Gibbston Valley Station

Ecological Assessment

Prepared by:

Natural Solutions *for Nature* Ltd

21st May, 2008

On behalf of:

Gibbston Valley Station
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New Zealand

Introduction

Gibbston Valley Station (GVS) is a 400 hectare (1000 acre) freehold property in the Gibbston Valley on the true right of the Kawarau River 14 kilometres east of Lake Hayes.

Figure 1: Location of Gibbston Valley Station.

Source: Map ToasterTopo: Integrated mapping Ltd 2000-2007

GVS proposes a multi-faceted development of about 160 hectares (400 acres) of the valley floor. The development comprises the establishment of

- an 18 hole golf course,
- club house and pro shop for golf,
- a range of residential and visitor accommodation units,
- service and maintenance buildings,
- worker accommodation,
- a café, retail and artisan village,
- restaurant and conference facility

The development will also incorporate

- vineyards,
- orchards,
- walking trails and
- a land management approach that will protect and enhance the indigenous vegetation and habitats of indigenous wildlife of the site.

Attachment A identifies the boundaries of Gibbston Valley Station. Attachment B identifies the footprint of the proposed development.

Natural Solutions *for Nature* Ltd has been engaged to provide the following services in respect of the GVS proposal:

- A comprehensive assessment of the ecological values of the property,
- A description of the significance of values present,
- A description of the potential and/ or actual adverse effects and/ or benefits the proposal may have on the identified values,
- Recommendations for avoiding, minimising or off-setting any potential adverse effects,
- Recommendations regarding the potential for ecological restoration,
- A plan to guide the ongoing management, protection and/ or re-instatement of ecological values.

The report is presented in two parts and is structured according to the above headings:

- Part 1: The ecological assessment and description of the potential and actual adverse effects, benefits and recommendations for avoiding or minimising any potential adverse effects.

- Part 2: A Conservation Management Plan to guide land management, revegetation and habitat enhancement required to achieve both the recommendations of Part 1 and support Gibbston Valley Station's stated intention to create an environmentally sustainable resort.

The attachments referred to in Part 1 will also be used to support Part 2.

1.0 Methodology

The property was visited for the purpose of providing an assessment of the ecological values at least 17 times between the 21st March 2007 and the 2nd of May 2008. Initial visits undertaken in March 2007 encompassed the whole property. Subsequent visits focused on the valley floor and lower slopes affected by the GVS proposal.

This assessment is based on direct observations, personal knowledge and experience of the surrounding Ecological Districts and Regions, a desk top review of relevant publications and peer reviewed journals as well as collegiate discussions with relevant experts as acknowledged within the report.

The location of threatened and interesting species was recorded using a GPS. Areas of potential lizard habitat were searched with the assistance of Tony Jewell. This information is provided in the attachments to this report as are descriptions of the existing vegetation, habitats and values of significance identified through these processes.

Acknowledgements

Recommendations contained with in Parts 1 and 2 have benefited from informative discussions with Marieke Lettink (Fauna Finders Ltd, Birdlings Flat, Christchurch), Grant Norbury (Landcare Research, Alexandra) and Tony Jewell (Ranfurly).

2.0 Ecological values

The site is located within the western portion of the narrow, steep sided Kawarau Gorge known as Gibbston Valley.

The Gibbston Valley is defined by the Nevis Bluff in the east, the flanking slopes of Mount Rosa and the Coal Pit Saddle (1079 metres above sea level) to the south. The southern slopes of Pisa fault block mountain range rise above the Kawarau River to the north. Schist outcrops known as the "Judge and Jury" mark the exit from the Gibbston Valley to the west.

Gibbston Valley Station (GVS) borders approximately 3.5 kilometres of the Kawarau River and follows the Coal Pit Saddle ridge for about 1.1 kilometres west from Coal Pit Saddle.

2.1 Land environment - climate, soils and geomorphology

Gibbston Valley Station is predominantly a north facing, dry inland basin site with schist outcrops, a cool, dry climate and moderately fertile alluvial soils. The following is a summary of details relating to the land environment:

2.1.1 Climate

The climate of the Gibbston Valley is characterised by:

- Warm summers (maximum, mean January daily temperature 16.5°) and cold winters (minimum, July mean daily temperature 2.7°).
- Rainfall of about 600 – 700 mm per annum with about 90 +/- rain days (mean annual).
- First air frosts can be expected from the beginning of April with the last air frosts occurring as late as mid-November in 1 of every 5 years.
- The property as a whole experiences an altitudinal variation in temperature and water deficits, with higher elevations being cooler and receiving higher precipitation.
- The mean annual air temperature is 9 to 10.9°C with a mean daily temperature of 10 – 13°C (about 2°C warmer than the broader valley containing Lake Wakatipu).

2.1.2 *Soils*

The soils of the valley floor and lower slopes are a combination of Pigburn (weathered fluvial recent) associated with the alluvial fans and fluvial (river) deposits and Gladbrook (typic immature pallic/ yellow-grey or recent) soils. Both are derived from schist parent material.

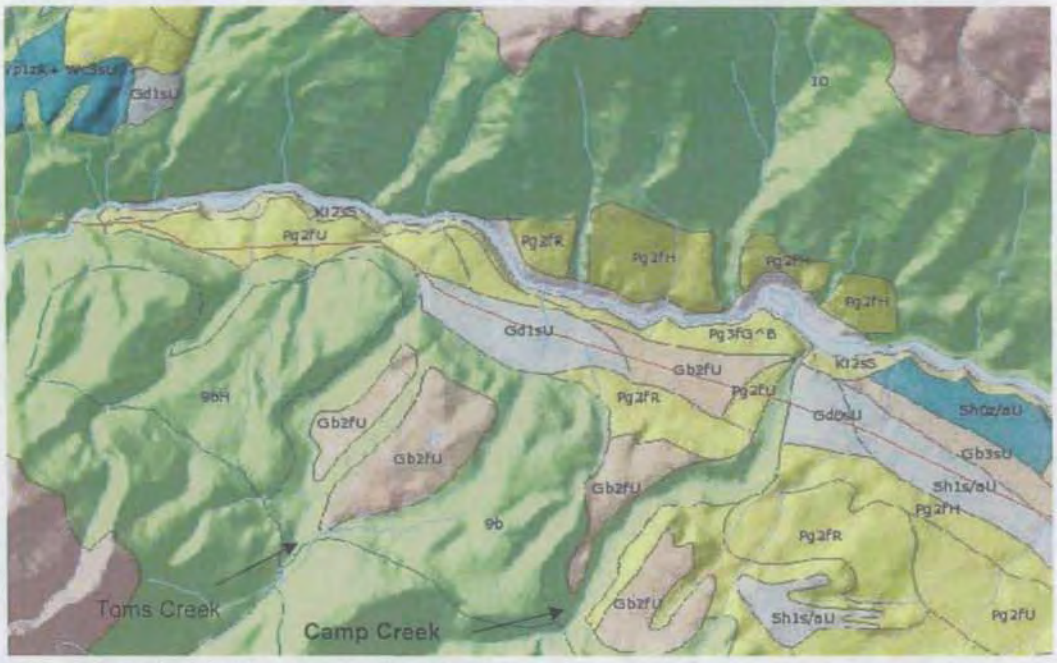


Figure 2: Soils of Gibbston Valley Station.

Source: GrowOtago website – www.growotago.orc.govt.nz - accessed 11/2/08

The attributes of these soil types that are of interest to the assessment of values, potential adverse effects and restoration of the site are summarised below.

Pigburn (recent soils) - Pg

- Good natural drainage and potential rooting depth
- Low in phosphorous but with good natural fertility

Gladbrook (pallic / recent soils) - G

- Medium to high nutrient content and strongly worm-mixed in the A horizon and transition to the B horizon.
- Water deficits in summer and water surpluses in spring and winter, with impaired permeability in places.
- Potential for high density in subsurface layers which may impede rooting depth in the sub-horizon
- Topsoil structures may break down under prolonged impact by heavy machinery and brittle B horizons are strongly dispersive and will readily slake.

Both Pigburn and Gladbrook soils are prone to erosion and have high base saturation levels. Growth rates of shrub and tree species may therefore be variable with establishment being

slower on pockets of less permeable, higher density soil, but well supported elsewhere.

Figure 3 (above) – "Rabbit Ridge" pallic soils with high slaking potential. View west from point 1. Source: D Palmer (21/3/07).

Figure 4 – Exposed Pigburn (recent) soils with areas of impaired permeability upon which wetlands have formed near northern, river boundary. View south from point 2. Source: D Palmer (17/9/07)

Refer to Attachment C for the location of all photo points.

2.1.3 Geomorphology

Alluvial terraces extend discontinuously from the eastern portion of the Wakatipu Basin into the Gibbston Basin where they overlay sometimes shallow schist bedrock. Alluvium overlays lake sediments and outwash deposits on the terraces from the river edge at 300 metres above sea level (m asl), up to about 530 m asl. These alluvial deposits incorporate a combination of gravel, sand and silt.

The base of a large landslide (the Resta Road slide) from within the Toms Creek catchment extends to the edge of the present day terrace escarpment between Toms Creek and Resta Road and into the Gibbston Valley Station. Seepages supporting small wetland communities along the toe of the historic slide indicate the occurrence of ongoing subterranean drainage.

Figure 5: Resta Road landslide highlighted within fan deposits.

Source: Barrell, D. ,Riddolls, B. Riddolls, P., and Thomson R. (1994): Surficial Geology of the Wakatipu Basin, Central Otago, New Zealand. *Institute of Geological and Nuclear Sciences Limited. Map for report 94/39.*

Surface flows over the valley floor alluvial fans have been confined into channels, lined by willows, contained within culverts where they flow under the State Highway and directed into

water races. A recent build up of sediment was within Toms Creek was noted at the southern edge of the basin floor behind a line of mature willows.

Seepages have been degraded by cattle, goats and/ or deer. There are two man made ponds present on both the north and south side of State Highway 6 which transects the site.

Schist outcrops present within the central, eastern and river edge areas of the site have provided refugia from grazing, predation and fire for both plants and wildlife. A band of schist runs from the un-named creek east of the Gibbston Valley Winery, south of the State Highway to the margins of the Kawarau River. This rock band creates a natural point of constriction within this part of the basin. Smaller bands of exposed bedrock are surrounded by an array of boulders in the north eastern portion of the site.

The GVS has an obvious history of mining and farming. Disturbance associated with those activities are clearly evident in the form of vegetation clearance, tailings, tracks, dams, water races and rock stockpiles.

The geomorphological processes that have shaped the valley remain clearly evident.

There are two Geopreservation sites on and near GVS. These are the NW Cardrona Fault, Kawarau River faulted terrace north of the State Highway at the western most area of the site and the Gibbston landslide which is north of the site on the opposite side of the Kawarau River (Hayward and Kenny, 1998). Neither is affected by the development.

3.0 Ecological Values

3.1 Indigenous vegetation

The vegetation of the GVS development area is dominated by pasture grass, briar and indigenous shrubland. Wetlands contribute an interesting diversity to this degraded and otherwise relatively depleted site.

Attachment D maps the existing vegetation. Attachment E identifies the location of species of conservation interest such as *Hebe pimeleoides* subsp. *faucicola* a species in gradual decline (Hitchmough, Bull and Cromarty, 2007) found scattered among the bluffs and the naturally sparse species *Olearia lineata* also found in the shrublands outside the development area up to mid elevations in both Camp and Franks Creek.

A summary of the vegetation types identified within the proposal area is provided below:

3.1.1 Open shrubland associated with schist outcrops

3.1.2 Grey Shrubland

3.1.3 Briar* dominated shrubland (dense and open)

3.1.4 Gorse* and Broom* shrubland

3.1.5 *Raoulia* cushionfield – *Pimelea* shrubland and grassland

3.1.6 Wetlands – ponds, creeks and seepages

3.1.7 Other areas – pasture*, pines*, poplars* and willows*

* denotes exotic species.

3.1.1 Open shrubland associated with schist outcrops

Schist outcrops on the terrace edge and basin floor provide refuge for a range indigenous species and are likely to be remnants of a once more diverse and extensive shrubland.

This community has been distinguished from grey shrubland (discussed below) because of its association with rocky habitat and the presence of threatened species which tend to inhabit bluffs and outcrops. The areas containing outcropping bedrock have been labeled **A** to **F** on Attachment D, in order to provide clarity for discussion purposes. Attachment D1 provides greater clarity of the extent of the schist outcrops and associated rocky habitat within those areas.

South of State Highway 6

The schist outcrop labeled **A** at the western end of the escarpment south of the State Highway contains a relatively diverse example of remnant lowland shrubland. It therefore

provides a useful comparison for shrublands associated with schist outcrops elsewhere on the valley floor.

Species present include Kowhai *Sophora microphylla*, *Olearia lineata,* matagouri *Discaria toumatou* and *Coprosma propinqua.* The upper and western side of this outcrop is vegetated by *Coprosma crassifolia*, butterfly fern *Asplenium flabellifolium*, *Pimelea aridula*, porcupine shrub *Melicytus alpinus,* briar*, *Poa colensoi, P. cita, Elymus* spp., *Raoulia australis* and *R hookerii.*

Kowhai was noted to be seedling prolifically although no recent regeneration was noted for this or any other species – possibly a consequence of the rabbit infestation.

The threatened plant *Hebe pimeleoides* subsp. *faucicola*, (a species in gradual decline – Hitchmough, et al., 2007) was noted on bluffs, protected from browse on the north side of this outcrop.

North of State Highway 6

Along the Kawarau River a matagouri dominated grey shrubland straddles the marginal strip, Conservation Areas and GVS land (refer to Figures 6 to 11).

The area identified as **B** is very small with most of the indigenous vegetation being present at or over the GVS boundary. *Hebe pimeleoides* subsp. *faucicola*, was found on rocky bluffs overlooking the river on the *Lepidium* 'Kawarau' habitat Conservation Area and on bluffs protected from browse on the north side of an outcrop in area **C** (refer to Figures 10 and 11).

The area identified as **D** contains the largest area of rocky shrubland on the valley floor of GVS. It contains matagouri, porcupine shrub, *Coprosma propinqua, and Pimelea aridula* in association with *Olearia odorata, an occasional O. lineata with O. avicenniifolia* and native broom species *Carmichaelia petrei* and the threatened (range restricted) *C. compacta* (the later not present on GVS land). Stone ruins were noted throughout.

All areas variously contain native grasses including silver tussock *Poa cita,* blue tussock *Poa colensoi,* the diminutive *Poa maniototo,* hard tussock *Festuca novae-zelandiae* and blue wheat grass *Elymus* spp. These are found in crevices around the base of rock outcrops and growing through low shrubs (such as *Melicytus alpinus*). The lianes *Muehlenbeckia complexa* and *Rubus schmidelioides* also climb through shrubs and from schist crevices.

M. axillaris contributes to the ground cover along with the native mat daisy *Raoulia hookerii* on top of the outcrops. *Coprosma petrei* was noted on top of the largest schist outcrop in area **C**. The mat forming sub-shrub had been browsed into a turf like habit.

Exotic species present within this and other communities were cotoneaster* *Cotoneaster* spp., elder* *Sambucus nigra*, hawthorn* *Crataegus monogyna*, briar* *Rubus rubiginosa*, gorse* *Ulex europaeus* and broom *Cytisus scoparius*.

The area identified as **F** on the north eastern extent of the site also contains bands of outcropping schist bedrock along with boulders and piles of loose rock which create habitat for a good population of lizards (discussed later in this report). The area is vegetated with clusters of matagouri dominated shrubland also containing *Coprosma propinqua*, *Muellenbeckia complexa*, *Melicytus alpinus*, and an occasional *Olearia odorata*. Small seepages are identifiable by the presence of soft rush* *Juncus effusus*.

Extensive areas of gorse are present along with briar, broom, elder and hawthorn. Browsing by goats and historical burning has contained the gorse as a low, closely cropped shrubland (Figure 17). Release from browsing would result in the rapid spread of this noxious weed.

Tracks have been bulldozed through areas **A**, **D** and **F**. Quarries, stone ruins and a charcoal pit with what appears to be large poplar stumps are present in area **F**.

Figure 6. Schist outcrop vegetation – Kowhai, *Olearia lineata*, *Hebe pimeleoides* var. *faucicola*, *Melicytus alpinus*, *Poa colensoi*, *Discaria toumatou*, *Coprosma propinqua*.

View north from point 3 in Area A on Attachment D.

Source: D Palmer; taken 22/3/07

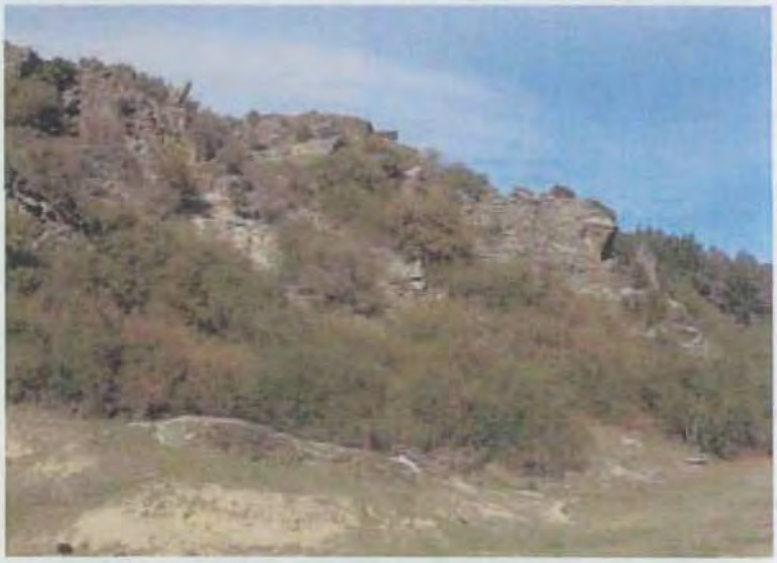


Figure 7. Open Kowhai woodland on the schist outcrop with sweet briar and elder on the alluvial fan below.

View west from point 4 of Area A.

Source: D Palmer; taken 22/11/07.

Figure 8. Above: *Asplenium flabellifolium*

Figure 9. Left: *Coprosma crassifolia*

Plants seen at point 5
Source: D Palmer; 22/3/07

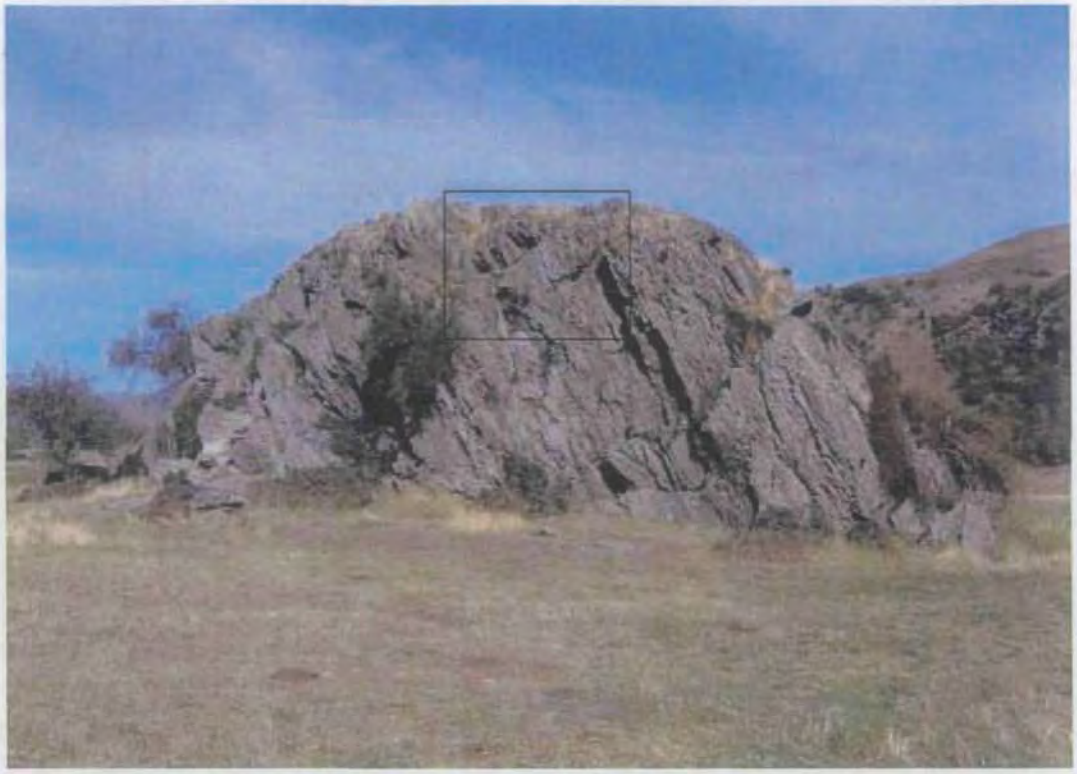


Figure 10 (above): Schist outcrop (area C) supporting *Hebe pimeleoides* var *faucicola* and *Coprosma petrei* located south of the 6th green would not be affected by the introduction of golf to the site. View south from point 6. *See close up of framed view below – Figure 11.* Source: D Palmer; 22/3/07

Figure 11. WP 106 N aspect, *Hebe pimeleoides* var. *faucicola, Poa colensoi, Coprosma petrei* (close up of framed area within Figure 10 above). Source: D Palmer; 22/3/07

3.1.2 Grey shrubland

Matagouri dominated - briar shrubland is present in small pockets within the more deeply incised portion of Toms Creek and as sparsely scattered plants over the valley floor and upper terrace.

Where matagouri dominates, *Coprosma propinqua*, porcupine shrub, silver tussock, *Pimelea aridula* and *Carmichaelia petrei* also form a component of this community. *Olearia avicenniifolia, Hebe salicifolia* and toetoe were also present within the gullies. Indigenous and exotic herbs and occasional tufts of tussocks including *Poa cita, P. colensoi*, and *Elymus* spp. are scattered within shrub clusters with a predominantly exotic pasture grass understory.

Briar is more abundant on north facing aspects. *Pinus radiata**, crack willow* *Salix fragilis*, introduced broom*, poplars*, buddleia* *Buddleja davidii*, hawthorn* and elder* also form an undesirable component of this community.

3.1.3 Briar dominated shrubland (dense and open)*

South of SH6 on the lower north facing slopes of the terrace, briar dominates the shrubland. This vegetation type has been mapped (Attachment D) showing two component categories of density (dense and open).

Where briar is more open it forms a mosaic with the *Raoulia* cushionfield – *Pimelea* shrubland community which dominates the dry, exposed ridges. Grey shrubland and thyme* *Thymus vulgaris* (found at low density on GVS) also merge with this community.

Exotic and indigenous herbs and grasses provide ground cover below and between areas with more open canopy and include woolly mullein* *Verbascum thapsus*, horehound* *Marrubium vulgare, Vittadinia australis**, *Raoulia hookerii, R. australis, Leucopogon fraseri*, and short tussocks (*Poa cita* and *P. colensoi* and diminutive *Poa/ Rytidosperma* species).

This community is generally species-poor with a large proportion of bare ground.

