

2013

Henley Downs Plan Change - Ecological Assessment

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1/31/2013

Ecological Values

1.0 Background

Natural Solutions for Nature Ltd has been engaged to identify ecological values with respect to a proposed plan change affecting the Henley Downs portion of the Jacks Point Resort Zone.

In 2002 Darby Partners Ltd commissioned the Coneburn Area Resource Study (Coneburn Study). The Coneburn Study provided a summary of the natural resources, including ecological, existing and potential landuses of the Coneburn Area. This report provides a more detailed assessment of ecological values within the Henley Downs portion of the zone.

Subsequent to the publication of the Coneburn Study, the Land Environment of New Zealand (LENZ) classification system was developed (2003) and then the Threatened Environment Classification (TEC) system (2007) was developed. These classification systems have provided tools for assessing the significance of the values present. The Threatened Environment Classification uses indigenous vegetation cover as a surrogate for indigenous biodiversity and provides a national context for the vulnerability of the ecosystems represented by the vegetation cover. In addition, the New Zealand Threat Classification system for indigenous plants and wildlife was reviewed (2008) and lists of threatened birds and plants were updated in 2008 and 2009 respectively.

This report will

- Identify the presence and location of values of significance within the Henley Downs portion of the Jacks Point Zone,
- Identify threats posed to those values by the proposed Henley Downs plan change and recommend appropriate mitigation measures,
- Provide recommendations regarding the management of the interface between the Henley Downs swamp and the proposed development.

2.0 The Environment

2.1 Geology and landform

Rolling bands of grade III schist are overlain by glacial till of varying ages (Royden Thomson, 2002). These rise to prominent ice worn ridges, with rocky outcrops in the north and central portion of the zone. The ice plucked eastern faces of these ridges hold scattered boulders, tors and small bluffs.

A central valley (c. 340 to 380 masl) is overlain with glacial till, fluvio-glacial deposits, alluvial fans, fan/ delta systems and lake bed deposits (Royden Thomson, 2002). The geological evaluation prepared by Royden Thomson included a detailed map¹ broadly differentiating the younger deposits summarised in **Figure 1** as quaternary deposits.

Post glacial fan deposits range widely in age (Barrell, 1994). Stream channels have incised through the glacial till and deposited alluvium, over small fans extending from both the hummocks and ridges to the west (Tablelands) and the flanks of the Remarkables to the east onto the valley.

¹ Figure 6 of the Coneburn Area Resource Study.

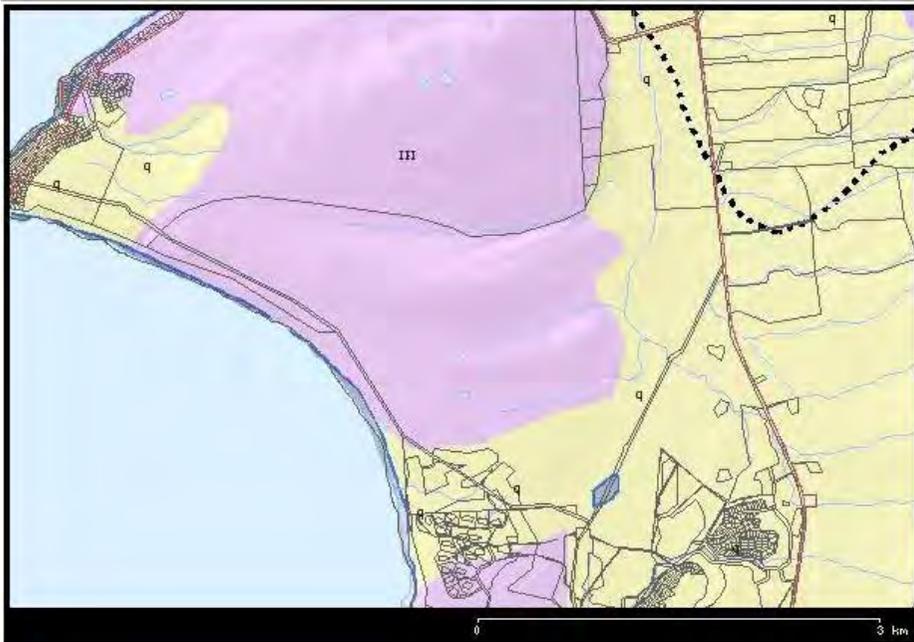


Figure 1: Geology: Grade III Schist (purple), younger quaternary glacial/ ablation (glacial melt water) till deposits (q).

