandica	trib. Swinburn	440 m	Redcoat damsel
Lestidae -a damselfly family			
Austrolethes colensonis	trib. Swinburn	440 m	Blue damsel
Orthoptera - grasshopppers, weta and crickets			
Acrididae -short horn grasshoppers			

Sigaus australis	trib. Shag R. Kakanui Pk.	850 m	Short horn grasshopper. Eastern South Island mountain areas Otago to mid Canterbury
	trib. Shag R. Kakanui Pk.	620 m	
	trib. Shag R. Kakanui Pk.	950 m	
	trib. Swinburn Kakanui Pk.	850 m	
Plecoptera -aquatic stoneflies			
Gripopterygidae			
Zealandobius sp.	trib. Shag R. Kakanui Pk.	850 m	A stonefly, subfamily Antarctoperlinae
Pseudoscorpiones -false scorpions			
Pseudoscorpion sp.	trib. Swinburn Kakanui Pk.	850 m	A false scorpion species
	trib. Shag R. Kakanui Pk.	850 m	
Trichoptera -aquatic caddis			
Helicophidae			
Zelolessica sp.	trib. Shag R. Kakanui Pk.	620 m	Larvae inhabit tumbling mossy streams. A black caddis