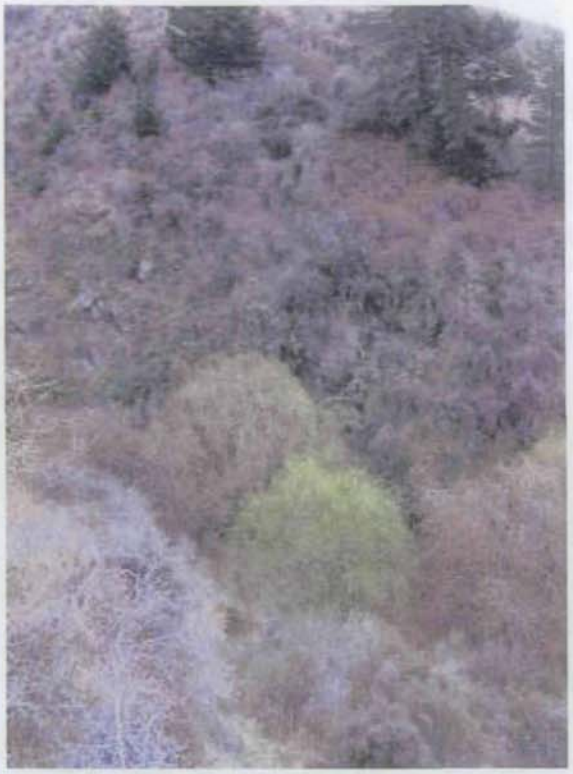


Figure 12. Left: Toms Creek view of true left. Grey shrubland species – Matagouri, *Coprosma propinqua*, and *Olearia avicenniifolia* with silver tussocks. *Pinus radiata* is spreading slowly.

View west from point 7. Source: D Palmer; 10/9/07

Figure 13. Below: Toms Creek view north from above the gorge from point 8. Briar on upper slopes giving way to the Matagouri dominated grey shrubland Source: D Palmer: 10/9/07

Figure 14 (left). Open briar community. View west across Resta Road from point 9. Source: D Palmer; 21/3/07

Figure 15 (below). Open and dense areas of briar dominated shrubland. View east from west side of Toms Ck – point 10. Source D Palmer; 10/9/07

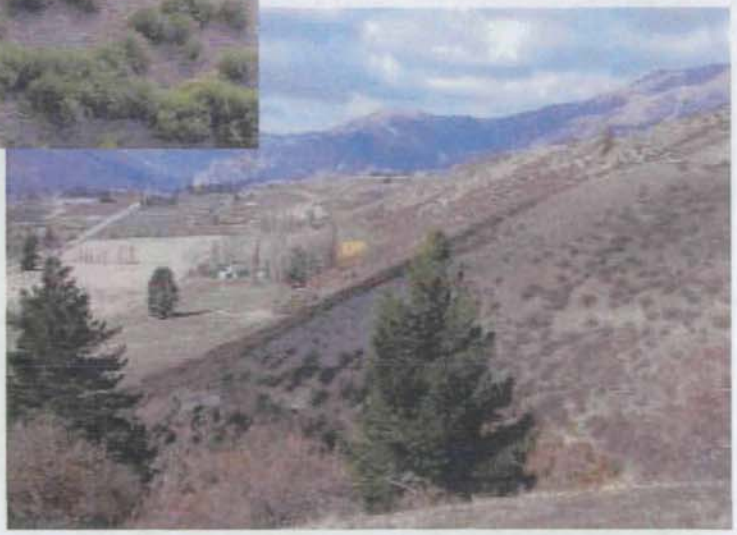


Figure 16 (above): Gorse in the gully is coming into flower (yellow). Red rosehips are visible on the dense briar shrubland, matagouri/ *Coprosmas* are green. View south from point 11. Source: D Palmer; 17/9/07

Figure 17: Gorse shrubland near rock outcrops in area F and man made pond also provides habitat for McCann's skinks *Oligosoma maccanni*. View south east from point 12. Source: D Palmer; 17/9/07.

3.1.4 Gorse and Broom* shrubland*

A dense pocket of gorse (*Ulex europaeus**) is present in a gully on the toe of the slope south of the State Highway and also over a central - eastern portion of the lower flats (refer to Figure 17). Exotic broom is also present on the north eastern terrace. These infestations have been closely browsed by goats and charred gorse stems indicate past management has included burning.

3.1.5 Raoulia cushion field – Pimelea shrubland and grassland

On the exposed rolling, north facing aspects of the landslide/ terrace edge south of the State Highway, the vegetation community is severely depleted and carries a substantial rabbit infestation.

Large areas of bare ground are interspersed with low growing mats (up to 1m across) of *Raoulia australis* and *R. hookerii*, with *Leucopogon fraseri, Luzula* spp., *Colobanthus brevisepalus* a species listed as threatened but about which little is known (Hitchmough et.al., 2007) and lichens. The occasional *Pimelea aridula, Melicytus alpinus* as well as tufts of blue and hard tussock (*Poa colensoi, Festuca novae-zelandiae*) and silver tussock *Poa cita* as well as more diminutive grass species are present.

Exotic grasses and adventive herbs such as brown top* *Agrostis capillaris*, sweet vernal* *Anthoxanthum odoratum,* woolly mullein* *Verbascum thapsus*, sheep sorrel* *Rumex acetosella,* Californian thistle* *Cirsium arvense,* St Johns wort* *Hypericum perforatum* and vipers bugloss* *Echium vulgare* populate these areas. Comparatively little thyme* also is currently present.

Figure 18. Above left: threatened pin cushion *Colobanthus brevisepalus* and *Raoulia hookerii.* From point 13 west of Resta Road. Source: D Palmer; 21/3/07

Figure 19: *Pimelea aridula* in flower from near photo point 14. Source: D Palmer; 10/9/07

Figure 20 (Left): Effects of rabbit browse and aspect evident with pasture grasses and *Melicytus alpinus* (Porcupine shrub) present on the west facing aspects, a browsed turf community in the foreground and the dry depleted *Raoulia – Pimelea* community left of the track in this view. View north from point 15 Source: D Palmer; 10/9/07.

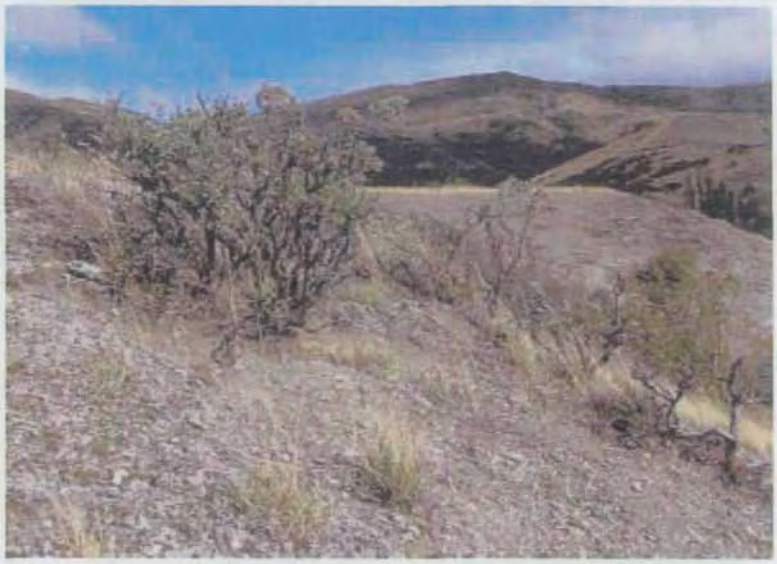


Figure 21 (Left): *Pimelea aridula*, *Raoulia* spp. and tufts of pasture grass.

View west from point east of Resta Road near point 9. These species are also present west of Resta Road. Source: D Palmer; 21/3/07

Figure 22: View from east of Toms Ck at point 14. Domed *Raoulia australis* mounds, open briar down slope with occasional *Pimelea aridula* (centre). Source: D Palmer; 10/9/07

3.1.6 Wetlands – ponds, creeks and seepages

The ponds and seepages on the valley flats are variously damaged by cattle and/ or deer and earthworks. Several of these seepages were noted near the river boundary.

A seepage was identified on a low, rocky step in the terrace is to the area labeled **B** on attachment D. It bounds the *Lepidium* 'kawarau' habitat Conservation Area in the north-western portion of the site and is dominated by a sward of *Carex coriacea* along with the small exotic rush *Juncus articulatus**, exotic herbs and pasture grasses, (refer to Figure 24).

Toms Creek flows through the property to the Kawarau River. Its course over the valley flats has been both choked and contained by willows (refer to Figures 25 and 26). *Hebe salicifolia* and *Olearia avicenniifolia* are present where the flow is more deeply incised into the southern terrace or confined by rock closer to the Kawarau River (refer to figure 28).

Surface flows that historically deposited alluvium over the valley floor are substantially contained within the channel of Toms Creek, culverts and water races. Attachment D illustrates the distribution of wetlands and areas of damp pasture.

A wetland area in the shrubland labeled **D** on Attachment D has been modified by historical excavations along the terrace edge south of the schist outcrops.

Man made ponds north and south of SH6 receive water either via pumped supply and/ or surface flows (refer to Figure 27). The northern such pond is surrounded with soft rush* *Juncus effusus*, *J gregiflorus* [*J edgariae*], J *articulatus**, monkey musk* *Mimulus guttatus*, forget me not* *Myosotis* spp., water cress* *Rorippa nasturtium-aquaticum*, introduced grasses and herbs, and an occasional *Carex buchananii*.

South of SH6 a number of small seepages were present on the lower slopes of the terrace riser. Indigenous diversity at these sites was higher than the valley floor sites and included toetoe *Cortaderia richardii*, purei *Carex secta*, sphagnum moss, *Carex petrei*, *Carex* spp. and *Juncus gregiflorus*. Exotic pasture species such Yorkshire fog* *Holcus lanatus* and cocksfoot* *Dactylis glomerata* form a dense sward around the native sedges (refer to Figure 23).

Crack willows* *Salix fragilis*, some of which may have been planted are well established in many of the wetland habitats.

Figure 23. Left: Seepage with *Carex secta*, sphagnum, *Juncus* spp. surrounded by dense briar. View north-west from track at point 16. Source: D Palmer; 23/8/07

Figure 24. Right: cattle damage in seepage adjacent to the proposed 8th green. View north from point 17. Source: D Palmer; 23/8/07

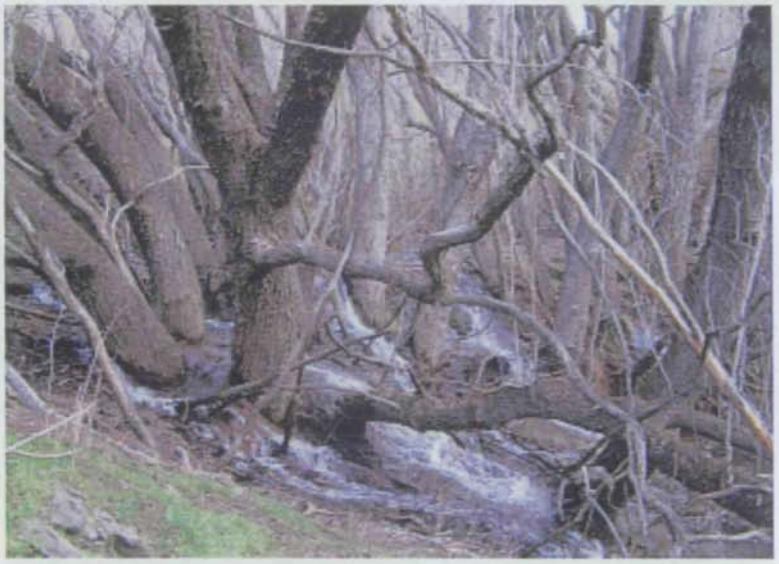


Figure 25. Left: Toms Creek is choked by crack willow . Point 18. Source: D Palmer; 10/9/07

Figure 26. Centre left: Crack willows confine the flow of Toms Creek over the alluvial fan between SH6 and the Kawarau River. View south west from fence line south of point 19. Source: D Palmer; 27/9/07

Figure 27 (Above): Man made irrigation pond terrace south SH6. View north-west from near point 1. Source: D Palmer; 21/3/ 07

Figure 28 (left): Toms Ck waterfall acts as a barrier to fish movement. *Hebe salicifolia, Olearia avicenniifolia* and *Coprosma propinqua* are present. View south west from point 19. Source: D Palmer; 21/7/07

3.1.7 Other areas - pasture, pines, poplars and willows

Areas not yet described are vegetated by exotic pasture grasses, vineyards, gardens, and residential curtilage areas. Exotic pasture comprises the majority of the valley floor vegetation.

Lombardy* and other poplars and pines mark settlements past and present. *Pinus radiata* seedlings and saplings are slowly invading the communities of the southern escarpment (toe of the Resta Road landslide). Elder and hawthorn are present near ruins and in gullies. Leyland cypress* *Cupressocyparis leylandii* and *Pinus radiata* have been planted as windbreaks in the north western portion of the site.

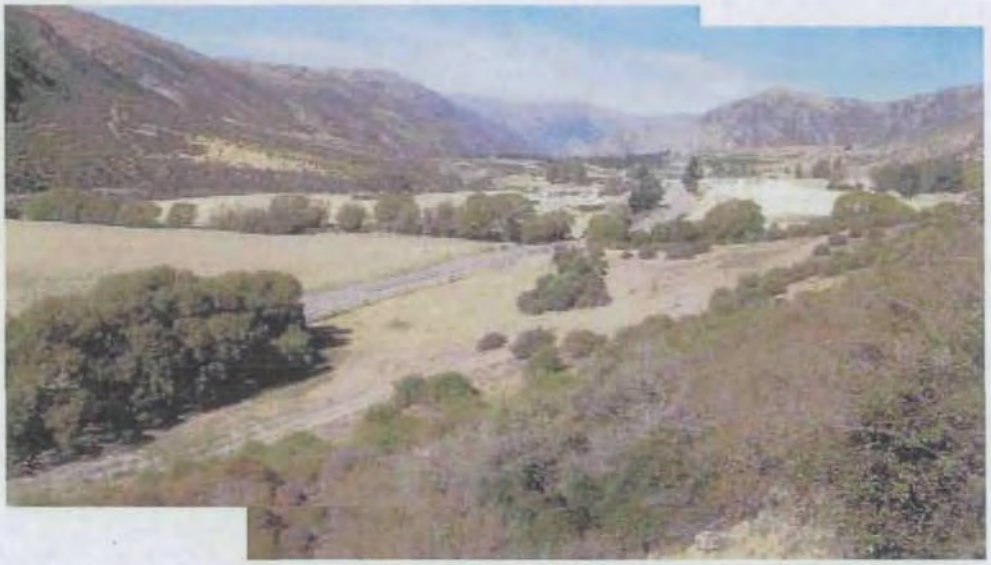
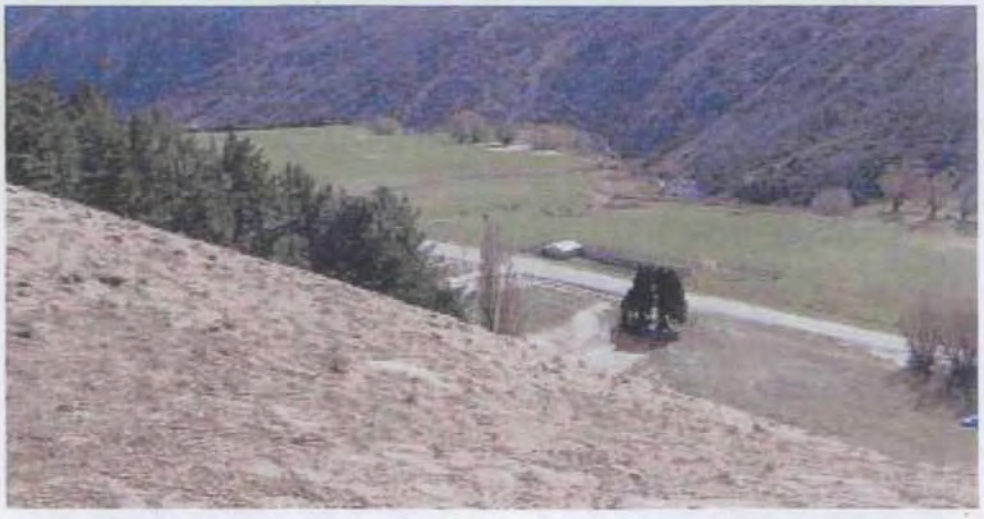


Figure 29. Above. View east from point 5 of the GVS flats. Willows line Toms Creek. Trees denote settlement sites (past and present) and SH6 transects the valley floor. Source: D Palmer; 22/3/07

Figure 30. Below. A seepage area and damp pasture being grazed by cattle (centre of view). View north-west from just east of point 20. Source: D Palmer; 10/9/07



3.2 Fauna

3.2.1 Avifauna

The shrubland and grassland communities on the property support indigenous passerines such as silver eye *Zosterops lateralis* and grey warbler *Gerygone igata* in addition to introduced finches. Two male tomtits *Petroica macrocephala* were also noted on May 2nd 2008 foraging in valley floor shrubland.

White-backed magpies were observed on the valley flats and lower slopes; these are territorial and therefore a competitor of the endemic falcon *Falco novaeseelandiae* "eastern" observed over head from the valley floor to upper elevations of GVS. Harrier *Circus approximans* were also noted over the lower to mid elevation portions of the property.

California quail* *Callipepla californica* are present throughout areas of shrubland habitat up to mid level elevations. Blackbirds* *Turdus merula* were also present throughout lowland areas and skylarks *Alauda arvensis* were heard overhead in areas of pasture.

In late September 2007, silvereyes, bees and butterflies were seen feeding on kowhai nectar. Bellbirds are also likely to feed on kowhai nectar providing pollination in return as they have been reported (seen and heard) by Gibbston Valley residents in places where flax has been planted (personal communication Susan Stevens, GVCA, 11th October 2007).

Bellbird populations will assist in the natural regeneration of kowhai, *Coprosmas* as well as other berry bearing tree or shrub species in the area.

3.2.2 Lizard fauna

Good populations of two lizard species Cromwell gecko (*Hoplodactylus* "Cromwell') and McCann's skinks (*Oligosoma maccanni*) were found during site visits in September, 2007. Both species are ranked "not threatened" (Hitchmough et al., 2007) and are secure within their known range. However the known range of the Cromwell gecko is restricted to areas within Central Otago. Refer to Figures 32a to 32d for illustrations of these species.

McCann's skinks and Cromwell geckos have been found occupying suitable habitat throughout the altitudinal range of the entire property. However, valley floor populations are likely to be isolated from each other by the open and inhospitable habitat between the rocky "islands" (personal communication, Tony Jewell, 18/7/2007).

Attachment E illustrates the areas where lizards were recorded. McCann's skinks were more widespread than indicated on the attachment having been noted in pasture grass near and west of Toms Creek and near area **B**.

The greatest numbers of Cromwell gecko were found in the rocky shrubland areas labeled **D** and **F** on Attachment D, where schist slabs sat directly on the ground or in piles surrounded

by shrubs (e.g. porcupine shrub, *Muellenbeckia* spp., *Coprosma* and matagouri) and grassland.

While geckos were found during searches of the rock tailings, large gaps between rocks incorporated into the tailings and ruins and the relative scarcity of food may render these areas less favourable for geckos which prefer crevices where both their backs and bellies are in contact with rock (Personal communication, Tony Jewell, 17/9/07; Marieke Lettink 26/9/07; Grant Norbury, 12/10/07).

Geckos in the Hoplodactylus *maculatus* species complex, which includes the Cromwell gecko, have small home ranges (Whitaker, 1982). For example, average movements of geckos from Turakirae Head near Wellington were around 1 metre (Whitaker, 1982), and those of geckos from Birdlings Flat near Christchurch were just over 3 m (Lettink, 2007a).

Individual geckos found under isolated small rocks north of SH6 (see attachment e) therefore have little opportunity to migrate and breed with larger populations. Unless they are moved to other areas of existing habitat or provided with linkages in the form of enhanced food and shelter (localised planting and placement any available supplementary rock) their chances of long term persistence are very limited.

McCann's skinks were abundant within (previously burnt) gorse shrubland and grassland areas but were also found within the historic tailings closer to the Kawarau River.

3.2.3 Freshwater fish

Brown trout *Salmo trutta*, long-finned eels *Anguilla dieffenbachia* and perch are present in the Kawarau River but a waterfall near the Kawarau River confluence with Toms Creek forms a barrier to upstream movement of trout and probably indigenous fish. No surveys for non-migratory indigenous fish have been undertaken on this site. It is the author's view based on personal knowledge and experience with fish surveys of nearby Kawarau tributaries that freshwater fish populations are unlikely to be present.

3.2.4 Invertebrate fauna

New Zealand's invertebrate fauna is unique and diverse with about 90 percent being endemic at the species level (Patrick, 1994). *Olearia, Hebe, Muellenbeckia, Pimelea, Coprosma, Carmichaelia, Kowhai, Rubus, Leucopogon, Raoulia, Colobanthus, Carex* as well as *Poa, Elymus* and *Festuca*, are genera well known for supporting a range of indigenous

invertebrate fauna through their various life stages (Patrick, 1994; Patrick, 1994a; Patrick, 2007).

The presence of all these genera at GVS suggest that even though the indigenous communities are fragmented remnants the species present are likely to host indigenous invertebrate fauna populations (Patrick, 1994; Patrick, 1994a; Patrick 2007; Derraik, Dickinson and Closs, 2003). Common host species are known to provide the foundations for invertebrate communities (Patrick, 1994).

Given that the GVS proposal incorporates a substantial enhancement component and only minor and localised disturbance, no detailed assessment of invertebrate fauna has been undertaken. The assumption is made that the invertebrate fauna is likely to be well supported by the proposal's land management goals, refer to Part 2 – Conservation Management Plan.

3.2.5 Other wildlife

The Gibbston Valley basin floor and terraces are heavily infested by rabbits (*Oryctolagus cuniculus*). The basin floor is currently grazed by domestic goats and cattle. Sheep and deer are also periodically grazed.

Figure 32a; left Cromwell gecko *(Hoplodactylus* "Cromwell"). Source: Dawn Palmer, taken in schist outcrops in area F.

Figure 32b; above. McCann's skink (*Oligosoma maccanni).* Source: Tony Jewell, taken at Coal Pit Saddle.

Figure 32c; bottom left. Lizard habitat noted in area F.

Figure 32d; below right. McCann's skink on a log within the gorse on the valley floor. Source: D Palmer, 17/9/07

4. Ecological significance

4.1 Historic vegetation

The vegetation of Central Otago has been extensively modified and very little indigenous vegetation and/ or ecosystems in pristine condition remain (Walker, Lee and Rogers, 2003).

From around 3000 yrs BP Mountain totara - celery pine *Phyllocladus alpinus* forests, mountain beech *Nothofagus solandri* var *cliffortioides*, possibly silver beech *N menziesii* and groves of cabbage trees *Cordyline australis* (Walker, Lee and Rogers, 2003) may also have been present on the valley slopes. However, natural fires and frost are likely to have inhibited the establishment of continuous forest cover, (McGlone, et.al., 1995).

Analysis of pollen and charcoal samples, considered alongside the presence of remnants such as the patches found within and near GVS suggest that in pre-human times, the vegetation of the lower hill slopes and terraces south of the State Highway, the rock outcrops, gullies and river margins would have been vegetated by shrubland – woodland – forest associations containing kowhai *Sophora microphylla*, manuka *Leptospermum scoparium*, mountain totara *Podocarpus hallii*, matagouri *Discaria toumatou Coprosma, Olearia, Carmichaelia, Pimelea, Ozothamnus, Melicytus, Myrsine, Aristotelia, Hebe* and *Melicope* species. Lianes including *Rubus* and *Muellenbeckia* would have been abundant (Walker, Lee, Rogers, 2003).