Source: GrowOtago - www.growotago.orc.govt.nz

2.2 Hydrology

Perched water tables, depressions, surface flows and spring fed streams from both the rolling western hummocks and the flanks of the Remarkables to the east support streams as well as permanent and ephemeral² wetlands. The catchment within which Henley Downs sits drains predominantly into and through the central valley with the western most escarpments draining into Lake Wakatipu. Farm drains on the central basin floor contain and channel surface flows north to the Kawarau River. A low saddle north of the Henley Downs swamp (A), refer **Figure 5**, bunds on the north and south and a planted eastern margin prevent surface flooding from the swamp which does not have an obvious outlet.

Streams draining into the site from the flanks of the Remarkables have incised through historic lakebed deposits, glacial till and alluvial fans of varying ages (Barrell, 1994). The stream marked (B), refer **Figure 5**, sustains small wetlands (**Photographs W8, and W11**) and meanders through a broad gully which has been planted with willows, conifers and poplars before being confined into a farm drain where it crosses the road and flows into the central valley.

² Ephemeral – seasonally or periodically saturated or submerged wetland, alternately becoming a dry habitat (Johnson, 2004)

2.3 Soils

Organic Soils

At this site organic soils (blue) occur where wetlands are either present or were historically. They occur in the partly decomposed remains of wetland plants (peat) or forest litter (Hewitt, 1998) **Figure 2**.

The gently undulating northern flats (A), are strongly gleyed, silty loam soils (FkOzG). Without the farm drains these soils are prone to water logging (Landcare Research and Otago Regional Council, 2012).

The wetlands in the rolling hummocky areas (B) and a large drainage gully (C) are underlain by deep silt loams (Parea soils).

Gley Soils

Within the area mapped as 'gley soils' (teal) there is some variability across the rolling and undulating hummocks. Ponding of surface water is likely on the lowest sites where drainage is poor and water tables are high (Hewitt, 1998), elsewhere sandy to fine sandy loam Wakatipu soils (Wp) are present (ORC, 2012). This correlates well with the observed pattern of ephemeral streams, wetlands and swamps, refer to **Figure 2**.

Figure 5 is also illustrative of the drainage system established in the central valley to facilitate farming.

Melanic Soils

Melanic soils (grey) overlay the steep to hilly tablelands and an undulating band across the central valley. Shotover soils on the valley floor (Sh1s/aU) are

moderately deep and well drained with low drought vulnerability. Wakatipu Soils (Wp2sR) on the higher rolling country ('tablelands') can be drier³.



Figure 2: Soil Map

Source: GrowOtago Maps, ORC (www.growotago.orc.govt.nz)

³ Landcare Research Manaaki Whenua and Otago Regional Council: Factsheets. 20-Dec-2012 from <http://smap.landcareresearch.co.nz> This information sheet describes the typical average properties of the specified soil to a depth of 1 metre, and should not be the primary source of data when making land use decisions on individual farms and paddocks.

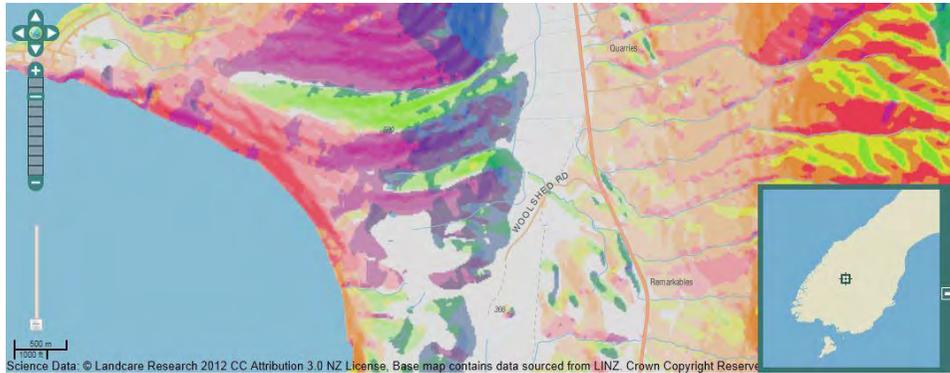


Figure 3: Slope Aspect

Source: Landcare Research, *Our Environment Online* website maps – Direction of Slope
<http://ourenvironment.scinfo.org.nz> accessed 20/12/2012.