At the time of European settlement the finer textured soils of the site would have been vegetated by short tussock grassland – such as hard tussock *Festuca novae-zelandiae* and silver tussock *Poa cita* as well as blue wheat grass *Elymus* spp. (Leathwick, et.al. (2003).

Remnants of the historic shrubland - woodland are likely to have been present at the time of European settlement. Most of the component species are likely to have been both frost-tolerant and capable of re-colonising alluvial fans and terraces following disturbances such as debris avalanches in the absence of grazing (Walker, Lee, Rogers, 2003). The currently restricted distribution of these communities within inter-montane valleys and basins is likely to be a consequence of their limited tolerance of and ability recover from burning and grazing.

Mining, the loss of diversity in indigenous seed sources, depletion of soils along with the introduction of exotic plants, browsing animals and predators have irretrievably and extensively modified the indigenous communities of the Gibbston Valley floor.

The drainage of wetlands and diversion of water into water races have further degraded habitat integrity and diversity

4.2 Current ecological context - linkages/ connectivity

The GVS as a whole contains a range of indigenous vegetation communities and habitats that span an altitudinal sequence from pasture grasslands and open shrublands at 320 m asl to sub-alpine grasslands at 1079 m asl.

Within the proposed development area fragments of the historical indigenous communities have been retained within refugia (bluffs, gullies, rock gaps and crevices) primarily associated with schist outcrops.

The vegetation mapped as open shrubland associated with schist outcrops, wetlands and grey shrubland along the river boundary and lower slopes is reasonably contiguous with the local network of protected areas (refer to Attachments D and F).

GVS is in close proximity to seven protected areas. Attachment F provides a map illustrating the proximity and relationship of this network to GVS.

The *Lepidium* 'Kawarau' habitat Conservation Area and the marginal strip identified as **B** and **C** in Attachment **F** have the highest level of connectivity with the property and the greatest potential for mutual benefit to be achieved if the indigenous vegetation of GVS were to be at least maintained in its current state.

The adjoining protected areas contain the same suite of species found on GVS with the exception of Cromwell broom *Carmichaelia compacta* (a range restricted species found in rocky, open places and grassland communities of Central Otago), *Pimelea oreophila and Lepidium sisymbrioides* (after Heenan et al., 2007), which is nationally endangered, (Hitchmough et al., 2007). These have not been found on GVS. The protected areas are however also in a degraded state. In the absence of pest control, the values of both public and GVS land will continue to be at risk of further degradation.

Attachment E illustrates the distribution of species of conservation interest both within GVS and along the boundary inside the adjoining protected areas. There may be others but Attachment E is considered to provide a reasonable representation of the distribution of such species.

4.3 Representativeness/ naturalness

The indigenous vegetation communities and habitats of the site are fragmented remnants with generally low levels of naturalness. However, they are none the less distinctly recognisable.

Landcare Research New Zealand Ltd developed a classification tool known as Land Environment of New Zealand or LENZ. LENZ is a classification of New Zealand's landscapes using climate, landform and soil variables chosen for their roles in driving geographic variation in biological patterns. LENZ provides a framework to predict a range of biological and environmental attributes and aids the assessment of the values and significance of existing ecosystem remnants (Leathwick, et al., 2003).

The GVS site has a LENZ classification of "N – South Eastern Island Plains". The valley floor up to about 400 metres asl has a level IV classification of N5.1c. The terrace system up to about 620 m asl is classified as N4.1.d (also level IV).

The valley floor communities present today contain elements associated with N4.1.d and more scarcely, N5.1.c although they are classified by LENZ as N5.1.c. The LENZ system's scale of resolution (25 x 25 m per pixel) is too coarse to have identified the small wetlands and these localised variations. However, the classifications still provide a means of comparing the GVS site with other similarly classified sites.

Another tool that assists the consideration of representativeness is the Threatened Environment Classification (TEC) also developed by Landcare Research New Zealand Ltd. TEC combines information generated by the LENZ model into a GIS tool that focuses attention on areas in which indigenous vegetation remains, and the proportion of those areas that are legally protected (Walker, et.al, 2007).

The N5.1.c Environment on the basin floor and N4.1.d on the terraces to the south are classified as acutely and chronically threatened environments, respectively. This does not in itself mean that the indigenous vegetation of the site is significant. However, these classifications provide another means of alerting us to the fact that the vegetation within these valley floor environments have been greatly diminished and that where remnants exist, so too does the possibility that threatened species associated with those environments may also be present.

For example, the TEC system estimates that 2.72 percent of the indigenous vegetation associated with areas classified as N5.1.c remains (on a national scale) with only 2.23 per cent protected, Walker (2005), Walker, et.al. (2005).

This point is well illustrated by the lack of local examples of short tussock grassland which retain even moderate levels of naturalness within the Wakatipu Basin, the outwash plains south of Lakes Wanaka and Hawea and inter-montane basins or valley floors of Central Otago (other N5.1.c environments).

Figure 33. Land Environment classification of the lower Gibbston Valley Station.

Source: Landcare Research New Zealand Ltd – LENZ/ Threat Classification System; image provided 19/11/07 by QLDC.

On the valley floor of GVS, short tussock grassland remains only as isolated tufts of *Poa cita, Poa colensoi, Poa maniototo* and *Elymus* species along with cushion/ mat forming species, low shrubs scattered on the open valley floor and in the vicinity of schist outcrops. Although present within a threatened environment, their contribution to the floristic diversity and indigenous cover of the site does not in our view make these few scattered plants significant examples of short tussock grassland.

The dry, lower slopes and terraces classified as N4.1.d are mapped as chronically threatened with 18.59 percent of the indigenous vegetation associated with that environment remaining and just 3.04 percent of the land in this environment protected (Walker, 2005) at a national scale. Locally, this vegetation type is better represented within the protected area network and is more widespread on the mid elevations within the Camp and Franks Creek

catchments on GVS. A swathe of vegetation within the area labeled **A** on Attachment D has been cleared and stockpiled at the base of the outcrop.

Figure 34. Threat classification for the Gibbston Valley Station area.

Source: Landcare Research New Zealand Ltd - Threat Classification System; image provided 19/11/07 by QLDC.

The vegetation characteristic of N4.1.d environments is mapped as open shrubland associated with schist outcrops and grey shrubland on Attachment D.

Seepages on the Resta Road terrace escarpment are of reasonable significance to the site while those on the valley floor north of SH6 and Valley are quite degraded and would benefit from enhancement. In general, they provide localised variation within the land environment and are themselves ecosystems greatly reduced in extent (i.e. about 85 - 90 percent of previous extent lost at a national scale), Leathwick, et.al., (2003). Their greatest ecological value remains their potential for enhancement or naturalisation.

Although mere fragments, shrublands associated with schist outcrops, grey shrubland elsewhere and wetlands on the terrace escarpment between Resta Road and Toms Creek provide examples of the full range of remaining vegetation and habitats representative of N4.1.d. In our view there is insufficient short tussock grassland present to suggest it as a representative of the N5.1.c environment.

The fact that remnants of these communities have persisted on the valley floor confers a value which is more closely related to their vulnerability to further loss than their naturalness.

Given the level of loss of these communities the shrublands present in area A are considered to be of local if not regional significance as a result of both their remaining diversity and the presence of threatened species. Along the river edge all threatened species are outside the GVS boundary with the exception of the naturally sparse *Olearia lineata*, present in area D as well as other gullies from the river boundary to mid elevations in Camp and Franks Creek. Area C has the threatened *Hebe pimeleoides* var *faucicola* high on a north facing bluff. Area F, while densely infested by gorse in places contains good lizard habitat. For these reasons, the later areas are therefore considered to be of local interest.

Most importantly, they support the foundation for enhancement of the communities on both GVS and the adjoining protected areas.

4.4 Rarity/ distinctiveness

As previously noted, the following threatened plant species have been recorded on or adjacent to GVS:

- *Hebe pimeleoides* var *faucicola* a species in gradual decline found here and elsewhere on rocky outcrops and cliff faces from about 200 to 500 m asl. Its known range is from South Canterbury, mid Waitaki valley, Central Otago, Manuherikia, Clutha and the Kawarau Valley (Eagle, 2006).
- *Olearia lineata* is a naturally sparse (Hitchmough et al., 2007), but reasonably hardy tall shrub or low tree. It is found as a minor component throughout the indigenous shrubland present over the low to mid elevations of GVS.
- *Carmichaelia compacta* is a range restricted species (Hitchmough, et al., 2007) and while this it forms an important part of the local community it has not been found within the GVS site.
- The *Raoulia* cushionfield - *Pimelea* shrubland community contains *Colobanthus brevisepalus* a pin cushion species. Little is known of this species leading to its status of data deficient (Hitchmough, et al., 2007).
- Repeated NZ eastern falcon sightings over GVS indicate this site is likely to be within a territory. No nests are present within the land affected by the proposal. Eastern

falcon are in a state of human induced gradual decline (Hitchmough, et.al., 2007) with little known about the conservation needs of local populations.

4.5 Summary of significance

The indigenous vegetation of GVS makes a significant contribution to the diversity of indigenous ecosystems within the Kawarau Valley for the following reasons:

- The GVS as a whole contains a range of indigenous communities and habitats that span an altitudinal sequence from pasture grasslands and open shrublands at 320 m asl to sub-alpine grasslands at 1079 m asl.
- Open shrubland associated with schist outcrops, wetlands and grey shrubland present along the river boundary and lower slopes provide a reasonably contiguous connection with and buffer to the local network of protected areas (refer to Attachments D and F).
- Threatened species are present on bluffs and in the rocky refuges of schist outcrops in area A south of the State Highway. Along the river edge all threatened species are outside the GVS boundary with the exception of the naturally sparse *Olearia lineata*, present in area D as well as other gullies from the river boundary to mid elevations in Camp and Franks Creek. In area C, *Hebe pimeleoides* var *faucicola* is secure high on a north facing bluff.
- Rocky shrublands and grasslands provide habitat for common lizard species, and it is assumed, invertebrate populations (also present elsewhere) from the basin floor to the southern ridgeline. These habitats are important for the retention of local wildlife populations and their dispersal to, from and the within the site.
- Although mere fragments, the open shrubland associated with schist outcrops, areas of grey shrubland, and wetland communities (on the terrace riser south of the valley floor) provide examples of vegetation representative of the remaining *range of quality* of such communities and the associated habitat present within N4.1.d Environments. These valley floor examples are however considered to represent the more degraded spectrum of this range.
- No ecological values of any significance were found within areas of open pasture.

- The presence of the NW Cardrona Fault, Kawarau River faulted terrace at the north-western end of the site is of geological rather than ecological significance. It will not be disturbed by the proposed development.

5.0 Potential or actual adverse effects on ecological values

Actual and/ or potential adverse effects of the proposal were determined using the following process:

- Areas of conservation interest including the existing vegetation, location of lizard (particularly gecko) habitat and threatened plants were mapped. Refer to Attachments D and E.
- The footprint of the development was over laid with this information. Further site assessments were then undertaken to determine the level of actual and/ or potential effect. Refer to Attachment G.
- Reiterative discussions between the inter-disciplinary consultants involved with the proposal have resulted adjustments to the site layout which have avoided and minimised the potential for adverse ecological effects.
- No threatened species will be adversely affected by the construction or earthworks associated with any of the proposed site developments.

Residual and minor potential adverse effects can therefore be summarised as:

- Localised disturbance to areas of matagouri dominated shrubland in the vicinity of schist outcrops in areas **D** and **F**,
- Removal of small clusters of native shrubs (mostly matagouri) in areas mapped as grey shrubland on the valley floor, and
- Further modification to some of the small wetlands on the valley floor (although in most instances the disturbance will result in the enhancement of indigenous diversity and character),
- Localised and incidental disturbance to the habitat of isolated geckos.

Aspects of the proposal with the potential to result in these minor effects are:

- The formation of the building platforms and accessways north of SH6,
- The construction of some tees and greens,
- The formation of trails and golf accessways,

Proposed development south of the State Highway will not result in any adverse effects on the wetlands, identified in Attachment D, on the escarpment (toe of the Resta Road landslide), Toms Creek or the shrubland associated with the schist outcrops (area A).

Attachment J provides a summary of the existing values, the potential adverse effects and benefits of the proposal along with recommendations to further avoid or minimise residual potential adverse effects.

Details of the nature and extent of the potential adverse effects are provided below under the heading of the vegetation communities affected and mapped on Attachment D.

5.1 Open shrubland associated with schist outcrops

5.1.1 Residential dwellings and vehicle access

The proposed location of residential dwellings and vehicle access on the terrace riser in the north-eastern most part of the site (area **F**) has substantially avoided the potential for disturbance to indigenous vegetation and lizard habitat.

Their patchy distribution, reliance on rocky substrates, small home ranges and tendency to live in groups can make geckos vulnerable to disturbance and population losses. The likely effects on geckos (if present) where disturbance of isolated rock occurs are direct and/ or indirect losses which occur during earthworks, through predation or exposure. However, the impacts of disturbance associated with the proposed development can be minimised through management (personal communication, Marieke Lettink, 3 May, 2008).

Comparatively little disturbance to surface or loose rock will occur as part of the proposal. Excavation of underlying bedrock is however likely to occur in places. The rock that becomes available through site development is to be relocated to expand or enhance existing undisturbed habitats and/ or used to create new habitat. Combined with enhancement planting this will enable isolated habitats to be linked and a net improvement in the quality and quantity of rocky habitat in the surrounding areas to be achieved.

The Conservation Management Plan (Part 2) and more specifically Attachment H (Lizard Translocation and Habitat Enhancement Plan) outline the means by which such improvements would be achieved.

Given the stated development approach of GVS, the proposed mitigating response may over state the importance of this issue. However, it does so purposefully in order that potential

benefits arising from any such disturbance may be fully realised. These will be discussed later in this report.

Threatened plants found within rocky refuges have been identified and will be avoided by the proposed development.

Wherever patches of matagouri dominated shrubland are incidentally removed, revegetation with more diverse indigenous shrubland will follow in the areas identified on Attachment I such that the net presence of rocky, valley floor shrubland and short tussock grassland communities will be increased.

It is therefore the view of the author that if or where the effects referred to above occur, and the management response recommended by NSN and incorporated into the GVS proposal as described above, are implemented, the net effect of any disturbance will be no more than minor.

5.1.2 Golf course construction

NSN is advised that the formation of tees and greens in the vicinity of areas B, C and E and within area D may require both minor excavation and the importation of soil. Tees and greens in these areas have been located in open areas or on areas of outcropping bedrock with little indigenous vegetation. Existing bulldozed tracks have also been identified for use.

The placement of soil on top of the existing rock will retain the original feature minimising the need for excavation (personal communication, Greg Turner, 27th March 2008). The course design will be able to incorporate any schist excavated/ removed from the areas affected. NSN is advised that the final course design remains flexible enough to further avoid or minimise potentially adverse and localised ecological effects which become obvious during construction.

NSN understands that in establishing the golf course:

- threatened species will be protected and minimal disturbance to other indigenous vegetation will occur,
- if or where clearance is required it would be minor in nature and replaced with ecologically appropriate enhancement planting
- enhancement planting with ecologically appropriate species will occur low level revegetation in the vicinity of the schist outcrops with more extensive planting elsewhere (refer to Attachment I),
- relocation of schist where this becomes available as a result of development will maintain or enhance lizard habitat,
- there will be judicious use of fertilizers and herbicides in keeping with industry best practices (personal communication, Greg Turner, 21/7/07),
- there will be judicious use of irrigation resulting in little or no run off in keeping with industry best practices (personal communication, Greg Turner, 21/7/07).,,
- where access trails for golf are required through the rocky, northern boundary areas, they will share the alignment of existing bulldozed tracks and/ or any new trail created as part of the Gibbston River Trail to avoid or minimise the need for a duplicate trail system.

As a result of these provisions, the view is held that the proposed golf course is likely to result in no more than minor effects on ecological values in these areas.

5.1.3 Gibbston River Trail and the GVS trail network

GVS has volunteered (subject to obtaining resource consent) to incorporate the dual use (pedestrian and mountain biking) Gibbston River Trail (GRT) into their overall development plan. This would occur in consultation with the Gibbston Valley Community Association (GVCA). The Gibbston River Trail is an initiative of the GVCA and potentially affects area **D** (shown on Attachment D).

GVS also propose to extend the Gibbston River Trail by the formation of additional loops and linkages enabling the public to avoid interaction with golf, to cross the State Highway via an underpass accessing the proposed resort facilities, Gibbston Valley Winery and a network of proposed trails on the escarpment south of the Highway.

A bulldozed track established by a previous land owner traverses the northern boundary of area D then follows the fence line to the eastern boundary. This track has already created the most significant impact that could be associated with trail development in the area. The formation of the trail through GVS therefore requires very little additional disturbance to rocky habitats or indigenous vegetation east of Toms Creek.

West of Toms Creek, the trail may require additional formation, involving shallow excavation or benching into soils along the margin of the existing pasture and river terrace.

Attachment G identifies the proposed alignment of the trail in relation to threatened and interesting plants identified on both GVS and the adjacent public land. Localised disturbance or losses of these plants can therefore be avoided during construction.

The trail network proposed along the escarpment (within briar dominated shrubland) south of the State Highway will afford excellent views of the Gibbston Valley and surrounding mountains. The use of or upgrade of the established tracks will avoid additional and unnecessary disturbance to the soils and existing flora or fauna of the site.

GVS have stated that there is further potential to create a new trail along the base of the escarpment extending from the central village area to Resta Road. Confirmation of this trail or its exact alignment has not yet been determined. However no threatened or uncommon species were noted in this area and it is considered that provided the trail is well formed (preventing soil erosion) there will be no adverse effects associated with its construction.

The GVS proposal for trail development includes;

- Ecologically appropriate revegetation in the vicinity of the trail through the schist outcrops with more extensive planting elsewhere,
- Habitat enhancement via the placement of any schist removed from the site (e.g. residential areas, greens or tees and/ or the formation of the trail),
- The protection of historic sites,
- The protection of threatened species identified on Attachment E, and/ or any others found during the establishment of the trail.

These measures will ensure the effects of trail formation will be no more than minor.

5.2 Grey shrubland

There are no aspects of the proposed development likely to result in more than minor, localised adverse effects on grey shrubland.

The release of browsing pressure will however require the immediate control of woody weeds in order to prevent their regeneration and spread within or from the site.

5.3 Wetlands

On the valley floor and southern escarpment there are a number of man made and natural but degraded wetland areas. Aspects of the proposed development likely to affect wetlands are:

- The construction of a large retention pond proposed for the terrace at the northern river boundary (south and west of the proposed 7th tee). This is an area that retains a comparatively high level of natural moisture. The positioning of a pond in this area supports and extends the natural inclination of this highly modified portion of the site. Currently a "wallow" of deeply pugged soil (cattle and/ or deer damaged) is present at the terrace edge surrounded by rank grass growth and willows.

- Seepages in the vicinity of any GVS development will be incorporated into site design such that the net effect of the overall development will be the enhancement and naturalisation of wetland features on the valley floor.

- Two crossings of Toms Creek will be required north of the State Highway for golfing and/ or the Gibbston River Trail and one crossing south of the State Highway. NSN considers that these are likely to be achieved with no more than minor effect on the creek values by placing culverts such as those commonly used in such situations.

- The 3rd green is located on an existing track. This placement avoids a rushland to the south. The rushland is west of what appears to be a large soil bund so whilst the site obviously retains moisture, this may be a result of historic excavation and modification. Construction of a green to the north of the wetland is unlikely to have any effect on this wetland given the practices described in section 5.1.2 above. Conversely revegetation of the wetland environs associated with the construction of a golf course is likely to lead to an enhanced/ naturalised condition.

- The 7th tee has been placed within a heavily modified wetland. The wetland has been drained and large trenches excavated with soil heaped onto a central, raised mound. Cattle have trampled and pugged the surrounding soil and rank grass dominates the surrounding area. The tee has been pegged on top of the raised mound. Landscaping to create the proposed tee is likely to result in substantial improvements to the current site condition.

- The 7th green is located on moist, undulating ground north of a row of mature crack willows. The vicinity of the green is vegetated by rank grass, therefore landscaping associated with golf course establishment is likely to result in no more than minor effects. Naturalness at this site could be improved through landscaping associated with the construction of the golf course and walking trail.

- The development of the 9th tees and 8th green and access to them may require management of the effects on this natural seepage. Measures to protect and or improve the natural character of this seepage should be incorporated into any final site designs (e.g. boardwalk or approach from the south). Provided this occurs the effect of the development of the proposed golf course and walking trail will be no more than minor.

- The formation of the 13th fairway will cross a water race, damp pasture and a chanelised unnamed creek which historically flowed from a gully east of Gibbston Valley Winery. The proposed fairway will, in the author's view result in no more than minor effect on these highly modified wetland areas. Naturalness of this area could be improved through landscaping associated with the construction of the golf course and walking trail.

- A seepage community present at the base of the gorge of Toms Creek (refer to Attachment D) supports *Coprosma propinqua, Carmichaelia petrei, Juncus gregiflorus, Juncus effusus*, Carex secta, Carex petrei, Cortaderia richardii, Poa colensoi*, and *Luzula* spp. A spa and/ or treatment rooms proposed in the vicinity of this seepage are unlikely to have an adverse effect on the vegetation of the seepage as they have been positioned to the north of the toe of the slope. Management of woody weeds in this area that occurs as part of the development would further protect and enhance this community.

5.4 Raoulia cushionfield – Pimelea shrubland and grassland

As discussed in 5.2 above, the release of browsing pressure will require the immediate control of woody weeds in order to prevent their regeneration and spread through this community.

5.5 Other areas

5.5.1 Waste water disposal fields

The advice of NSN was sought regarding an ecologically appropriate location to site waste water disposal field, lines and settlement ponds.

The orchard area and the alluvial fan east and west of Toms Creek, north of the State Highway were identified by NSN as appropriate sites. The rationale behind this recommendation was the fact that historical and recent development of the valley floor in this area has resulted in this alluvial fan being cleared of indigenous vegetation. Surface flows have been chanelised by drainage trenches leaving the fan cut off from the intermittent flows of fertile alluvial sediments. In its current state, the potential for revegetation is likely to be restricted by exposure and summer moisture deficits. The establishment success of any revegetation on these areas would be enhanced by the presence of a source of moisture and nutrients from a subsoil waste water disposal field.

5.5.2 Farm paddocks

The balance of the resort development is located on open pasture with little or no ecological value and no more than minor, if any adverse effects.

5.5.3 Areas required for deposition of fill

GVS proposes to deposit soil (surplus material excavated from the development of GVS) in the gully systems east of Resta Road and south of the main power line system. NSN has assessed the terrace and network of gullies in this area and found them to be rabbit infested with a low level of indigenous diversity. They are vegetated by briar in the main with matagouri scattered through the briar thicket in the base of the gullies. A few isolated *Melicytus alpinus* were present along the fringe of the shrubland with *Pimelea aridula, Raoulia hookerii* and *R australis* more common on the spurs between gullies. Pasture grasses were present throughout although browsed to bare earth under the cover of the briar. They are similar to the gullies to the west.

The terrace east of the gully system referred to above is vegetated by pasture grasses.

NSN considers that the effect of filling these gullies would be no more than minor and the site condition may be improved by the control of rabbits followed by revegetation with indigenous shrubland species, short tussock grassland, *Raoulia* and pasture species such as chewings fescue *Festuca rubra*.

Alternatively, spreading the fill (if it is of a suitable nature) thinly over the terrace with a smaller volume being used to fill the gullies could provide another option with a relatively indiscernible ecological effect if followed by the revegetation measures described above (i.e. re-instatement of indigenous shrubland in the filled portion of the gullies). The topsoil could be reserved and re-spread over the top of the fill material and re-sown to pasture on the terrace.

6.0 Potential beneficial effects on ecological values

6.1 Conservation Management Plan

As previously noted, GVS has engaged NSN to provide advice regarding the potential for restorative planting and the adoption of an integrated approach to the management of pest animals and indigenous vegetation and habitats.

GVS has also sought advice from NSN regarding the benefit(s) if any that would be associated with any such undertaking and how the work could be implemented.

A Conservation Management Plan has therefore been prepared. It has not been prepared as a means of mitigating of any potential adverse effects arising as a result of the proposed development. However management necessary to avoid or minimise any potential or actual adverse effects of the proposal would be mitigated by aspects of the Plan and so have been integrated with the Plan.

The Conservation Management Plan ("the Plan") outlined in Part 2 of this report has drawn on the personal experience of the author, collegiate discussions with practicing ecologists, herpetologists, contractors and the published and cited research of others undertaken on a variety of scales elsewhere.

The Plan requires a responsive approach to its implementation that permits adaptation to seasonal fluctuations, and the site response to management. Dry land restoration is an area where research and learning is ongoing. It presents challenges not shared by areas with higher rainfall. Given this, GVS have stated that they intend to:

- Retire the lower portions of the property from grazing;
- Control rabbit browse on a landscape scale;
- Protect and enhance threatened plant populations, supplement and extend indigenous vegetation communities with restorative planting;
- Enhance the quality and quantity of habitat for lizards and invertebrate populations;
- Explore the potential for carbon sequestration through these enhancements to offset emissions associated with operational aspects of the GVS development.

Given the significance of the values described in Section 2 and 4 above, any such undertaking is viewed as beneficial for the biodiversity of GVS and the Gibbston Valley in general.

6.2 Revegetation and re-instatement of floristic diversity

Restorative planting will reintroduce seed sources which have been lost from or reduced within valley floor environments of the Kawarau Valley and surrounding ecological Districts. The property is adjacent to or in close proximity to several conservation areas, which will benefit from this approach.

Revegetation efforts would be staged with development.

Key communities that would be supplemented and/ or re-instated are:

(a) *open shrubland in the vicinity of schist outcrops (rocky habitats)*

(b) Grey shrubland on the valley floor, escarpments and gullies

(c) Short tussock grassland as an association with other shrublands and exotic pasture

(d) Wetlands – seepages and riparian areas adjacent creeks

(e) *Raoulia* cushion field – *Pimelea* shrubland

(f) Beech forest within deep, sheltered gullies

Attachment I illustrates the proposed extent of planned revegetation.

Attachment I identifies **"indigenous savannah"** as a vegetation type. This label has been used as an abbreviation for **"open grey shrubland with a mixed short tussock and exotic pasture grass understory".** The term 'indigenous savannah' conveys the visual image that the land will be openly planted area with occasional emergent tall shrubs/ small trees along with grey shrubland species. These would be extensively surrounded by grassland.

Grey shrublands on the valley floor will be more openly planted than those of the southern escarpment.

Grassland areas will also contain low shrubs such as *Pimelea, Melicytus* and *Carmichaelia.*

The benefits of the recommendations relating the *Raoulia* cushionfield – *Pimelea* shrubland community and the reinstatement of pockets of beech forests are described below as they have not be fully addressed elsewhere.

Raoulia cushionfield – *Pimelea* shrubland communities

The most important management actions affecting this community will be rabbit and weed control. The depleted terrace edge community is likely to have a strong response to rabbit control with infestations of briar, mullein, thistle, thyme and exotic pasture sward species increasing following initial control. The *Pimelea*, *Melicytus*, spring annuals (if present), and any remaining indigenous herb and grasses are however also likely to be released and will rely on effective and selective weed control. Supplemental planting of species such as *Carmichaelia compacta, Pimelea and Melicytus alpinus* has the potential to substantially enhance this degraded community.

Beech forest

Natural regeneration of indigenous forest cover at this site will not happen spontaneously due to the extensive, long-term depletion of these communities and potential seed sources within the landscape. If GVS is able to establish a small patch of beech forest it will appear as a remnant within the Kawarau Valley. Its reintroduction is not likely to provide ecologically meaningful connectivity to other forest remnants, the nearest being surrounded by Douglas fir in the Roaring Meg. However, it will improve the visibility of indigenous diversity and over time (hundreds of years) may provide a founding link in a more comprehensively restored landscape.

The identification of areas suitable for revegetation resulted from the following process:

- An analysis of the site including climate, soils and geomorphological processes,
- A review of published literature on the likely historic vegetation of the site,
- An assessment of the current extent of site modification (e.g. extent and diversity of remnant vegetation, degree of current settlement and site degradation) and the potential to retrieve elements of the former condition of the site.
- The identification of areas of conservation interest (Attachment E) and the potential to supplement and link these populations.

- The identification of areas where the potential for revegetation and habitat enhancement can be extended or are limited by aspects of site management and/ or the proposed development.

By protecting and enhancing the indigenous vegetation diversity through weed and rabbit control and restorative planting, the natural character of the Gibbston Valley can be improved, communities containing threatened species supported and the significance of the site's remnants ultimately enhanced.

6.3 Lizard populations

Further to the benefits accruing through the implementation of the Lizard Translocation and Habitat Enhancement Plan (Attachment H) and Part 4.4 of the Conservation Management Plan are the less tangible benefits of enhanced community awareness of lizard populations and the opportunity to trial the recommendations of herpetofauna research while managing effects of the development on lizard habitat.

6.3.1 Elevated community awareness of lizard populations

Consultation with residents of the Gibbston Valley Community Association has already raised public awareness of the potential for lizard populations to be present on other properties within the Gibbston Valley. Residents attending the consultative forums have expressed interest in lizard populations on their own properties. This may lead to their own, independent initiatives to protect localised populations.

While this would be a valuable indirect benefit that could accrue as a result of the proposal, the GVS proposal does not rely on other conservation efforts occurring within the Gibbston Valley to mitigate any potential adverse effects that may arise from its own development.

Translocation of lizards off site is not being considered by this proposal.

6.3.2 Trial translocation into man-made habitats

In order to mitigate the any potential effects of development within rocky habitats, lizards and their habitat where or if affected by the footprint of the proposed development will be translocated. Enhancement of the receiving environment and the creation of additional habitat throughout the development will support translocated animals and the broader, unaffected population. The Lizard Translocation and Habitat Enhancement Plan -

Attachment H provides further detail. Habitat enhancement areas are identified but should not limited to the areas shown on Attachment I given the relatively small home ranges of geckos.

Unlike Cromwell geckos, McCann's skinks are able to utilize a wide range of habitats including tussock grasslands, shrublands and rocky areas (personal communication, Marieke Lettink, 3/5/08).

The proposal outlined in Attachment H substantially extends the mitigation of localised disturbance one would expect to occur given the low level of potential disturbance. The proposal adopted by GVS to apply and monitor restoration management techniques provides a substantial educational opportunity.

The methods described in Attachment H have been peer reviewed by Marieke Lettink of Fauna Finders Ltd, and will essentially trial the application of techniques used elsewhere (Lettink, 2007a; Lettink, 2007b; Lettink and Cree, 2007; Wilson et al., 2007) for habitat management or relocation of populations. If successful, Gibbston Valley Station may be able to provide an example which assists the restoration or enhancement of habitat for indigenous wildlife in dry land and other habitats elsewhere. Results achieved at GVS may therefore indirectly support the management of both common and threatened species at other locations.

Rock excavated anywhere within the footprint of the development will be relocated to a suitable north facing site within the property as outlined in Attachment H and shown on I.

Enhancement planting will include the establishment of fleshy fruited species (e.g. porcupine shrub, *Coprosmas*, *Muellenbeckia* etc.) important food plants for lizards and the establishment of shrubs known to support invertebrate populations (which are also an important component of lizard diet)

6.4 On site interpretation and plant nursery

6.4.1 On site interpretation

In addition to implementing the Conservation Management Plan, and subject to obtaining resource consent for its proposal, GVS has stated an intention to provide on-site interpretive information about the conservation values identified, protected and enhanced on Gibbston Valley Station and the natural history of the Kawarau Gorge generally.

GVS has stated their intention to provide displays and/ or interpretive information which would be available to the public walking any of the trails or visiting the site improving public understanding of the surrounding environment. The Ecological Assessment and Conservation Management Plan along with the reports of other consultants will provide resource material useful for incorporation into interpretive material.

6.4.2 Plant nursery

While some plants will need to be supplied by existing commercial nurseries GVS has stated an intention of establishing a nursery to grow on plants for incorporation into the site's revegetation and enhancement proposals. The nursery would be located in the vicinity of service buildings. Such ventures are often supported by strong community interest. The extent to which the community would be involved with the nursery would be a matter for GVS to determine and or initiate.

The presence of threatened species within and adjacent to GVS such as *Hebe pimeleoides* var. *faucicola*, *Olearia lineata, Colobanthus brevisepalus, Carmichaelia compacta* as well as other species such as *Pimelea aridula, Sophora microphylla* and more common grey shrubland species mean that seed collection opportunities from local sources is possible.

There is also potential for restorative planting to include *Lepidium sisymbrioides,* a nationally endangered species managed under the Inland Lepidium Recovery Plan (2000 – 2010). The creation of additional populations of this species within its known range is consistent with the goals of the Recovery Plan. In this regard, GVS would be well placed to support the recovery of this species through co-operative agreements with the Department of Conservation and the suggestion to do so has been well received by the Recovery Group Leader, (personal communication, Mike Thorsen, DOC, 7/7/08). Commercial sale of *Lepidium sisymbrioides* to the public is not being considered by this proposal.

Figure 35. Kowhai *Sophora microphylla* seed in Area A, east of photo point 5. No recent regeneration was noted. The level of rabbit infestation was noted as being very high.

Figure 36: *Lepidium sisymbrioides* coming into flower near GVS – 1 December 2007: Source; D Palmer

6.4.3 Geopreservation site

The NW Cardrona Fault, Kawarau River faulted terrace geo-preservation site near the western boundary of the site will be unaffected by the proposal and will be maintained in open meadow grasses thus ensuring this significant geological feature remains visible

Figure 37: The NW Cardrona Fault, Kawarau River faulted terrace geo-preservation site. Grid ref: 2187719E – 5569518N. Source: D Palmer 24/8/08

6.4.4 Gibbston River Trail and the GVS trail network

GVS has as previously mentioned, volunteered (subject to the outcome of their resource consent application) to provide public easements enabling about 3.5 km of the Gibbston River Trail to be aligned over the GVS land. The easement would provide for dual use (pedestrian and mountain biking) and would, where possible share trails required for the development's golf course.

GVS has also identified a proposal to extend the Gibbston River Trail by providing additional loops and linkages which would:

- Enable the public to avoid interaction with golf if they choose to,
- Cross the State Highway via an underpass to gain access to the proposed service and retail areas,
- Access a network of trails on the escarpment and terrace edge to the south of the Highway to obtain views of the surrounding landscape and valley floor.

Prior to discussions with GVS, the Gibbston Valley Community Association had obtained approval in principle from the Department of Conservation to align the Gibbston River Trail on the more precipitous public conservation land along the margins of the Kawarau River (personal communication, Greg Lind, DOC 16/11/07 and Susan Stevens, GVCA 21/7/07) adjacent to GVS.

NSN understands that an alignment within GVS may result in a significant cost savings to the Gibbston River Trail project as the need for a number of structures would be avoided (e.g. two large bridges), (personal communication, Susan Stevens 21/7/07).

Attachment G identifies the proposed alignment of the trail on GVS. Existing farm tracks along the southern escarpment south of the State Highway will also be incorporated into the GVS trail network. These additional trails south of the State Highway will afford excellent views of the Gibbston Valley and surrounding mountains.

The proposed trail network will facilitate access for enhancement planting, weed and animal pest control. The public will be able to experience both common and threatened indigenous species within the dry land communities along the trails.

7.0 Recommendations

7.1 Recommendations to avoid or minimise actual or potential adverse effects and achieve actual or potential benefits of the proposal

(a) Disturbance to habitat in the vicinity of schist outcrops is to be avoided or minimised.

(b) Any development in the vicinity of these areas should result in a net improvement in the quality and quantity of rocky shrubland habitat on the surrounding valley floor.

(c) Areas of rocky shrubland habitat identified as areas A to F on Attachment D1 should be linked through enhancement planting and the relocation of rock that may become available through the development of the site.

(d) Where the need for lizard and/ or habitat translocation or enhancement occurs, it should be undertaken in accordance with the Lizard Translocation and Habitat Enhancement Plan (Attachment H) and parts 4.3 and 4.4 of the Conservation Management Plan and should be focused in but not limited to areas identified on Attachment I. This work should be implemented prior to and concurrently with staged development.

(e) The staging of development will be determined following the outcome of the GVS resource consent application and the creation of an integrated management plan that encompasses the construction programme, the implementation of the Conservation Management Plan, Attachment H and the recommendations of this and any other consultant reports. The integrated management plan will recognise the seasonal requirements associated with habitat management and planting.

(f) A suitably qualified ecologist and/ or herpetologist will provide contractor briefings and monitor earthworks undertaken in the vicinity of the schist outcrops. This will facilitate the containment of any disturbance to habitat and therefore effects.

(g) It is also recommended that a suitably qualified ecologist or herpetologist work along side contractors tasked with the translocation of rocks for habitat replacement and/ or enhancement.

(h) It is recommended that threatened plants be retained in situ (avoided), protected and enhanced through the control of invasive woody weeds and browse as per Parts 4.1 and 4.2 and supplemental planting as per part 4.3 and Table 1 of the Conservation Management Plan.

(i) It is recommended that existing indigenous vegetation communities are enhanced in accordance with Part 4.3 of the Conservation Management Plan and wherever they are affected by development, they should be replaced in areas identified on Attachment I and supplemented with a more diverse and ecologically appropriate range of species (refer to Table 1 in the Conservation Management Plan).

(j) It is recommended that a suitably qualified ecologist works along side the golf course design team to ensure the avoidance or disturbance to threatened plants and that appropriate opportunities to enhance lizard habitat and indigenous vegetation are taken as described in section 5.1.2 of this report as well as Attachment H and Parts 4.3 and 4.4 of the Conservation Management Plan.

(k) Where placement of soil is preferable to excavation of rock, the volume imported should be no more than the amount required to form the tee or green.

(l) Where the Gibbston River Trail and any other trail network is established on GVS they should use and share existing bulldozed tracks and any new tracks established where it is safe and practical to do so.

(m) Removal of grazing is likely to result in the regeneration of woody weeds and rank pasture grass. These will need to be managed to ensure they do not spread or suppress the existing indigenous remnants as per Part 4.2 of the Conservation Management Plan (Part 2). Control will need to be undertaken immediately following de-stocking and the implementation of Part 4.1 of the Conservation Management Plan to prevent their spread within and/ or beyond the site.

(n) It is recommended that wetlands be naturalised in a manner that relates to the surrounding geomorphological character of the site and planted in accordance with Part 4.3 and with species identified in Table 1 of the Conservation Management Plan.

(o) New man made ponds required by the development should be positioned in natural depressions and formed in a manner that relates to the surrounding geomorphological character of the site.

(p) No surface flow or nutrient enriched runoff from the golf course should affect the creeks or wetlands. As the site is released from the nutrient inputs associated with cattle (and other stock) grazing, and riparian enhancement occurs, measures are to be put in place to ensure that the GVS wetlands achieve an improvement in condition and indigenous diversity.

(q) Seepages in the vicinity of any development will be incorporated into site design such that the net effect of the overall valley floor development will be the enhancement and naturalisation of wetland features on the valley floor.

(r) Where Toms Creek must be crossed, culverts or bridges should be constructed and the bed and/ or riparian margins naturalised with enhancement planting as per Part 4.3 and Table 1 in the Conservation Management Plan.

(s) The Conservation Management Plan forms a core aspect of the GVS proposal. Its implementation is required in order to achieve the beneficial effects associated with Gibbston Valley Station's management of the site.

Part 2: Conservation Management Plan details an environmental vision and goals for the property, recommendations, tasks and timeframes, required to put in place the recommended change in land management.

Key tasks to achieving environmental goals for the property include:

- Control of browsing animals (Section 4.1);
- Control of noxious woody weeds (Section 4.2);
- The re-instatement of indigenous seed sources (Section 4.3);
- The protection and enhancement of lizard habitat in the vicinity of schist outcrops (Section 4.4); and
- Establishment of public access via a trail network (Section 4.5).

(t) It is recommended that Gibbston Valley Station provide on site interpretation of the natural values existing and enhanced by the proposal, this information should be available to the public using any public access easements established over GVS.

(u) The vegetation over the Geopreservation site identified on GVS should be maintained as open grassland in order to protect its visibility.

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Attachments

A	Ortho-photo with Gibbston Valley boundary
B	Proposed footprint of the Gibbston Valley Station development
C	Map of photo points
D	Existing vegetation
D1	Areas with schist outcrops and associated rocky habitat
E	Location of areas of conservation significance – species and habitats
F	Relationship of property to local protected area network
G	Relationship of areas of existing vegetation and areas of conservation significance to footprint of development
H	Lizard and translocation and habitat enhancement plan
I	Summary of areas of potential restorative planting and management
J	Summary of values, effects and recommendations

Attachment A

Ortho-photo with Gibbston Valley Station boundary overlaid

gibbston valley station | gibbston

attachment a: orthophoto + legal boundary

key

legal boundaries

Gibbston Valley STATION | PATERSON PITTS | CONSTRUCTION MANAGEMENT SERVICES | Natural Solutions for Nature Limited | MICHAEL WYATT ARCHITECT LTD | Turner Macpherson golf design | MPA14160-83 | 853 | draft

gibbston valley station | gibbston | attachment a: orthophoto + legal boundary | Ralf Kröger and Alan Cutler | Rodrigo Pellizzari | 27/08/07 | 1:4000 @ A1 1:8000 @ A3 | all right reserved to morgan+pollard associates | 145 glenda drive | p.o. box 1259 | queenstown | nz | p 03 442 3440 | f 03 442 3449 | office@greenbelt.co.nz

morgan+pollard associates

Attachment B

Proposed footprint of the Gibbston Valley Station Development

gibbston valley station | gibbston

development footprint attachment b

Gibbston Valley STATION | PATERSON PITTS | CONSTRUCTION MANAGEMENT SERVICES | Natural Solutions for Nature Limited | MICHAEL WYATT ARCHITECT LTD | Turner Macpherson golfdesign

MPA1416G-03.vwx

gibbston valley station | gibbston | development footprint attachment b | Ralf Krüger and Alan Cutler | Rodrigo Pelizzari | 27/08/07 | 1:4000 @ A1 1:8000 @ A3

145 glenda drive | p.o. box 1289 | queenstown | nz | p 03 442 3448 | f 03 442 3449 | office@greenbelt.co.nz

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Attachment C

Map of photo points

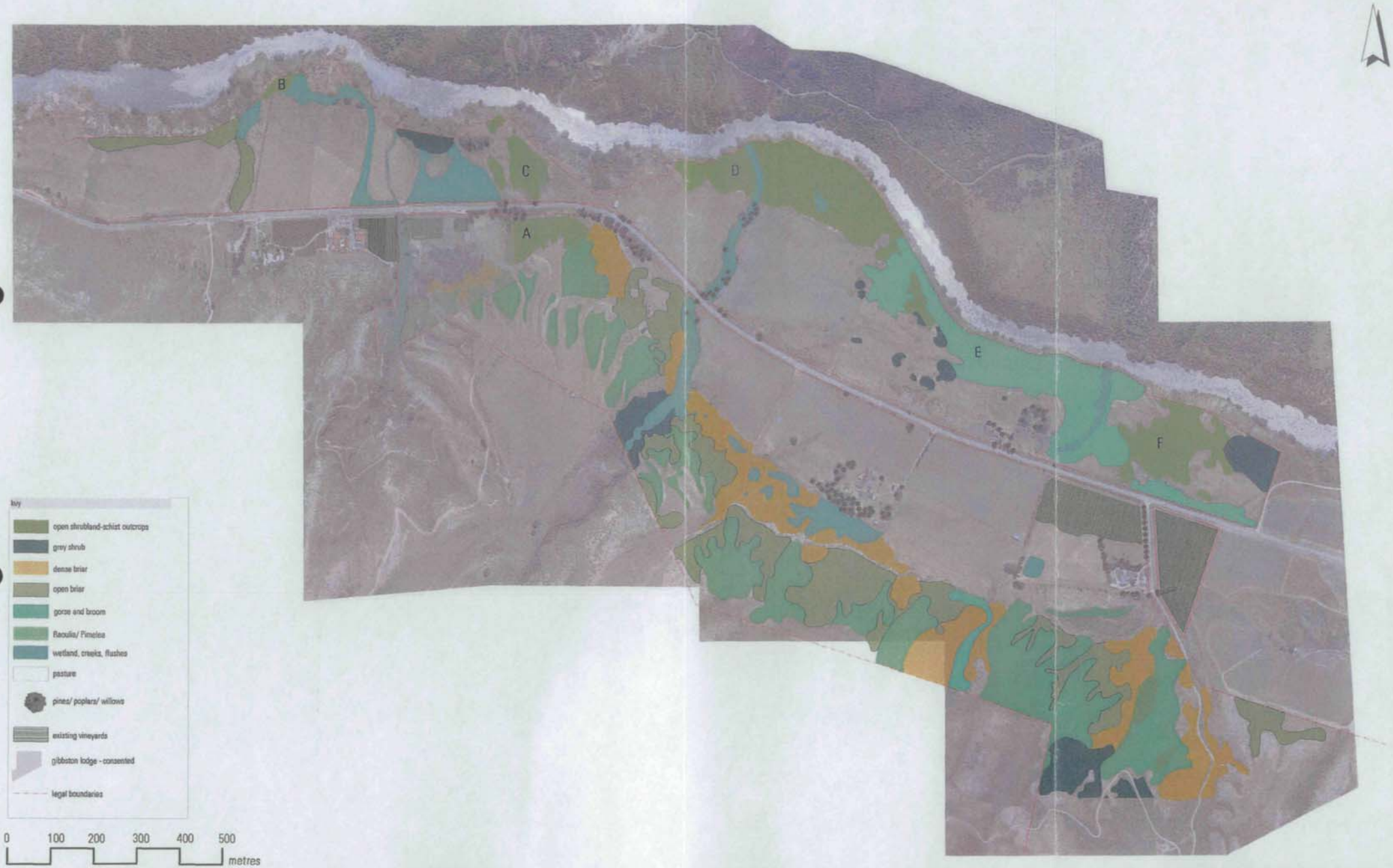
Attachment C Photo points (printed from MapToaster Topo/NZ) Air Photos 2.5 m F41C 2000-01

Attachment D

Existing Vegetation

gibbston valley station | gibbston

existing vegetation attachment d



Gibbston Valley STATION | mitchell landscape | PATERSON PITTS | CONSTRUCTION MANAGEMENT SERVICES | Natural Solutions for Nature Limited | MICHAEL WYATT ARCHITECT LTD | Turner Macpherson golfdesign

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gibbston valley station | gibbston | existing vegetation attachment d | Ralf Krüger and Alan Cutler | Rodrigo Pellizzari | 27/08/07 | T: 4000 @ A1, 1:8000 @ a3 |

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Attachment D1

Areas of schist outcrops and associated rocky habitat

Gibbston Valley Station
Areas of schist outcrops and associated rocky habitat
Rocky habitats within the areas labelled A to F in Attachment D.