2.4 Aspect

The central valley area of Henley Downs is gently undulating to flat (white) while the rolling hummocks and rising tableland ridges which run along an east to west axis have north (green) and south (purple) facing aspects. The lake side escarpment and lowest slopes of the Remarkables are west facing (pink). The eastern aspects of the hummocks and tablelands are shown in blue - grey in **Figure 3** above.



Figure 4: Steepness of Slope

Source: Landcare Research, *Our Environment Online* website maps – Steepness of Slope
<http://ourenvironment.scinfo.org.nz> accessed 20/12/2012.

2.5 Steepness

The site's slope steepness ranges from flat (0 to 5 degrees), with the palest shading to gently undulating (10 degrees), rolling (11 to 24 degrees) with the bluffs and schist outcrops (about 38 degrees +) highlighted by the darkest shading.

3.0 Habitat Types

Wetlands and shrubland communities have been identified within the farmland of Henley Downs. **Figure 5** illustrates the network of wetland habitat types while **Figure 6** illustrates the distribution of all habitat types over the site.

3.1 Wetlands

3.1.1 Wetland Values

Wetlands found at the site include swamps, ephemeral basins, wide natural drainage gullies with gentle gradients, streams draining the flanks of the Remarkables as well as man-made ponds and drainage channels. All are modified by a history of agricultural land use.

A range of wetland habitats on the site are illustrated below in **Photographs W1 to W13**. The location of photographs is indicated as waypoints (WP) in **Figure 5**.

Swamps

The indigenous vegetation of the Henley Downs swamp (marked **A** in **Figure 5**), is dominated by a *Carex* sedgeland - Raupo reedland. This 7.9 hectare swamp lies in a basin with no obvious outlet and is fed by surface run-off and ground water. Historically, it is likely this wetland drained to the south into Woolshed Bay.

A range of common waterfowl and pukeko were observed on the open water and margins.

Grey (*Salix cinerea*) and crack willow (*S. fragilis*) have formed an invasive deciduous canopy dominating areas of shallow water. *Carex secta* occupies deeper water. An extensive cover of the highly toxic and exotic celery-leaved buttercup (*Ranunculus scleratus*) occupies a substantial area around the raupo

beds, east of the schist outcrop. This species is an annual emerging each spring.

Terrestrial vegetation is comprised of grey shrubland along the western margin around the schist outcrops. Over mature crack willows (*Salix fragilis*) have formed a thicket around the northern shallows. Poplars, willow, flax (*Phormium tenax*) and toetoe (*Austroderia richardii*) have been planted along the eastern boundary in an effort to retain the wetland. The landform, soils and presence of wet paddocks to the east suggest a historically more extensive area of swampland.

A smaller swamp also retaining a *Juncus* rushland – *Carex* sedgeland occupies a shallow basin on the hummocks, marked **B** in **Figure 5**. **Figure 5** identifies the location of the more substantial wetlands noted. A *Carex* sedgeland swamp marked **C** sits within the Jacks Point Zone in **Figure 5**.

Ephemeral wetlands perched within shallow basins and wider drainage gullies on the hummocks and tablelands are vegetated by a mixture of pasture grasses, rushes (*Juncus* sp.), sedges (*Carex* sp.) with silver tussock (*Poa cita*).

Streams A stream draining from the Remarkables (refer to **Figure 5 – Waypoint 267**), flows through a wide drainage gully near the north or eastern boundary of Activity Areas A, B, C and D. In the upper gully within the Henley Downs land and Jacks Point land upstream (near Area C), an open matagouri and briar shrubland is present. The creek flows through pasture and under the canopy of willows and pines with virtually no native vegetation in the riparian area but for a small pocket of rushland in an area where water ponds (**Figure 5; Photographs W8 to W10**).

Farm dams ponding surface flows between the bands of schist ridges on the tablelands have been planted with weeping willows (*Salix babylonica*), flax (*Phormium tenax*) and toetoe (*Austroderia richardii*).

A list of species recorded in the wetland communities and other habitats is provided in **Table 1** at the end of this report.

Wildlife

Black-fronted terns, a nationally endangered, seasonal migrant, nest on the Shotover River and were observed feeding on recently ploughed pastures on the farm flats within the Agricultural Activity Area north of the proposed urban Activity Areas, and the margins of Lake Tewa to the south.

South Island (NZ) pied oystercatcher (a species in decline) were also observed.

The damp farm pastures are likely to provide an abundant invertebrate resource for these species which are also known by the author to forage over the Frankton Flats and paddocks of the Wakatipu Basin. The oystercatchers will nest in early spring in short cropped pastures.