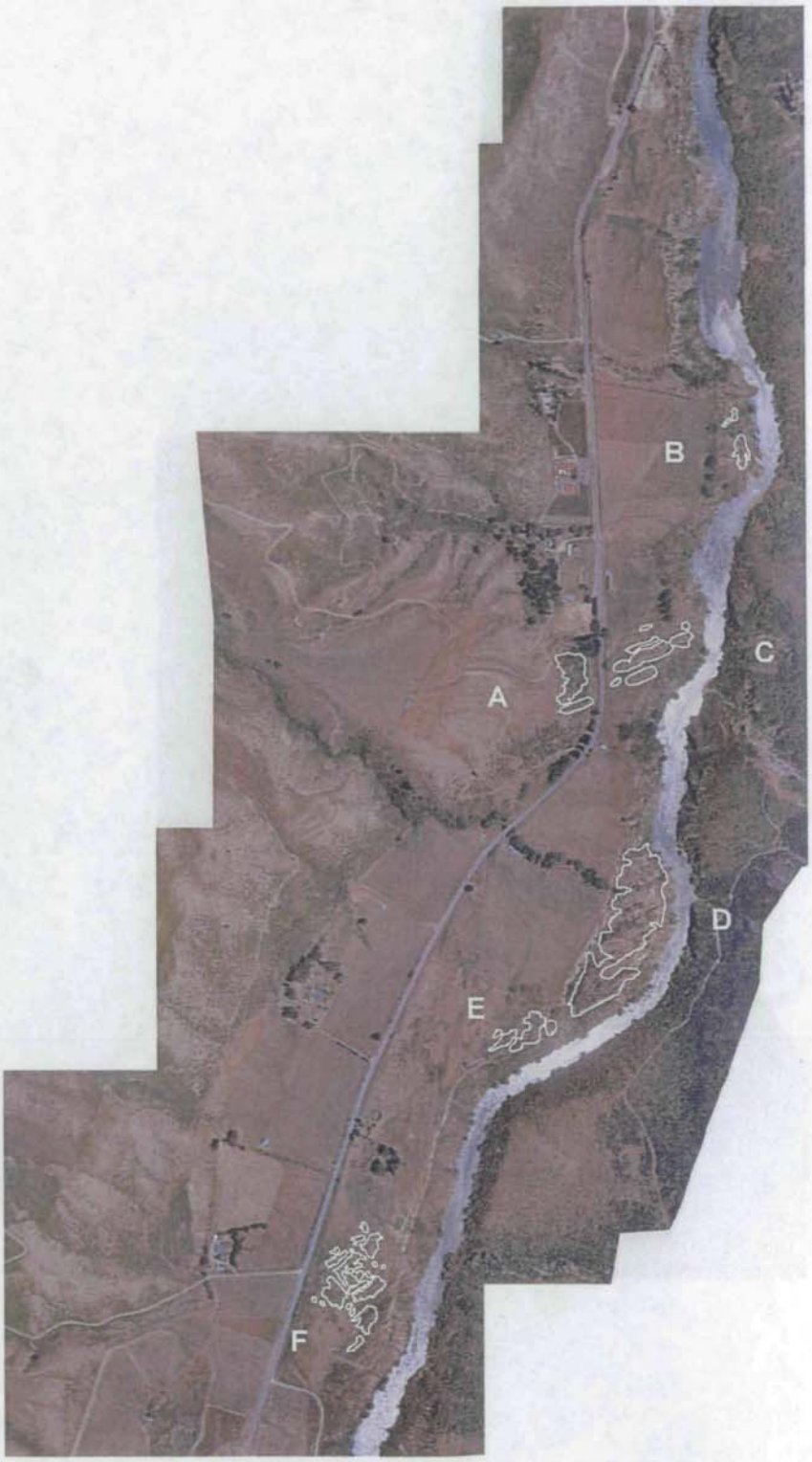

Image source: Paterson Pitts Partners Ltd. Date of photography 8 January 2003.

Attachment E

Location of species of conservation interest

gibbston valley station | gibbston

location of species of conservation interest attachment e

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D50 D55

gibbston valley station | gibbston | C4 - location of species of conservation interest attachment e | Ralf Krüger and Alan Cutler | Nigel Cowburn | 27/06/07 | 1:8000 @ A3

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existing vegetation + golf + hard development attachment g

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gibbston valley station | gibbston | existing vegetation + golf + hard development attachment g | Ralf Krüger and Alan Cutler | Rodrigo Pellizzari | 27/08/07 | 1:4000 @ A1, 1:8000 @ a3 |

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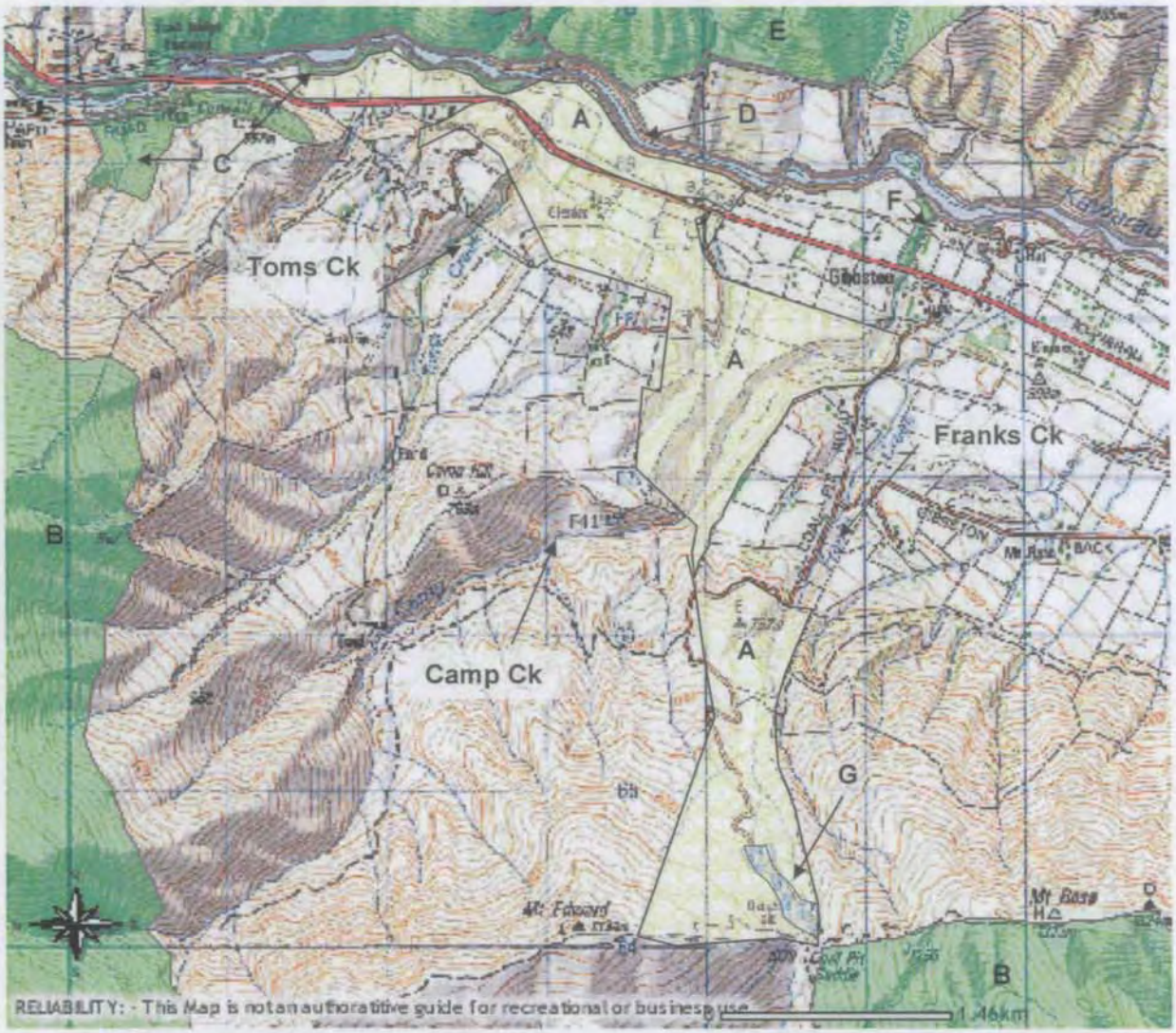
Attachment F

Relationship of property to local protected area network

Attachment F **Relationship of property to local protected area network.**

Areas B, C and E were formed or expanded as outcomes of the tenure review of Glenroy, Wentworth, Cone Peak, Waitiri-Eastburn and Mount Rosa Stations.



Protected area network

A Proposed purchase area (boundaries are approximate only)
B Remarkables Conservation Area (21,827 ha)
C Conservation Area – Lepidulum 'Kawarau' habitat (49.6 ha)
D Marginal Strip – fixed, true right (18 ha)
E Pisa Conservation Area (16,967 ha)
F Conservation Area – Access (Gibbston) (4.35 ha)
G Coal Pit Saddle Historic Reserve (6 ha)

Source: DOC GIS : http://extranet.doc.govt.nz/bip/ 28th March 2007

Attachment G

Relationship of existing vegetation and areas of conservation interest to the footprint of the GVS development

Attachment H

Lizard Translocation and Habitat Enhancement Plan

Lizard Translocation and Habitat Enhancement Plan

21st May, 2008

Prepared by

Natural Solutions *for Nature* Ltd

On behalf of

Gibbston Valley Station

Lizard Translocation and Habitat Enhancement Plan

A comprehensive and multi-faceted development is proposed on the valley floor of Gibbston Valley Station, refer to Attachment B.

As part of this development, residential buildings, their curtilage areas, access ways, trails and part of a golf course are proposed for construction in the vicinity of areas containing lizard habitat in the form of piles of schist, boulders and outcropping schist bedrock surrounded by shrubs and grassland (*Refer to Attachment D1 of the Ecological Assessment)*.

These areas provide habitat for a population of geckos (Cromwell gecko; *Hoplodactylus* "Cromwell") and skinks (McCann's skink; *Oligosoma maccanni*), refer to Attachments E and G for an indication of their distribution over the site. Both species have been given a threat ranking of "Not Threatened" by the Department of Conservation (Hitchmough et al., 2007).

Project planning has resulted in the avoidance and minimisation of the potential for disturbance to lizard habitat, however, the potential for localised disturbance to isolated individuals remains. This has been discussed in detail in section 5 of the Ecological Assessment.

This Plan has been prepared in order to provide the means of mitigating any effects of development on lizards. The translocation aspect of this plan is provided as a contingency response to the potential for disturbance to isolated individuals.

Geckos in the *Hoplodactylus maculatus* species complex, which includes the Cromwell gecko, have small home ranges (Whitaker, 1982). For example, average movements of geckos from Turakirae Head near Wellington were around 1 m (Whitaker, 1982), and those of geckos from Birdlings Flat near Christchurch were just over 3 m (Lettink 2007a).

Hoplodactylus geckos are mostly nocturnal and thigmothermic. They are reliant upon heat from the rocky substrates they shelter within during the day as it re-radiates during the night when they are active. Cromwell geckos are considered to be a reasonably robust species in terms of their ability to cope with placement into rocky man made habitats elsewhere (personal communication, Grant Norbury, 12/10/07).

Their patchy distribution, reliance on rocky substrates, small home ranges and tendency to live in groups can make geckos vulnerable to disturbance and population losses. However, the impacts of disturbance associated with human activities can be minimised through management.

McCann's skinks are diurnal (heliotherms) and warm themselves by basking in direct sunlight. Unlike Cromwell geckos, McCann's skinks are able to utilize a wide range of habitats including tussock grasslands, shrublands and rocky areas.

McCann's skinks have a comparatively greater reproductive output (up to 6 young per year versus no more than 2 for *Hoplodactylus* geckos; Cree, 1994; Holmes and Cree 2006).

Lizards essentially require:

- habitat/ shelter (rocks and/ or vegetation);
- food (invertebrates and fleshy fruits); and
- protection from predators.

Lizards have been found on GVS in areas providing these resources. The species present at GVS are among those which are more resilient to predation. This is evidenced by virtue

of their persistence within rocky refuges in the presence of predators such as (i.e. ferrets, cats, stoats, hedgehogs etc).

Preliminary findings of recent research by Landcare Research suggests that predator control covering areas of about 400 hectares or less in size (similar to the development area of GVS) is insufficient area to achieve a response (i.e. increase in numbers) in low but stable populations of McCann's skinks and *Hoplodactylus* geckos (personal communication Grant Norbury, Landcare Research, 5/5/08).

Similarly, research recently published relating to the measurement of management achievements at Macraes Flat in eastern North Otago reports no significant response (increase) in lizard populations between their "Fence" (predator exclusion fence – 18 ha) and a surrounding "Removal" (predator control) area – 1200 ha (Wilson, et al., 2007).

On land parcels the size of the GVS development area, resources are likely to be more effective if they are directed toward enhancement of habitat quality and quantity and trying to improve the linkages between the patches of habitat (personal communication Grant Norbury, Landcare Research, 5/5/08).

On this basis, the management focus at GVS which will be directed towards habitat enhancement and rabbit control which may result in fewer numbers of predators on site as they gravitate to other areas.

Sections 5, 6 and 7 of the Ecological Assessment and Part 4.4 of the Conservation Management Plan refer to and recommend the relocation and use of any rock material that may become available through the development of the land for the enhancement of the quality and quantity of existing habitats as well as linking otherwise isolated populations.

This Plan further recommends that any lizards directly affected by development be translocated into more suitable habitat.

These recommendations are made as a means of mitigating the localised effects of construction disturbance, enhancing and linking available habitat.

This Plan provides a guide for the translocation and enhancement of lizards and their habitat.

The translocation of lizards (where present) and their habitat from the footprint of disturbance associated with any development will involve a series of coordinated tasks in order to replace, expand and enhance the habitat within the receiving environments.

The methods used will essentially trial the techniques used and recommended elsewhere (Lettink, et al., 2005; Lettink, 2007a; Lettink 2007b; Lettink and Cree, 2007; Wilson et. al., 2007). If successful, Gibbston Valley Station could provide another example of restoration of habitat for indigenous wildlife in dry land habitats and may therefore indirectly support the management of both common and threatened species elsewhere.

Summary of Tasks required for the translocation and enhancement of lizards and their habitat

Staging and time frames for implementation of this Plan will be determined following the outcome of the GVS resource consent application. The requirements of this Plan will be integrated with those of the Conservation Management Plan and the construction programme. The resulting Integrated Management Plan will also recognise seasonal (biological) constraints relating to habitat enhancement and species management.

Identification of individuals

- Translocated individuals as well as those present within the receiving environment may need to be individually marked and if this is required, a Low Impact Research and Collection Permit from the Department of Conservation will be required. Marking is likely to be required in order to monitor the success of translocation.
- This work would be carried out in either spring or autumn prior to any site work within rocky habitats.

Enhancement of new and existing habitat

- Prior to translocation of any rocks and lizards, the receiving habitats shall be planted in species identified as suitable for habitat enhancement – refer Table 1 in the Conservation Implementation Plan. Supplemental planting will be staged with development. Initial planting will target existing habitat that will not be disturbed.
- New areas of habitat that will be safe from disturbance associated with development should also be planted (this work will be staged).
- Woody material (e.g. pine or willow rounds) could be placed in disturbed and enhanced areas. This would also provide temporary shelter for skinks to replace gorse.
- Enhancement planting for the golf course, trail and residential areas shall incorporate as much of the surplus local rock, if any, as possible. Areas of schist shall be surrounded by grassland, climbers and woody shrubland species (as per Table 1) which enhance or improve the quality of the available cover and food throughout the golf course and residential areas.
- Enhancement planting will better support existing populations and their potential for expansion and dispersal.
- Enhancement planting would be supported with irrigation.

Artificial cover objects to capture and provide shelter for lizards.

- Geckos will be targeted for capture prior to disturbance by the placement of Onduline tiles (www.onduline.co.nz), a fibrous bitumen material which is light weight and portable. This material has ideal thermal and structural properties for lizard shelters (Lettink and Cree 2007). Onduline tiles will be placed around rocky areas in both the receiving and collection areas. Tiles will be placed at least 3 months prior to earthworks and/ or habitat disturbance, throughout the area of earthworks. They

will be positioned in locations likely to catch lizards up to 1 metre beyond the boundary of a perimeter of disturbance.

- They will be checked at appropriate intervals and animals moved into predetermined, enhanced or undisturbed habitat in advance of earthworks.
- A trial of these techniques would be beneficial.
- Some animals may home back to their disturbed habitat, and this will be difficult to avoid. *Hoplodactylus* geckos returned to their capture site when moved short distances (up to 110 m; Marshall 1983), but remained at their release site when moved over a distance of 1 km, either because they were unable to home back or because they chose to stay put (Lettink 2007a). Onduline tiles will therefore be left in the vicinity of earthworks to provide shelter for any missed or homing individuals. These will be relocated to enhanced but otherwise undisturbed sites more than 500 metres from the capture site. The distance over which individuals can be moved is limited by the size of the site.
- Prior to disturbance, skinks and geckos will as far as practicable be hand collected and immediately released to suitable habitat in undisturbed or enhanced habitat.
- Onduline tiles will be removed as plantings establish (bear fruit and produce leaf litter) and rock habitats settle and/ or the tiles begin to deteriorate as an effective cover, which ever is the later.

Translocation of rock for habitat enhancement

- Rock shelter must be of sufficient thermal mass to absorb and then re-radiate solar heat for geckos, particularly during winter. The size of material required will be guided by the size of the material under or within which geckos are found on site. Rock "islands" of about $9m^2$ (as a minimum) to about $100m^2$ are to be created with translocated material.
- Relocated rock will be oriented where possible to north facing aspects in lizard habitat enhancement areas – Attachment I. Habitat enhancement should not be limited to the areas identified in Attachment I as small, localised improvements may also be beneficial. Rock should be placed in a way that replicates the natural setting and creates natural gaps and crevices for lizards. This should be supported by enhancement and replacement planting to offset the effects of vegetation lost from the development site.
- Rock will, where suitable also be embedded into cuttings creating retreats and crevices using a range of rock sizes interspersed with organic material that maintains gaps of about 5 to 10 mm but not larger than about 2 cm (personal communication Marieke Lettink, 26/9/07). This is a guideline rather than a prescription as experience elsewhere has indicated that where a labyrinth of rock layers is comprised of variable gaps and crevices, lizards will occupy the habitat (personal communication, Grant Norbury, 12/10/07). In general gaps of 5 to 10 mm will exclude mice which predate young geckos. Geckos preferentially occupy crevices which enable their "bellies and backs" to maintain contact with rock surfaces (personal communication, Marieke Lettink, 26/9/07; Grant Norbury, 12/10/07).

A series of rock piles containing layers of schist will also be placed onto the soil along with small rocks, and/ or organic material to create a network or corridor of retreats between existing habitat islands. All rock placements will then be planted with species identified in Table 1 of the Conservation Management Plan.

- Habitat translocation, where required, is to be staged with development.
- Translocation into new areas will support the potential for population dispersal.

Staged earthworks.

- Earthworks required by the development will be staged and this will be determined through the development of an integrated site management plan.
- The footprint of disturbance has avoided obvious areas of habitat. Disruption to lizard populations is therefore unlikely to be more than minor. Staging determined through an integrated management approach will further ensure that any residual disturbance in the vicinity of lizard habitat will not occur as a single, large scale excavation event and will enable management to focus on "samples" or smaller portions of habitat at a time. This will permit adaptive management if an element of the programme proves more or less successful.
- Any individual and isolated geckos affected by the development can be moved into areas of existing habitat not scheduled for disturbance.
- Infrastructural development will occur in advance of disturbance to the building platforms of individually titled sites.
- Areas of rocky habitat will be expanded when or if rock becomes available through the establishment of access and infrastructural services to the Golf Course Units and/ or Riverside Units, or any other area.
- Rock will be relocated as outlined above in a manner that:
    - Enhances existing habitat
    - Links or expands pockets of existing habitat
    - Create new areas of habitat within areas identified on Attachment I as well as in areas of open short tussock grassland and grey shrubland communities identified on the valley floor north of the SH6.

Monitoring.

- The success of any translocations as well as the habitat enhancement efforts will be determined by
    - The persistence of translocated and previously existing individuals at release sites and
    - Occupation of new or expanded areas of habitat.

  This will require the use of mark/ recapture monitoring.

- Monitoring will adopt an experimental design that may include autumn trapping within the following sites:

  Disturbed - residential or unit accommodation - sites – subsequently landscaped to include elements of rocky habitat,

  Existing habitat to be enhanced –rocky shrubland/ grassland with resident and translocated lizards,

  New habitat – grassland/ shrublands with little or no rocky habitat and no lizards previously detected into which lizards may be translocated,

  Undisturbed (control) sites with resident lizards but no enhancement or translocations (e.g. around historical sites)

- This proposal provides an opportunity for research into the efficacy of the proposed methods for restoration; a need identified by Lettink (2007b), Lettink and Cree (2007) and Wilson et al. (2007).

- The monitoring programme outlined above may be varied and will be developed in detail subsequent to obtaining resource consent and the development of an integrated site management plan. An indication of the seasonal constraints and progression of this management programme is provided in the following schedule.

Attachment G identifies lizard habitat likely to be affected. The areas where revegetation and enhancement planting is proposed are indicated on Attachment I.

Acknowledgements
These guidelines have benefited from informative discussions with Marieke Lettink (Fauna Finders Ltd., Birdlings Flat), Grant Norbury (Landcare Research, Alexandra), James Reardon (Department of Conservation, Dunedin), Tony Jewell (of Ranfurly) and Jan Kelly (of Wanaka). They reflect a synthesis of those discussions, consideration of the following publications, details of the GVS proposal, its constraints and the potential for the application of advice received from of all of the above sources at the Gibbston Valley site.

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Preliminary Schedule for Implementation (and dependent upon resource consent being obtained)

The need for translocations may become redundant if no lizards are found to be affected by the proposed development. In this event, monitoring the success of lizard habitat enhancement would still occur.

Identification of the existing population in affected areas	
Identification of existing populations, if any, in the vicinity of development areas.	Spring (October) or Autumn (March) – prior to any site disturbance
Confirm areas of existing habitat not scheduled for disturbance to receive translocations	
Enhancement of new and existing habitat	
Enhancement planting of existing habitat	To be determined by integrated management plan and as soon as plants become available. Planting in spring/ autumn
Expansion of existing habitat - linkages (corridors/ islands) between pockets of habitat	Staged with development and availability of rock and plants. or as soon as plants become available.
Planting to support the creation of new habitat	Staged with development and availability of rock and plants.
Translocation of Lizards	
Capture of lizards for translocation/ provision of supplemental shelter	To be staged with development in accordance with an integrated management plan. Capture and translocation to occur between September to April prior to disturbance in the vicinity of habitat. Artificial cover objects (ACOs) to be positioned within the footprint of development 3 months prior to any disturbance. No disturbance is to occur until capture rates indicate most animals have been relocated from the footprint of development.
Individual lizards under isolated rocks (e.g. those in the area of the Golf Course Units) will be hand collected from the foot print of development and moved into areas of existing habitat not scheduled for disturbance without the need for further trapping.	Prior to and staged with development in accordance with an integrated management plan.

Translocations where required will go to areas of existing habitat, then into enhanced and finally new habitat.	Staged with earthworks and development in accordance with an integrated management plan.
ACOs to be left on site in the vicinity of earthworks during and after their completion.	Staged with earthworks in accordance with an integrated management plan.
Relocation of rock for habitat enhancement	
Relocation of any surface or bedrock material from within the footprint of disturbance. Rock will be relocated in areas surrounding existing rocky habitats in order to expand and enhance the existing areas. This will be followed by the creation of linkages between areas of existing habitat.	Following confirmation that most affected animals have been translocated. Rock will be relocated in accordance with an integrated management plan to be developed following the receipt of resource consent.
Monitoring the success of lizard translocations and habitat enhancement	
Initial identification - as above	Spring (October) or Autumn (March) – prior to any site disturbance
Monitoring of individuals at the following sites is recommended: Disturbed residential sites – subsequently landscaped to include elements of rocky habitat Existing habitat to be enhanced – with rocky shrubland/ grassland and resident lizards, New habitat – grassland/ shrublands with little or no rocky habitat and no lizards previously detected Undisturbed sites with resident lizards but no enhancement	Autumn – enabling reproduction to be detected.

Plants incorporated into habitat enhancement planting will be those identified in Table 1 of the Conservation Management Plan.

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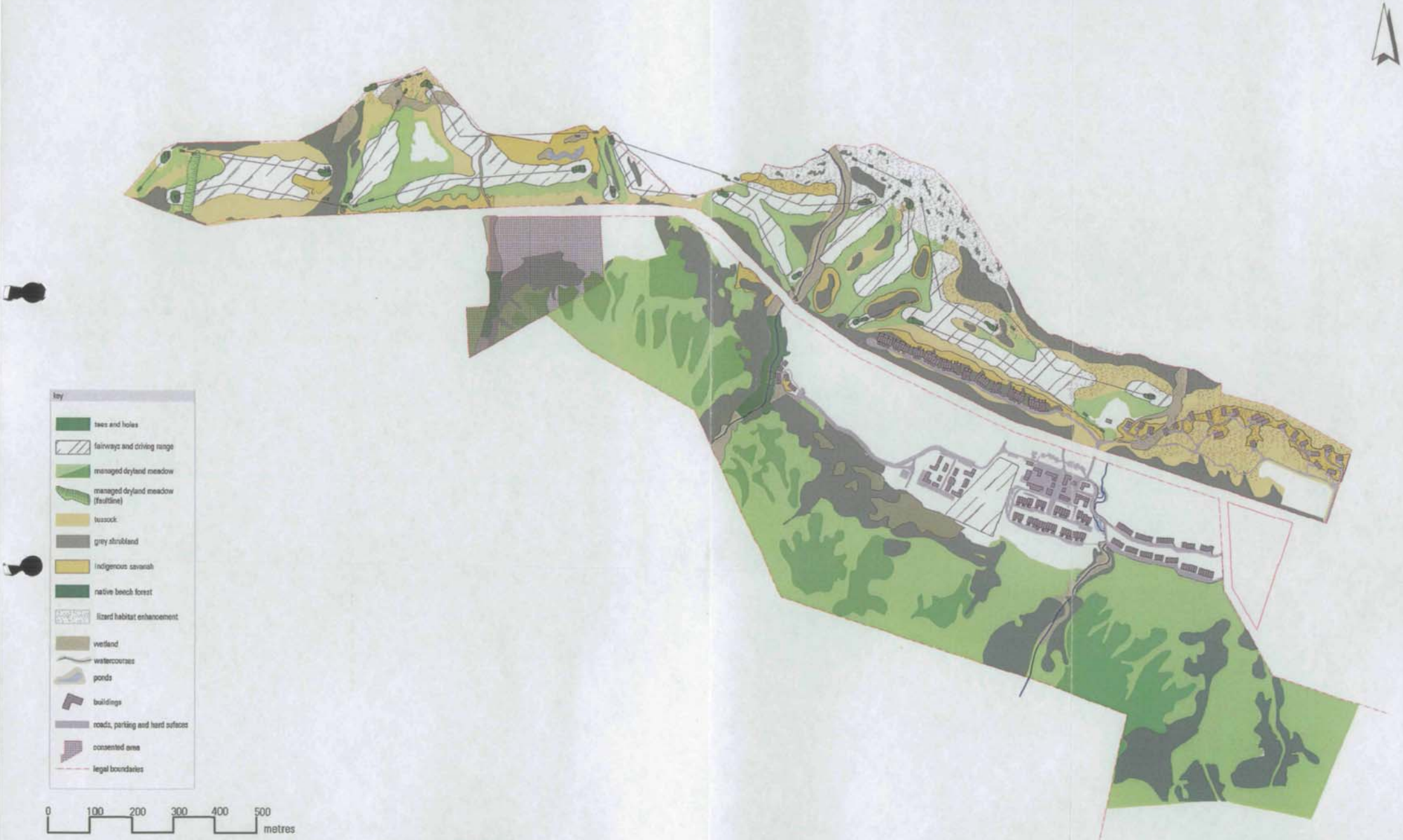
proposed revegetation + development attachment i



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gibbston valley station | gibbston | proposed revegetation + development attachment i | Ralf Krüger and Alan Cutler | Rodrigo Pellizzari | 27/08/03 | 1:4000 @ A1 1:8000 @ A3

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Attachment I

Summary of areas of potential restorative planting and management

Attachment J

Summary of values, effects and recommendations

Summary of Existing Values, Effects and Recommendations

Prepared by

Natural Solutions *for Nature* Ltd

On behalf of

Gibbston Valley Station

Vegetation Type	Description	Significance	Potential Benefits and / or Potential Adverse Effects of Proposal	Recommendations
Lowland shrubland associated with schist outcrops   Kowhai in flower	Matagouri dominated shrubland located within and around schist outcrops including indigenous woodland species such as Kowhai (in flower below left), *Coprosma, Olearia* and scattered short tussock species. *Hebe pimeleoides* subsp. *faucicola* is a species in natural decline found on bluffs north and south of the State Highway. Exotic shrubs, trees, exotic herbs and grasses, are also present. Rabbits present in high numbers, currently grazed by domestic goats.	• Threatened and naturally sparse species are present in the rock outcrops along the river boundary and south of the State Highway; • Indigenous species provide an example of previously more widespread communities in valley floor/ inter-montane basin environments; • Vegetation provides good seed source for regeneration benefiting and buffering adjacent protected areas; • Provides good lizard, invertebrate and native passerine habitat and hunting area for NZ falcon.	<u>Benefits</u> • Increased floristic diversity; • Reintroduce seed source for species once more common in the area, supporting potential for natural regeneration on and beyond the site; • Habitats for lizards, invertebrates and avifauna maintained and enhanced; • Public access to areas of conservation interest; • Control of briar, thyme, broom, gorse, and pine following removal of browsing animals; <u>Adverse Effects</u> • Localised disturbance of schist outcrops may affect some lizards; • Localised disturbance to indigenous shrublands	• Remove woody weeds e.g. briar, broom, elder, gorse and Corokia; • Intensive rabbit control; • Retire from grazing; • Increase diversity by planting clusters of kowhai, *Olearia, Coprosma, Hebe* and *Carmichaelia* and short tussock grasses around schist outcrops – as per Table 1 in the CMP; • Experiment with seed sowing to encourage regeneration; • Investigate introduction of *Lepidium sisymbrioides;* • Translocate lizards, if any, where disturbance occurs and enhance their habitat; • Location of the golf course and trails shall avoid disturbance of threatened plants;

				• Trail construction shall not cause or contribute to soil erosion.
Grey Shrubland and short tussock grassland  	Matagouri dominated shrubland with dominance varying. Indigenous shrubs such as C*oprosma propinqua, Pimelea aridula, Carmichaelia petriei* and *Melicytus alpinus* (below left) along with hawthorn and elder are also found within this community. Mixed indigenous and exotic herbs and grasses include *Poa cita, P. colensoi, Festuca novae-zelandiae* and *Elymus* spp. are also sparsely present.	Significant where the indigenous component dominates, such as Franks Creek and Camp Creek outside the area proposed for development. Where briar increases the significance of the vegetation is lost but retains the potential for restoration.	<u>Benefits</u> • Increased floristic diversity; • Reintroduce seed source for species once more common in the area, supporting potential for natural regeneration on and beyond the site; • Habitats for invertebrates and avifauna, maintained and enhanced; • Public access to areas of conservation interest; <u>Adverse Effects</u> • Removal of browsing animals will result in spread of briar, thyme, gorse, and pine if not ;	• Control rabbits. • Support natural regeneration and improved diversity with the removal of clusters of briar and replace these with clusters of indigenous shrubs; • Trail construction shall not cause or contribute to soil erosion. • Control of briar, thyme, broom, gorse, and pine following removal of browsing animals.

Vegetation Type	Description	Significance	Benefits and / or Potential Adverse Effects of Proposal	Recommendations
Briar and Gorse dominated shrublands 	Briar dominated shrubland, with other indigenous and exotic shrubs such as matagouri and occasional *Coprosma propinqua, Pimelea aridula, Carmichaelia petriei, Melicytus alpinus* hawthorn and elder, exotic herbs and grasses, occasional short tussock *Poa cita* and *P. colensoi*, thyme. Gorse shrubland within gullies and lower flats dominate the vegetation completely. Very high rabbit populations at lower altitudes. Gorse provides shelter for McCann's skinks on valley floor.	Not significant but has potential – can provide "nursery" for regeneration and restorative planting.	<u>Benefits</u> • Potential to support enhancement planting; • Reintroduce seed source of species which were once more common in the area, allowing for natural regeneration on and beyond the site; • Habitats for invertebrates and avifauna maintained and enhanced; • Public access to areas of conservation interest; • Habitats for lizards, invertebrates and avifauna, maintained and enhanced; <u>Potential Effects</u> • Removal of browsing animals will result in spread of briar, thyme, gorse, and pine;	• Control rabbits; • Support natural regeneration and improved diversity with the removal of clusters of briar and replace these with clusters of indigenous shrubs; • Trail construction shall not cause or contribute to soil erosion. • Control of briar, thyme, broom, gorse, and pine following removal of browsing animals.

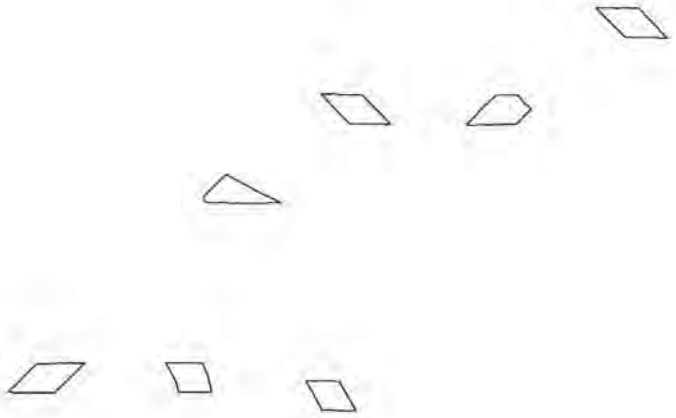
Raoulia cushionfield – *Pimelea* shrubland and grassland 	Low growing mats of *Raoulia australis* and *R. hookerii*, with *Leucopogon fraserii, Pimelea aridula*, lichens, *Poa colensoi, Carex* spp., *Leucopogon fraseri, Colobanthus brevisepalus*, exotic grasses and adventive herbs, thyme. Very high rabbit population.	Not significant. Depleted dryland cushion field with potential for regeneration.	<u>Benefits</u> • Natural regeneration will occur following the removal of rabbit browsing, providing habitat for invertebrates and avifauna; <u>Adverse Effects</u> • Removal of browsing animals will result in spread of briar, thyme, gorse, and pine; • Localised clearance associated with trail construction.	• Control rabbits, remove browsing stock and support natural regeneration of existing community; • Experiment with sowing seed; • Trail construction shall not cause or contribute to soil erosion. • Control of briar, thyme, broom, gorse, and pine following removal of browsing animals;

Wetlands – ponds, creeks and seepages   	Toms Creek is contained by rows of crack willow. Seepages on the valley floor have been grazed and damaged by stock with little natural diversity remaining. Seepages on the toe of the escarpment south of the State Highway contain *Carex coriacea,, C secta, Juncus effusus,* toi toi *Cortaderia richardii,* matagouri, *Coprosma propinqua* and *Carmichaelia petriei* Man made ponds contain a variety of exotic aquatic plants as well as *Eleocharis acuta*, at the margins.	Where the proportion of native species is high in seepages, the habitats and vegetation provide good examples of the site's existing and potential natural character. Elsewhere degradation negates the significance attached to the vegetation. Wetland systems in semi-arid environments have great potential for restoration.	<u>Benefits</u> • Removal of stock will stop trampling, browsing and fouling of wetlands; • Increased floristic diversity through enhancement planting; • Reintroduction of seed sources for species once more common in the area, allowing for natural regeneration on and beyond the site; • Habitats for lizards, invertebrates and avifauna maintained and enhanced; • Public access to areas of conservation interest;	• Control rabbit and remove browsing stock; • Support natural regeneration and improved diversity with the removal of woody weeds and replace these with clusters of indigenous shrubs, sedges, rushes, grasses; • Trail construction shall not cause or contribute to soil erosion and shall avoid disturbance of seepages and streams; • Where man made ponds are no longer required the natural wetland should be restored; • Where new ponds are required by the proposal their location and construction should support or expand the nature of the site; • Landscaping associated with the golf course and development shall result in improved water quality conditions.

Vegetation Type	Description	Significance	Benefits and / or Potential Adverse Effects of Proposal	Recommendations
Other areas – pasture, pines, poplars and willows  	Other vegetation within the boundary of the property includes; exotic grassland at low altitudes, with brown top, sweet vernal grass and other introduced pasture grasses. These areas are grazed by cattle and domestic goats. Shelter belts include pine, cypress, Lombardy poplars with crack willow lining creeks. Vineyards are also established on the eastern flats. Residences, barns, sheds, gardens and yards.	Not significant	<u>Benefits</u> • Increased floristic diversity; • Reintroduce seed source of species once more common in the area; • Habitats for lizards, invertebrates and avifauna maintained and enhanced; • Visual amenity along public access to areas of conservation interest improved;	• Reinstatement of pockets of indigenous species diversity.

Gibbston Valley Station

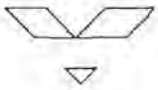
Part 2 Conservation Management Plan



Prepared by:

Natural Solutions for Nature Ltd

22nd May, 2008



On behalf of:

Gibbston Valley Station
C/- PO Box 523
Wanaka
New Zealand

1 Introduction

Gibbston Valley Station (GVS) is a 400 hectare property in the Kawarau Valley. Gibbston Valley Station Limited is proposing a multi-faceted development of about 160 hectares of its valley floor.

Natural Solutions *for Nature* Ltd has been engaged to prepare the following reports in respect of this proposal:

- An ecological assessment with recommendations to avoid adverse environmental effects (Part 1), and
- A conservation management plan (Part 2) which describes the means by which recommendations of the protection and enhancement of the values identified in Part 1 can be implemented.

The attachments referred to Part 1 are also used to support Part 2.

1.1 Scope of the Conservation Management Plan

The Conservation Management Plan ("the Plan") will describe:

- The recommendations for the implementation the Plan and its goals,
- Tasks required to implement the recommendations of Part 1 and the goals this Plan;
- The potential benefits associated with the implementation of the recommendations, and
- Risks and contingencies relating to the achievement of the potential benefits.

Dry land restoration is an area where research and learning is ongoing[1]. The isolated and degraded nature of many dry land community remnants means that opportunities for natural regeneration are limited. Land use within lowland and low montane areas pose an ongoing threat to our ability to sustain the remaining communities.

The recommendations of the Ecological Assessment (Part 1) have addressed these issues within the context of the Gibbston Valley Station proposal.

Implementation of this Plan will require an adaptive management approach capable of responding to the changing requirements of the site.

It is anticipated that the experiences gained at the GVS site will help inform other restoration projects within dry land environments and will in turn benefit from dry land restoration projects occurring elsewhere.

[1]Landcare Research Manaaki Whenua Collaborative Research Initiatives in sustaining and restoring biodiversity provide information on dryland restoration via their web link: http://www.landcareresearch.co.nz/research/obi_documents.asp?Objective_ID=kfk490gk40fvlo4n238bvskg

2 Goals and Objectives

The over-arching aims of the recommendations set out in this Plan are to ensure there is no loss of indigenous biodiversity from the Gibbston Valley Station through its development and that the diversity present is sustained and enhanced.

An environmental vision for the property as a whole has been developed in order to guide the creation of recommendations and identify the tasks required to implement them.

The vision

Areas of significant and interesting indigenous vegetation within the Gibbston Valley Station are protected and their floristic diversity enhanced. These areas provide readily visible examples of the natural character and diversity of Kawarau Gorge and support the process of natural regeneration within the property and surrounding areas.

Areas of significant and interesting indigenous vegetation in the vicinity of schist outcrops provide secure habitat for indigenous fauna (skinks, invertebrates and avifauna) within the Gibbston Valley Station.

Public use and enjoy trails along ridgeline and river environments which provide more healthy, naturalized settings and which meander through stone ruins and tailings.

3 Goals

The Goals

1. ***Browsing herbivores and woody weed invasions have been controlled over the lower escarpment and valley floor. Natural regeneration of indigenous vegetation is occurring within in those areas as a result of release from browsing and competition.***

2. **Indigenous species formerly present and more widespread in habitats like those within the property have been re-instated. Areas of significant indigenous vegetation are protected and enhanced.**

3. ***Wetlands will be naturalised in keeping with the geomorphological character of the land.***

4. ***Rocky habitats and indigenous vegetation in the vicinity of schist outcrops are protected and provide secure habitat for indigenous fauna (lizards, invertebrates and avifauna).***

5. ***A trail network provides a valuable community recreational asset improving public access along the Kawarau River, to adjacent and nearby protected areas and the lower escarpment of GVS.***

6. ***An integrated management plan which encompasses all aspects of the GVS proposal ensures that development is staged in a manner that provides for the protection and enhancement of indigenous vegetation and habitats of indigenous fauna.***

4 Recommendations

Management within key areas of the property is required in order to protect and enhance areas of significant and interesting indigenous vegetation, and the habitats of indigenous fauna (lizards, invertebrates and birds) within them.

Management will be most intensive on the valley flats and terrace risers up to about 500m. Extensive weed control and stock management will be undertaken within upper elevations.

Enhancement planting undertaken as part of any development and management and/ or retirement from grazing will support the regeneration of indigenous shrubland, short and tall tussock grasslands and the habitat of indigenous fauna.

The recommendations of the Ecological Assessment (Part 1) and the Goals of this Plan will be addressed under the following headings:

4.1 Control of browsing animals

4.2 Control of noxious woody weeds

4.3 The re-instatement of indigenous botanical diversity

4.4 Protection and enhancement of lizard habitat

4.5 The provision and enhancement of public access

4.6 Integration with the Gibbston Valley Station development

4.1 Control of browsing animals

Goal

1. ***Browsing herbivores and woody weed invasions have been controlled over the lower escarpment and valley floor. Natural regeneration of indigenous vegetation is occurring within in those areas as a result of release from browsing and competition.***

4.1.1 Rabbits

The control of rabbits is considered to be one of the most important components of the site's management.

Under the current infestation levels soil erosion is occurring and many areas remain vulnerable to further degradation and vegetation loss. Regeneration of indigenous herb, grass and shrub species is also likely to be inhibited if not prevented.

The following are recommendations for the control of rabbits:

a. In order to protect and enhance areas of indigenous vegetation it is recommended that intensive rabbit control be undertaken on the flats between State Highway 6 and the Kawarau River.

b. Rabbit proof fences should be installed at the eastern and western boundaries of the valley flat north of State Highway 6. Fences should extend on to DOC land if permitted and as close to the River as required for effective control. This would require agreements with DOC. It is also recommended that the southern boundary of the development area with Glenroy Station is rabbit fenced wherever this has not already occurred.

c. Styles or other appropriate measures can be installed to enable public access along the Kawarau River.

Post and wire farm or deer fencing are already present along these boundaries. Rabbit mesh can therefore be affixed to the existing fences.

Fencing the north side State Highway 6 will assist in the establishment and maintenance of rabbit control.

d. Rabbit control should be undertaken with the aim of maintaining a very low population of rabbits in these areas (i.e. no visible sign). A co-operative agreement with the Department of Conservation should be established otherwise rabbits will re-infest the property from the river margins.

e. Rabbit control work should be contracted to a suitably qualified party.

f. Control work is likely to involve laying pindone bait over the open valley flats where accessible by a four wheel drive vehicle. Poisoning will be followed up by night shooting.

g. Rabbit control will be long-term and ongoing and would benefit from a coordinated effort involving surrounding properties. It will achieve and maintain a very low population (i.e. no visible sign and little if any damage to establishing plants).

4.1.2 Goats/ Cattle

a. It is recommended that the valley floor and lower escarpments be retired from grazing.

b. Stock (escapees) from higher and/ or neighbouring land found on GVS shall be removed without delay.

4.1.3 Monitoring

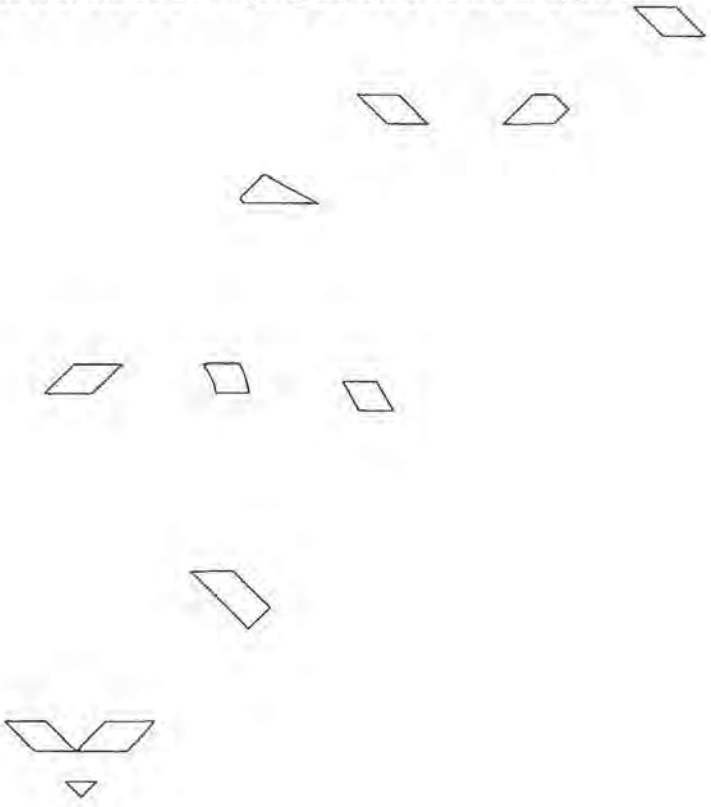
a. Rabbit numbers will be monitored and follow up control undertaken as required where existing, regenerating or establishing plants are damaged by browse and/ or a rabbit infestation becomes greater and 2 on the Modified McLean Scale in any portion of the site (Appendix 1).

b. No livestock are to be present on the lower escarpment or valley floor areas upon the implementation of this plan.

4.1.4 Contingencies/ Risks

a. A management agreement enabling control of rabbits and fencing on public land will be required from the Department of Conservation in order to prevent rabbits from re-infesting the river margins of the property. If this agreement can not be obtained, control along this boundary will difficult to achieve.

b. Rabbit control will be an ongoing aspect of land management.



4.2 Control of noxious woody weeds

Goal

1. ***Browsing herbivores and woody weed invasions have been controlled over the lower escarpment and valley floor. Natural regeneration of indigenous vegetation is occurring within in those areas as a result of release from browsing and competition.***

The control of woody weeds will be an ongoing aspect of land management with control required to support natural regeneration and the establishment of plants in revegetation and habitat enhancement areas, identified on Attachment I.

4.2.1 Woody weed control

a. The control of briar, gorse, broom, willows, thyme, conifers and other woody and herbaceous weeds are an essential aspect of the proposal particularly once stock are removed.

b. A suitably qualified contractor(s) will need to be engaged to undertake this work and control techniques appropriate to the site confirmed in consultation with that contractor.

c. All weed control will be staged with development and followed by enhancement planting. The areas where revegetation efforts will be focused are shown on Attachment I. The goal for these areas is to establish or enhance indigenous dominance in the vegetation communities.

4.2.2 Briar

a. In areas where briar control occurs, the indigenous character and diversity of areas will be improved through patch clearance and then cluster planting of grey shrubland species into areas of about $50m^2$ - variable depending on the terrain and site conditions.

b. A combination of methods will be used to clear briar, these will be confirmed following resource consent but are likely to involve; hand cutting and swabbing stumps with herbicide and any re-growth sprayed. Aerial spraying in January or February may usefully target pockets within the gully systems or larger areas of the terrace risers.

c. Clearance of tracks through the briar will be required to access and maintain planted areas. Natives will be avoided.

4.2.3 Gorse

a. Gorse is a noxious weed and will be eradicated. The escarpment infestation south the State Highway will be replaced with indigenous grey shrubland.

b. The gorse infestation on the lower flats, north of the State Highway will be replaced by a mixture of open grey shrubland with short tussock grassland in the areas indicated on Attachment I.

c. Gorse control will follow the removal of goats from the valley floor to prevent an otherwise inevitable and rapid spread.

4.2.4 Willow

a. The retention of some willows may be desirable for shelter or landscaping purposes. In these instances, over mature trees, broken and decayed limbs on otherwise healthy trees should be removed. Removal of low spreading limbs will allow for access for planting.

b. Willows will be prevented from further spread and colonization of wetland areas. Their removal is recommended in order to facilitate the naturalisation of streams and wetland character and diversity.

4.2.5 Thyme

a. Thyme is currently at low levels. It is recommended that thyme be prevented from spreading further within the site. In particular it should be controlled on the dry, escarpment ridges which support a *Raoulia* cushionfield – *Pimelea* shrubland community – refer to Attachments D and I.

4.2.6 Conifers

a. Conifers, predominantly *Pinus radiata*, are slowly spreading over the dry escarpment areas. It is recommended that isolated wilding pines e.g. *Pinus radiata* and any *Pinus contorta* be felled.

4.2.7 Control of other woody and herbaceous weeds

a. It is recommended that shrubs and trees (exotic broom, cotoneaster, buddleia, elder and hawthorn) be controlled and removed from areas where indigenous vegetation communities are to be re-instated and/ or enhanced and where lizard habitat enhancement or establishment is to occur.

4.2.9 Monitoring

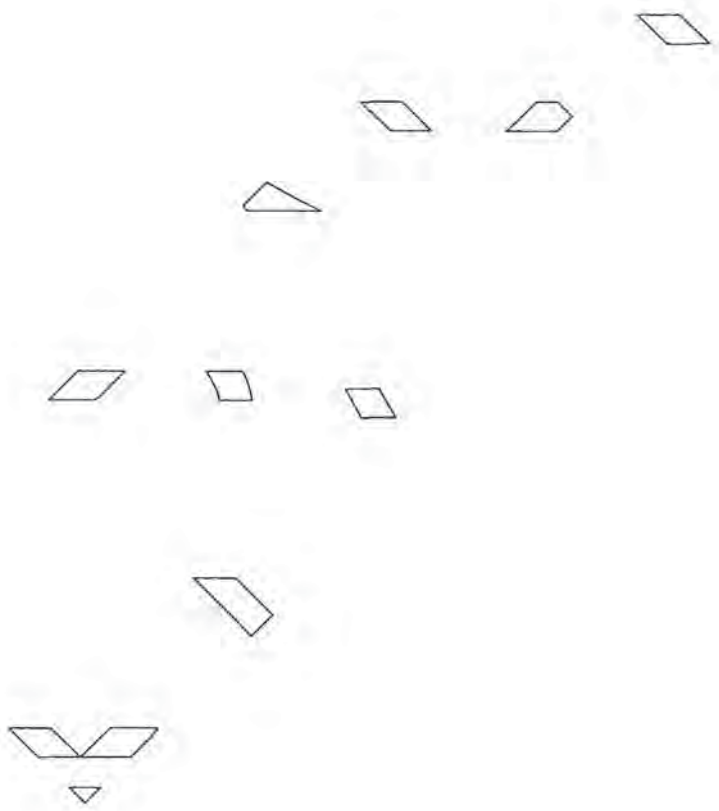
a. Indigenous plants within areas to be revegetated and enhanced will be clearly visible and free from woody or herbaceous weed competition during establishment.

b. Photo-monitoring will be used to monitor the transition of the site toward a more natural and indigenous character. Photo points will be established prior to disturbance or modification and will occur at three year intervals.

4.2.10 Risks/ Contingencies

a. Weed control will be ongoing in nature and it should be responsive to the changing needs of the site as management is implemented.

b. In the event of early failures during establishment or risk to non-target species from herbicide application or mechanical control, the methods and or timeframes may need to be adjusted.



4.3 The re-instatement of indigenous botanical diversity

Goals

2. **Indigenous species formerly present and more widespread in habitats like those within the property have been re-instated. Areas of significant indigenous vegetation are protected and enhanced.**

3. ***Wetlands will be naturalised in keeping with the geomorphological character of the land.***

4. ***Rocky habitats and indigenous vegetation in the vicinity of schist outcrops are protected and provide secure habitat for indigenous fauna (lizards, invertebrates and avifauna).***

The terms restorative or restoration planting and revegetation are used synonymously in this Plan.

Restorative planting is proposed for approximately 127 hectares. Sixty-one hectares will be a combination of indigenous savannah (11 ha), grey shrubland (31 ha), wetland (5 ha), short tussock grasslands (13 ha) and native beech forest (1.4 ha). Managed dry land meadow with occasional short tussock species and the Raoulia – Pimelea community comprise the balance of 76 hectares.

Table 1 provides a list of the species recommended for incorporation into the communities being re-instated. It has been placed at the back of this Plan. Areas where restorative planting is recommended are identified on Attachment I. Within each area planting should target the sites most likely to naturally support establishing plantings.

4.3.1 Shrubland (grey shrubland) associated with schist outcrops (*part of 31 ha*)

a. Structural and floristic diversity as well as habitat value for invertebrates and lizards is to be enhanced by planting of small clusters in the vicinity of rock outcrops and rocky habitats. Clusters will vary in size depending on available soil and microsites.

b. Enhancement planting should avoid obscuring or damaging archeological sites identified and any others found. Table 1 indicates species appropriate for incorporation into these areas, Attachment I identifies the areas where planting will occur. Rocky shrublands account for a portion of the estimated 31 hectares of grey shrubland planting.

c. Planted areas along the northern boundary should occur in a manner that does not delineate the boundary with the Department of Conservation Reserve adjacent to the Kawarau Reserve insofar as that is possible.

d. Seed hand collected from the area will be sown, where practical and possible, as an experimental means of encouraging regeneration in association with any enhancement planting. This method will not be relied upon to achieve the revegetation goals of the Plan and forms an interesting and optional component of the Plan.

4.3.2 "Indigenous Savannah" (*c. 11 ha*) - Open grey shrubland and short tussock (*13 ha*) – exotic pasture grassland (*portion of 76 ha*)

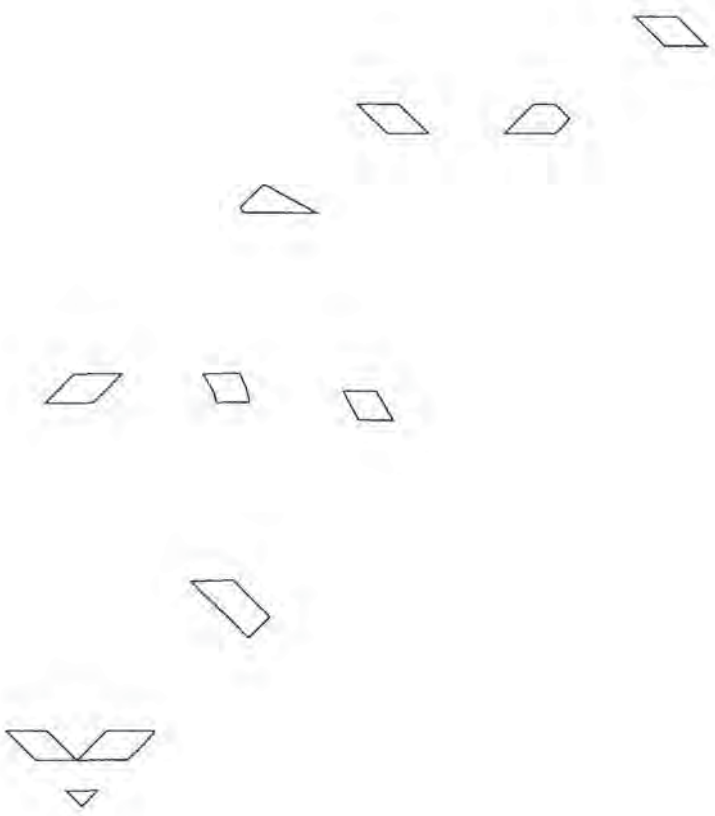
a. The valley floor vegetation will be enhanced by supplementing the existing, sparsely distributed shrubland in the areas shown on Attachment I. This will enhance the habitat of invertebrates and lizards and increase the floristic diversity of the site.

b. Tree species such as kowhai, *Olearia lineata*, *Phyllocladus alpinus* or mountain totara will blend the community associated with the schist outcrops with the open shrubland on the open valley floor. Table 1 guides the species composition of this community.

c. It is recommended that where possible, seed is collected from the site or valley surrounds. However, due to the fragmented nature of these communities local

seed/ cutting collection may not be possible. Table 1 provides information regarding areas appropriate for eco-sourcing

d. The form (physical appearance) of the community will be like that of a savannah in that it will have an open shrub canopy with a grassland understory.



4.3.3 Grey shrubland on terrace escarpment and gullies

a. It is recommended that grey shrubland be reinstated within the areas indicated on Attachment I. Gully and escarpments represent a proportion of an estimated 31 hectares of proposed grey shrubland planting.

b. Cluster planting will occur in pockets of about ($50m^2$ –depending on the terrain and site conditions) at about 0.75m spacing to minimise and acknowledge the potential for losses. Once established, plant densities should allow sufficient spacing for appropriate canopy closure which should be denser in gullies and sites with higher soil moisture and will naturally be more open on drier interceding sites.

c. Where briar or gorse control is required, it will be coordinated with planting efforts and will employ follow up methods that do not threatened establishing plants.. Species identified in Table 1 provide an indication of the composition of enhanced communities.

4.3.4 Naturalisation of streams and seepages (*c. 5 ha*)

a. Restorative work should focus on re-instating natural character of seepage and riparian communities covering about 5 hectares.

b. The margins of creeks and all ephemeral streams will be naturalised by planting along natural flow patterns and/ or where practicable softening the riparian areas where creeks have necessarily been confined (e.g. culverts under the State Highway).

c. The retention of willows may be desirable for landscaping purposes in some places. Where this is the case they should be limbed and under planted with indigenous species. Willows will otherwise be removed from seepages and stream environments.

d. Ponds redundant to the needs of GVS will be reinstated into seepage communities where ever possible and new ponds required will be located in areas which support of the natural inclination of the land e.g. within natural depressions and damp pasture.

4.3.5 Raoulia cushionfield – Pimelea shrubland

a. The most important management actions affecting this community are rabbit and weed control. The depleted terrace edge community is likely to have a strong response to rabbit control with infestations of briar, mullein, thistle, thyme and exotic pasture sward species dramatically increasing following control. The *Pimelea*, *Melicytus*, spring annuals (if present), and any remaining indigenous herbs and grasses are however also likely to be released. Rabbit and weed control is therefore recommended and this work is likely to be ongoing.

b. Management of this area will be responsive to changing site condition. Once the response of the site to release from browsing occurs and requirements for weed control become known supplemental planting of low, dry land shrubs is recommended as per Table 1 and Attachment I.

c. Planting will supplement areas with established low, open shrubland bounding the grey shrubland communities.

d. Bare ground is also important to invertebrates and portions of this area can be maintained as such through weed control unless likely to cause or exacerbate soil erosion.

4.3.6 Beech/ Podocarp forest (*c. 1.4 ha*)

a. A trial approach to the re-instatement of about 1.4 hectares of beech forest (*Nothofagus solandri* var. *cliffortioides* and *N menziesii*) will be adopted - Attachment I. This community will include associate species such as the podocarps mountain totara *Podocarpus hallii/ cunninghamii* and mountain celery pine *Phyllocladus alpinus*. Other species are indicated in Table 1. .

b. It is recommended that beech trees initially be introduced into Toms Creek in several small clusters (e.g. 15 to 30) targeting areas most likely to support their establishment. Then, depending on the success of establishment, planting can be progressively expanded within the gully.

4.3.7 General recommendations

a. It is recommended that restorative planting follow initial weed control and site preparation over a ten year establishment phase.

b. Eco-sourcing forms an important aspect of revegetation because of the small and isolated nature of the site's indigenous communities and the presence of threatened species. Available seed sources for some species are limited and some species widely available from nurseries may be commercial hybrids. Table 1 provides an indication of the areas from which seed can appropriately be sourced – it may be revised with the benefit of further investigation.

c. Given the potential for natural regeneration into adjoining conservation land to occur (as a result of the management and revegetation efforts within GVS), it is important that the final eco-sourcing recommendations are implemented.

d. Many plants will need to be grown to order and may require permission from DoC to collect seed (e.g. *Carmichaelia compacta/ Lepidium sisymbrioides*).

e. The opportunity to hand collect and propagate seed at the GVS nursery should be explored in more detail following resource consent. This could include the trial use of raised beds using soil excavated from within the development site. Seed collected from the site and surrounds could then be grown and planted out into the site.

4.3.8 Monitoring

a. Establishment success and enhanced natural character will be monitored using photographs. Photo points will be established prior to any site works and repeated every three years.

b. Natural regeneration and establishment of natives within restored communities will indicate the achievement of the over-arching aim and goals of this Plan.

4.3.9 Risks/ Contingencies

a. Plant availability is reliant upon the production and collection of seeds and cuttings from ecologically appropriate locations. Supply may be delayed if seeds are not available or nursery seedlings are slow growing or fail to thrive.

b. Plants may require additional rabbit protection with repellent, sleeves or rabbit proof mesh around the planted clusters. Areas of dense vegetation provide good cover for rabbits making their control more difficult. Effective rabbit control will be critical to the establishment of plantings.

c. The site provides a challenging environment for restoration. Planting should initially occur adjacent to existing outlying shrubs within or at the margins of existing shrubland and adjacent to schist outcrops, which will provide shelter from frost and sun.

d. Well balanced root: shoot ratios will be important to the successful establishment of nursery stock. Planting into exposed areas will leave plants vulnerable to frost, wind and soil moisture deficits. Deep planting with good horticultural technique will be essential.

e. High plant losses should be anticipated if plants are not irrigated and planting densities should therefore be high. Allowance for about 30 per cent mortality as a minimum should be planned for with anything less than 50 per cent mortality considered a success in the absence of irrigation.

f. Where extensive restorative planting occurs in the absence of significant shelter, it should be at relatively close spacing (0.75 to 1.0 metre spacing, for shrubs, less for tussocks). Small root trainer stock should be used rather than larger planter bag stock.

g. Irrigation will improve the probability of successful establishment.

h. Planting into the most favourable microsites will be undertaken in the initial establishment phases. The species composition of subsequent plant orders will be modified based on initial successes.

4.4 Protection and enhancement of lizard habitat

Goal

4. ***Areas of significant and interesting indigenous vegetation in the vicinity of schist outcrops are protected and provide secure habitat for indigenous fauna (lizards, invertebrates and avifauna).***

4.4.1 Protection and enhancement of rocky lizard habitat

a. Disturbance to habitat in the vicinity of schist outcrops is to be avoided or minimised.

b. Any development in the vicinity of these areas should result in a net improvement in the quality and quantity of rocky shrubland habitat on the surrounding valley floor.

c. Areas of rocky shrubland habitat identified as areas A to F on Attachment D1 should be linked through enhancement planting and the relocation of rock that may become available through the development of the site. Areas identified for habitat enhancement are identified on Attachment I but should not be strictly limited to those areas if the opportunity to expand further exists.

d. Where the need for lizard and/ or habitat translocation or enhancement occurs, it should be undertaken in accordance with the Lizard Translocation and Habitat Enhancement Plan (Attachment H). This work should be staged with development.

e. The staging of development will be determined following the outcome of the GVS resource consent application and the creation of an integrated management plan that encompasses the construction programme, the implementation of the Conservation Management Plan, Attachment H and the recommendations of this and any other consultant reports. The integrated management plan will

recognise the seasonal requirements associated with habitat management and planting. See section 4.6.

f. A suitably qualified ecologist and/ or herpetologist will provide contractor briefings and monitor earthworks undertaken in the vicinity of the schist outcrops. This will facilitate the containment of any disturbance to habitat and therefore effects.

g. It is also recommended that a suitably qualified ecologist or herpetologist work along side contractors tasked with the translocation of rocks for habitat replacement and/ or enhancement.

h. It is also recommended that a suitably qualified ecologist works along side the golf course design team to ensure the avoidance or disturbance to threatened plants and that appropriate opportunities to enhance lizard habitat and indigenous vegetation are taken as described in section 5.1.2 of Part 1 – Ecological Assessment.

4.4.3 Monitoring

a. This will occur as per the Lizard Translocation and Habitat Enhancement Plan – Attachment H.

b. Artificial Cover Objects and hand collection will be the primary means of recapturing/ capturing lizards.

c. Monitoring will provide a population index that will indicate changes in populations over time (after Wilson et al.).

4.4.4 Risks/ Contingencies

a. Some animals may avoid capture or home back to disturbed areas.

b. To minimise the potential for losses, it is recommended that any translocation work be restricted to the period between spring and autumn (September to April) when animals are more mobile and therefore more readily captured and translocated – refer to Attachment H for further details.

4.5 Public Access to be provided

Goal

5. ***A trail network provides a valuable community recreational asset improving public access along the Kawarau River, to adjacent and nearby protected areas and the lower escarpment of GVS.***

4.5.1 Public Access

a. The Gibbston Valley Community Association (GVCA) has initiated the development of a walking track along the Kawarau River. GVS has and will continue to liaise with the GVCA regarding the identification of access options on GVS land that are more practical than can be achieved on the marginal strip or other riverside conservation land.

b. Where the Gibbston River Trail and any other trail network is established on GVS they should use and share existing bulldozed tracks and any new tracks established where it is safe and practical to do so.

c. The formation of trails will incorporate the applicable recommendations of Part 1 and sections 4.1 to 4.4 of this Plan in their design and management.

d. It is important that the final location of the trail is determined on site as this provides the flexibility to avoid threatened plants, habitats or previously unidentified and interesting site features encountered during construction.

e. Alignments will ensure they do not create or exacerbate soil erosion.

f. It is recommended that styles or "kissing" gates be installed over rabbit proof fencing at the eastern and western boundaries of the valley floor.

4.5.2 Monitoring

- Monitoring of trail condition and compliance with any agreed standards will be the determined by the conditions of a formal easement agreement. NSN is aware that GVS has volunteered to accept responsibility for maintenance of the track whether or not it is location on GVS land between the eastern and western boundaries of GVS.

4.5.3 Risks/ Contingencies

- The formation of a trail on GVS is at this stage subject to obtaining resource consent. Failing this, the trail will return to the former and more difficult alignment identified by the GVCA.

- Vesting of the proposed easement would most logically be with Department of Conservation. This will require a management agreement for the ongoing maintenance.

4.6 Integration with the GVS development

Goal

6. ***An integrated management plan which encompasses all aspects of the GVS proposal ensures that development is staged in a manner that provides for the protection and enhancement of indigenous vegetation and habitats of indigenous fauna.***

4.6.1 Integrated Project Management

a. It is recommended that an integrated land management plan be prepared as an outcome of obtaining resource consent. This Conservation Management Plan (Part 2) will support the development of the integrated land management plan and Gibbston Valley Station's stated intention to create an environmentally sustainable resort.

b. The integrated land management plan will incorporate all aspects and requirements for land management (this Plan), site development including construction and landscaping plans, and any other recommendations requiring integration with the site's overall management and development.

c. An implementation schedule will be prepared that provides for the strategic staging and co-ordination of the tasks required by all aspects of the development. It will be updated as tasks and goals of the Integrated Land Management Plan are achieved.

Table 2 summarises the recommended tasks for implementing this Plan. The following list provides an indication only of the components that will need to be included in the integrated land management plan.

- The implementation of landscape scale rabbit control
- Control of woody weeds

- The re-instatement and enhancement of indigenous biodiversity, including the incorporation of threatened species
- Naturalisation and enhancement of wetlands
- Incorporation of public access into areas of historic, floristic and wildlife interest
- The identification, protection and interpretation of historic sites
- The construction and development of the GVS infrastructure and Resort
- Establishment of approved Landscape Master Plans
- The use and incorporation of waste water disposal into revegetated areas
- Mitigation of the development's effects on wildlife through enhancement and translocation of habitat for lizards
- The provision of interpretive information regarding the site and its natural history including the Geopreservation site near the western boundary.

4.6.2 Monitoring

a. Integration of the development will require the ecological considerations to be incorporated into a project implementation schedule.

b. Annual work plans will be prepared which incorporate the requirements of long term staging and annual implementation tasks and management. They will be reviewed annually and reports confirming the achievement of and/ or progress on tasks and goals will provide a mechanism for project audit.

4.6.3 Risks/ Contingencies

a. If ecological recommendations are not implemented along side infrastructural construction, service installation, and or residential development, particularly in areas north of the State Highway, the potential ecological benefits may not be fully realised.

b. There are seasonal constraints associated with the enhancement and management of vegetation, wildlife and habitats. Plan schedules should reflect these.

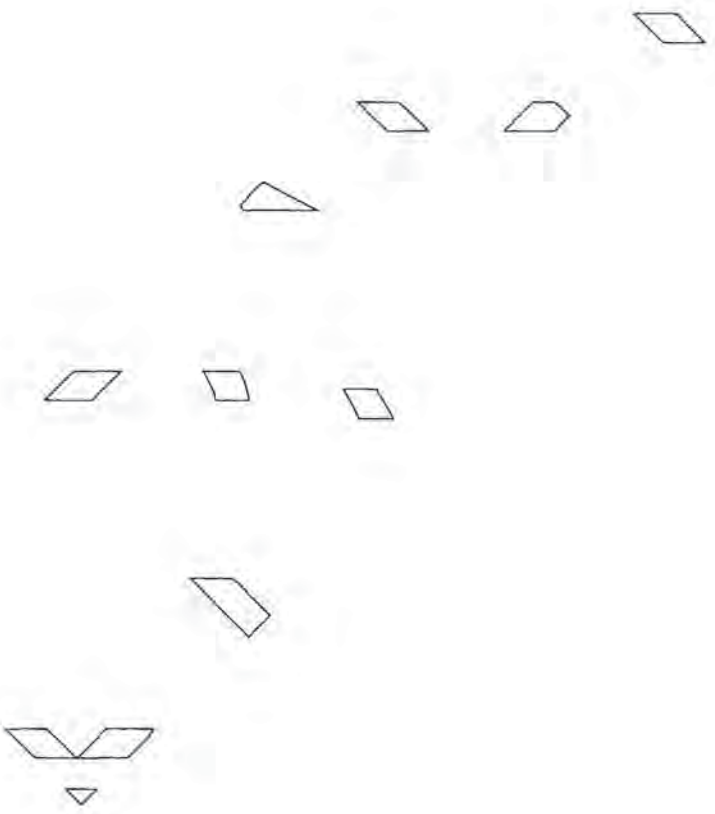


Table 1 Species recommended for indigenous revegetation

The site is recognised as a dry environment, the species selected for restorative planting are those likely to do best in the conditions naturally experienced at the site.

Open Shrubland associated with rocky habitats and lizard habitat enhancement areas

Structural and floristic diversity as well as habitat value for invertebrates and lizards is to be enhanced by planting of small clusters in the vicinity of rock outcrops and rocky habitats. An occasional Kowhai, *Olearia lineata*, *Phyllocladus alpinus* or Hall's totara will emerge from the shrub layer. Occasional clusters of tussocks and low shrubs will supplement those found in the vicinity of rock outcrops. Threatened species will be protected.

Botanical name	**Common name**	**Eco-sourcing* guide**
Aciphylla aurea	Golden Spaniard	Central and western Otago/ Northern Southland
Carmichaelia petriei	Desert broom	Central and western Otago/ Northern Southland
Coprosma crassifolia		Central and western Otago/ Northern Southland
Coprosma petriei	Turfy coprosma	Central and western Otago/ Northern Southland
Coprosma propinqua	Mingimingi	Central and western Otago/ Northern Southland
Coprosma rigida	Coprosma	Central and western Otago/ Northern Southland
Discaria toumatou	Matagouri	Central and western Otago/ Northern Southland
Elymus solandri	Blue wheat grass	Central and western Otago/ Northern Southland
Helichrysum lanceolatum		Central and western Otago/ Northern Southland
Lepidium sisymbrioides	Kawarau cress/ schist cress	Kawarau Gorge with agreement from DOC
Melicytus alpinus	Porcupine shrub	Central and western Otago/ Northern Southland
Muehlenbeckia complexa	Small-leaved pohuehue	Central and western Otago/

		Northern Southland
Mysine divaricata	*Weeping mapou*	Central and western Otago/ Northern Southland
Olearia avicenniifolia	*Mountain akeake*	Central and western Otago/ Northern Southland
Olearia lineata		Central and western Otago/ Northern Southland. Avoid *Olearia dartonii*, a cultivar erroneously grown as *O lineata*.
Ozothamnus leptophyllus	Tauhinu	Central and western Otago/ Northern Southland
Pimelea aridula		Remarkables/ Pisa Ecological Districts / Central and inland Otago
Poa cita	Silver tussock	Central and western Otago/ Northern Southland
Poa colensoi	Blue tussock	Central and western Otago/ Northern Southland
Rubus schmidelioides	Bush lawyer	Central and western Otago/ Northern Southland
Sophora microphylla	Kowhai	At risk from nursery hybrids, eco-source from Gibbston Valley

Indigenous Savannah - Grey shrubland and short tussock/ exotic pasture grassland

The floristic diversity and structure will be enhanced by supplementing the existing, sparsely distributed shrubland. The habitat of invertebrates and lizards will be enhanced. The visual presence of *Carmichaelia, Olearia, Coprosmas, Melicytus alpinus* and lianes along with short tussock grassland will enhance the indigenous character of the valley while retaining an open character within the planted areas. An occasional taller or emergent species such as kowhai, *Olearia lineata, Phyllocladus alpinus* or mountain totara will merge the community of the schist outcrops into the open shrubland on the deeper soils of the fans and valley floor.

Botanical name	**Common name**	**Eco-sourcing guide**
Aciphylla aurea	Golden Spaniard	Central and western Otago/ Northern Southland
Carmichaelia compacta	Cromwell broom	Kawarau Gorge with agreement from DOC

Carmichaelia petriei	Desert broom	Central and western Otago/ Northern Southland
Coprosma propinqua	Mingimingi	Central and western Otago/ Northern Southland
Corokia cotoneaster	Korokia	Central and western Otago/ Northern Southland
Discaria toumatou	Matagouri	Central and western Otago/ Northern Southland
Elymus solandri	Blue wheat grass	Central and western Otago/ Northern Southland
Hebe cupressoides	Cypress hebe	Central and western Otago/ Northern Southland/ McKenzie Basin
Melicytus alpinus	Porcupine shrub	Central and western Otago/ Northern Southland
Muehlenbeckia complexa	Small-leaved pohuehue	Central and western Otago/ Northern Southland
Olearia avicenniifolia	Mountain akeake	Central and western Otago/ Northern Southland
Olearia hectorii	Hector's tree daisy	Lakes, Shotover, Umbrella, Eyre, Nokomai, Hokonui Ecological Districts
Olearia lineata		Central Otago. Avoid *Olearia dartonii*, a cultivar erroneously grown as *O lineata*.
Olearia odorata	Scented tree daisy	Central and western Otago/ Northern Southland
Phyllocladus alpinus	Mountain toatoa	Central and western Otago/ Northern Southland
Pimelea aridula		Remarkables/ Pisa Ecological Districts / Central and inland Otago
Poa cita	Silver tussock	Central and western Otago/ Northern Southland
Poa colensoi	Blue tussock	Central and western Otago/ Northern Southland
Rubus schmidelioides	Bush lawyer	Central and western Otago/ Northern Southland
Sophora microphylla	Kowhai	At risk from nursery hybrids, eco-source from Gibbston

		Valley
Grey shrubland on terrace escarpments and gullies Indigenous composition of grey shrubland communities will be supplemented and as briar and gorse is removed, the native character will dominate. This will support natural regeneration of indigenous species within these communities and prevent further erosion of indigenous character.		
Botanical name	**Common name**	**Eco-sourcing guide**
Aristotelia fruticosa	Mountain wineberry	Central Otago
Carmichaelia petriei	Desert broom	Central and western Otago/ Northern Southland
Coprosma intertexta		Central Otago
Coprosma crassifolia		Central and western Otago
Coprosma propinqua	Mingimingi	Central and western Otago/ Northern Southland
Corokia cotoneaster	Korokia	Central and western Otago/ Northern Southland
Discaria toumatou	Matagouri	Central and western Otago/ Northern Southland
Helichrysum lanceolatum		Central and western Otago/ Northern Southland
Melicytus alpinus	Porcupine shrub	Central and western Otago/ Northern Southland
Muehlenbeckia complexa	Small-leaved pohuehue	Central and western Otago/ Northern Southland
Myrsine divaricata	*Weeping mapou*	Central and western Otago/ Northern Southland
Olearia avicenniifolia	*Mountain akeake*	Central and western Otago/ Northern Southland
Olearia lineata		Central and western Otago/ Northern SouthlandCentral Otago. Avoid *Olearia dartonii*, a cultivar erroneously grown as *O lineata*.
Olearia odorata	Scented tree daisy	Central and western Otago/ Northern Southland

Ozothamnus leptophyllus	Tauhinu	Central and western Otago/ Northern Southland
Pimelea aridula		Remarkables/ Pisa Ecological Districts / Central and inland Otago
Rubus schmidelioides	Bush lawyer	Central and western Otago/ Northern Southland
Sophora microphylla	Kowhai	At risk from nursery hybrids, eco-source from Gibbston Valley or Clutha River Valley for this project
Wetlands - streams and seepages Restorative planting will re-instate indigenous communities associated with ephemeral and permanent streams, seepage and flush areas.		
Aristotelia fruticosa	Mountain wineberry	Central Otago
Carex buchananii	Buchanans sedge	Central Otago
Carex coriacea	Rautahi	Central and western Otago/ Northern Southland
Carex secta	Purei	Central and western Otago/ Northern Southland
Chionochloa rubra subsp. *cuprea*	Red tussock	Central and western Otago/ Northern Southland
Coprosma propinqua	Mingimingi	Central and western Otago/ Northern Southland
Coprosma rugosa	Coprosma rugosa	Central and western Otago/ Northern Southland
Cordyline australis	Cabbage tree	Central Otago
Cortaderia richardii	Toetoe	Central and western Otago/ Northern Southland
Juncus australis	Rush	Central and western Otago/ Northern Southland
Juncus gregiflorus/ edgariae	Rush	Central and western Otago/ Northern Southland
Eleocharis acuta	Eleocharis acuta	Central and western Otago/ Northern Southland

Leptospermum scoparium	manuka	Central and western Otago/ Northern Southland
Olearia bullata		Central and western Otago/ Northern Southland
Olearia lineata		Central Otago. Avoid *Olearia dartonii*, a cultivar erroneously grown as *O lineata*.
Olearia odorata	Scented tree daisy	Central and western Otago/ Northern Southland
Phormium tenax	Harakeke	Central and western Otago/ Northern Southland
Schoenus pauciflorus	Bog rush	Central and western Otago/ Northern Southland

Raoulia cushion – Pimelea shrubland

The *Pimelea*, *Melicytus*, spring annuals (if present), and any remaining indigenous herb and grasses will be released from browsing pressure. Control of woody weeds and the exotic grass sward will be undertaken to prevent the suppression of indigenous species.

Patches of bare ground may persist as they provide potentially valuable habitat for invertebrates.

A low level of supplemental planting is recommended in order to enhance the natural character and diversity of the terrace edge communities once the response of the site to release from browsing occurs and requirements for weed control become known. Management of this area will be responsive to changing site condition.

Pimelea aridula		Remarkables/ Pisa Ecological Districts / Central and inland Otago
Carmichaelia compacta	Cromwell broom	Kawarau Gorge with agreement from DOC
Carmichaelia petriei	Desert broom	Central and western Otago/ Northern Southland
Melicytus alpinus	Porcupine shrub	Central and western Otago/ Northern Southland
Poa cita	Silver tussock	Central and western Otago/ Northern Southland
Poa colensoi	Blue tussock	Central and western Otago/ Northern Southland
Festuca novae-zelandiae	Hard tussock	Central and western Otago/

		Northern Southland
Beech/ Podocarp forest If able to establish, the beech community should appear as a remnant within the Kawarau Valley. The re-instatement of a beech/ podocarp community will introduce a visible example of lost indigenous diversity and over time (hundreds of years) may become a founding outlier in a more comprehensively restored and sustainably managed landscape.		
Aristotelia fruticosa	Mountain wineberry	Central Otago
Coprosma crassifolia		Central and western Otago/ Northern Southland
Coprosma linariifolia	Mikimiki/ yellow wood	Central and western Otago/ Northern Southland
Coprosma propinqua	Mingimingi	Central and western Otago/ Northern Southland
Corokia cotoneaster	Korokia	Central and western Otago/ Northern Southland
Hebe salicifolia	Koromiko	Central and western Otago/ Northern Southland
Muehlenbeckia complexa	Small-leaved pohuehue	Central and western Otago/ Northern Southland
Nothofagus menziesii	Silver beech	Central and western Otago/ Northern Southland
Nothofagus solandri var *cliffortioides*	Mountain beech	Central and western Otago/ Northern Southland
Olearia avicenniifolia	*Mountain akeake*	Central and western Otago/ Northern Southland
Phyllocladus alpinus	Mountain toatoa	Central and western Otago/ Northern Southland
Podocarpus hallii/ cunninghamii	Mountain totara	Central and western Otago/ Northern Southland
Polystichum vestitum	Prickly shield fern	Central and western Otago/ Northern Southland
Rubus schmidelioides	Bush lawyer	Central and western Otago/ Northern Southland

* Guidance has been provided regarding eco-sourcing. These recommendations are the result of research into the known distributional ranges, taxonomic stability and level of hybridization, prevalence of nursery cultivars in species that are readily available from nurseries. Reference to eco-sourcing assumes that suppliers will obtain either seed or cuttings from plants grown in wild populations, in the regions identified and from sites that are environmentally similar to the GVS site within those regions.

In some instances a restricted range for collection has been identified even though the natural distributional range extends well beyond that given and the taxon is secure. The recommendation for source material in these instances reflects the fact that the species is readily available within the range identified and there should therefore be no obstacle to obtaining local seed/ cuttings for propagation. Additionally there is a greater probability of obtaining plants which are more ecologically adapted to the site by collecting from within range identified.

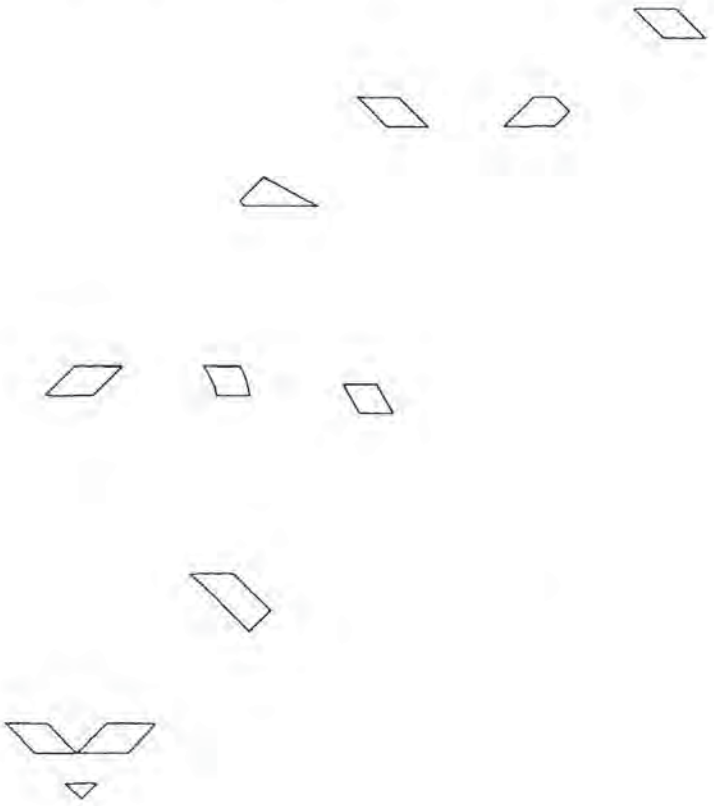


Table 2 Tasks recommended for implementation

Table 2 summarises the tasks, and seasons over which work should be undertaken and an indication of the costs associated with each task.

A comprehensive integrated management plan will co-ordinate and determine the appropriate staging sequence of the tasks identified within this plan and set out below. The exact timing of many will be dependent upon the when disturbance events are scheduled to occur. As many of the required tasks associated with wildlife management, habitat and vegetation enhancement, have seasonal constraints this table highlights these.

Task	Seasonality
Control of browsing animals	
Fencing areas of rabbit control	summer/ autumn
Rabbit control – valley flats	March to September.
Rabbit control – lower terrace risers to 500 metres	To be undertaken in winter.
Follow up control	Ongoing as required
Possum bait stations – pindone pellets	If and when necessary – spring and autumn
Control of noxious woody weeds	
Control and remove broom, gorse and other woody weeds – *priority target areas to be determined by integrated management plan*	Spring - summer
Fell conifers – *mostly outside of the proposed development area*	Spring/ summer – prior to coning
Follow up conifer control	Ongoing – every 5 to 8 years following initial control
Hand/ chemical release from rank grass. Mullein and thistles – defoliation via mowing/ scrub bar	November, January, March – as/ if needed
Fell and paint stumps of sycamores – *outside of proposed development area*	Autumn

Re-instate botanical diversity	
Arrange permit for collection of seed for threatened species – e.g. *Carmichaelia compacta, Olearia, Lepidium etc.*	Within in one year of obtaining resource consent
Order and arrange growing contracts for plants species	Within in one year of obtaining resource consent
Seed collection	Summer/ autumn following the confirmation of resource consent
Enhancement planting	To be staged with development.
Maintenance – release from weeds and browsing from around plantings	Ongoing - spring and autumn
Follow up planting where required 30% of previous season's planting cost, per annum	Autumn/ spring as required
Lizard translocation and habitat enhancement	
Initial identification of potentially affected lizards (capture/ mark)	Spring/ autumn prior to disturbance or site changes
Enhancement planting	Spring/ autumn – ongoing and staged with development
Capture/ mark/ recapture lizards in areas of potential disturbance, translocate to existing habitat	Spring/ autumn - staged with development
Monitoring and reporting	ongoing
Relocate schist/ rock to habitat enhancement areas	Ongoing as required and staged with development
Capture/ mark/ recapture lizards in areas of potential disturbance, translocate into enhanced habitat and linkage areas	Spring/ autumn - staged with development
Capture/ mark/ recapture lizards in areas of potential disturbance, translocate into recently established new habitat	Spring/ autumn - staged with development

Provide or enhance public access	
Removal of deer fence from northern boundary	Following confirmation of resource consent - staged with development
Liaise with the Gibbston Community Association regarding trail alignment, formation, signs and interpretation	formal establishment of easement(s) to be agreed between DOC and GVS following confirmation of resource consent

** Costs and timeframes are indicative only. Timeframes illustrate the sequence of events and will be dependent upon availability of plant material and the outcomes of the GVS resource consent application.*

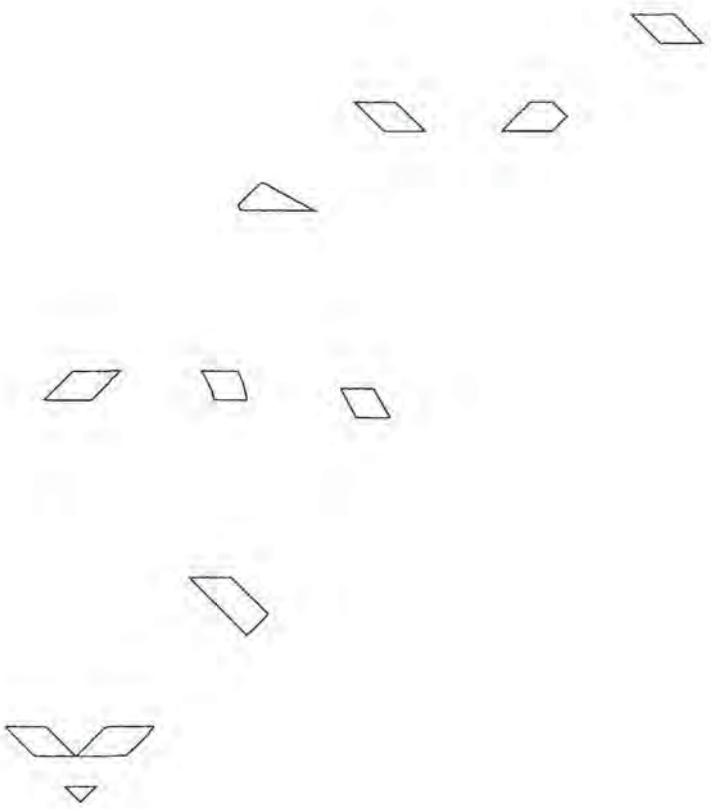
 # Rabbit fencing on boundaries with Glenroy Station will require rabbit mesh on 6 inch deer netting. This is more than the amount indicated.

8 References

Johnson, P. and Gerbeaux, P. (2004): *Wetland Types in New Zealand.* Department of Conservation, Te Papa Atawhai, Wellington

Meurk, C. and Hall, M.J. (2006): *Options for enhancing forest biodiversity across New Zealand's managed landscapes based on ecosystem modeling and spatial design.*

Meurk, C. (1997): *Rediscovering and restoring natural heritage in the Wakatipu Basin* Landcare Research Contract Report. Prepared for the Wakatipu Environmental Society Inc. LC9697/081



Appendix 1

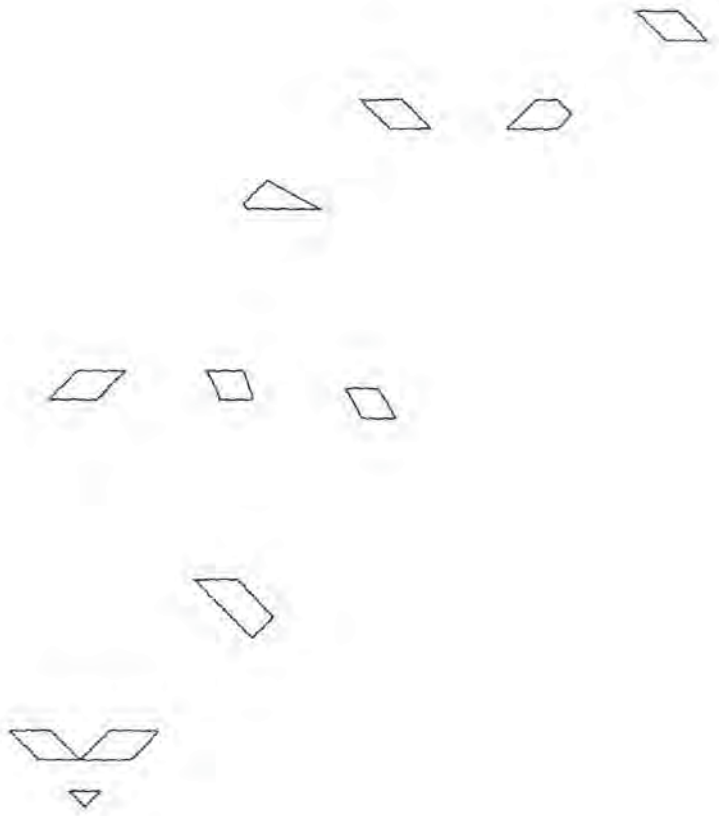
Modified McLean Scale

1	No sign seen. No rabbits seen.
2	Very infrequent sign present. Unlikely to see rabbits.
3	Sign infrequent with heaps more than 10 metres apart. Odd rabbit may be seen.
4	Sign frequent with some heaps more than 5 metres but less than 10 metres apart. Groups of rabbits may be seen.
5	Sign very frequent with heaps less than 5 metres apart in pockets. Rabbits spreading.
6	Sign very frequent with heaps often less than 5 metres apart over the whole area. Rabbits may be seen over the whole area.
7	Sign very frequent with 2-3 heaps often less than 5 metres apart over the whole area. Rabbits may be seen in large numbers over the whole area.
8	Sign very frequent with 3 or more heaps often less than 5 metres apart over the whole area. Rabbits likely to be seen in large numbers over the whole area.

The table below gives an indication of the number of assessment points required per area.

Number of Assessment Points	Size of Block/ Property
20 - 50	< 100 hectares
50 - 75	100 – 500 hectares
75 - 100	500 – 1000 hectares
100_	> 1000 hectares

Source: National Possum Control Agencies (2006): Pest Rabbits Monitoring and Control. Best Practice Guidelines. August 2006, Wellington.



APPENDIX E

Development Proposals Masterplan

gibbston valley station | gibbston

development proposal | master plan | DP 01 a1

Gibbston Valley STATION | PATERSON PITTS | CONSTRUCTION MANAGEMENT SERVICES | Natural Solutions for Nature Limited | MICHAEL WYATT ARCHITECT LTD | Turner Macpherson golf design

MPA1416D-03.vwx

gibbston valley station | gibbston | development proposal | master plan | DP 01 | Ralf Kröger and Alan Cutler | Rodrigo Pellizzari 27/08/07 | 1:8000 @ A3

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morgan+pollard associates

APPENDIX F

Indicative Floor Plans and Elevations for Visitor Accommodation Units (Types A, B and C)