Large areas of open water in the Henley Downs swamp along with dense marginal cover attract New Zealand shoveler, paradise shelduck and mallard (gamebirds), along with Australian Coot (a coloniser), grey teal and scaup protected but not threatened.

Pukeko were recorded around the Henley Downs swamp (**Figure 8**), this species is also protected and excluded from recent gamebird hunting schedules.

A full list of bird species observed during the site visits is provided in **Table 2** at the end of this report.

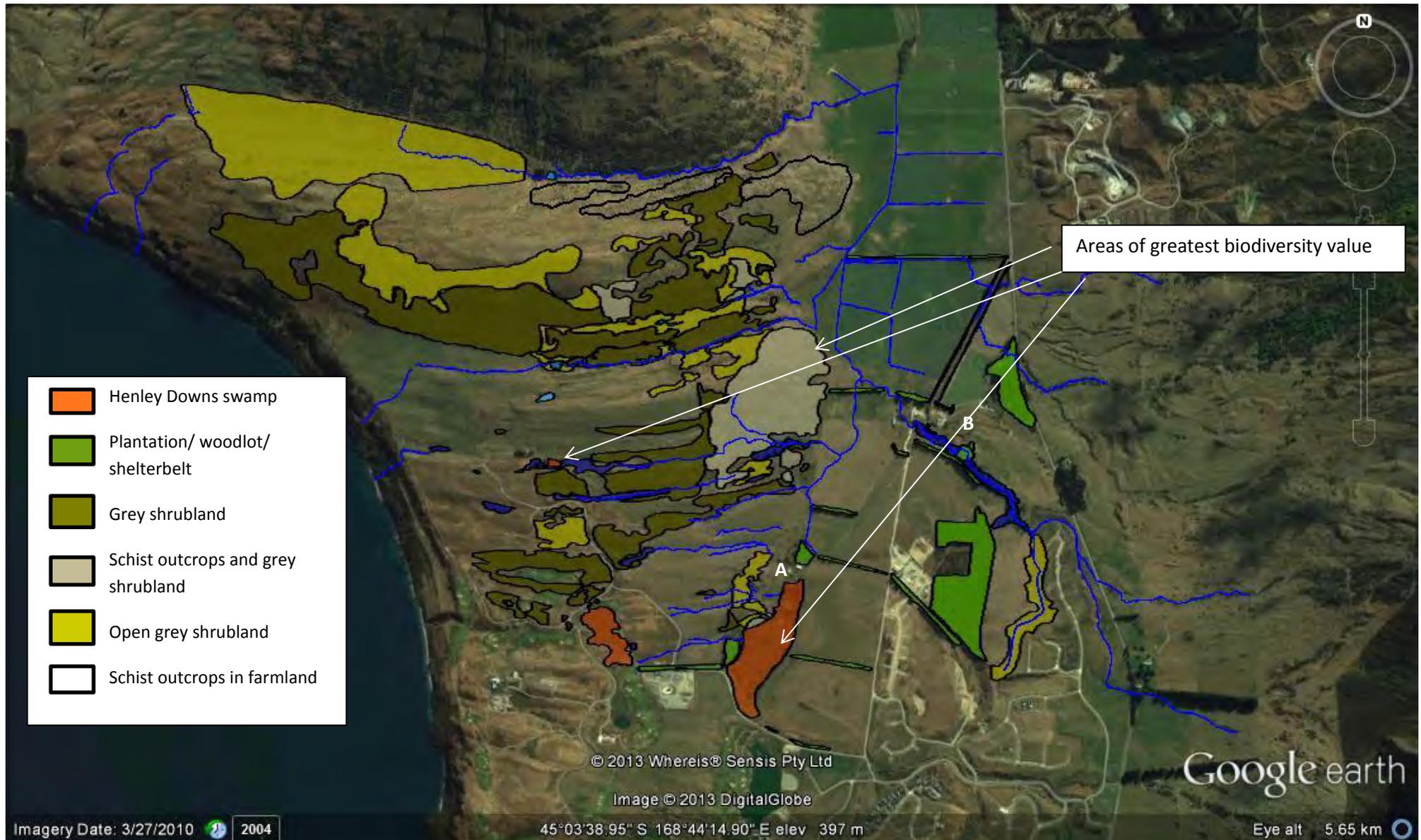


Figure 8: Pukeko on the margins of the Henley Downs swamp; 26/11/12.

Figure 5: Wetlands and Location of Photographs W1 to W13



Figure 6 Habitat Types of Henley Downs



Photographs W1 to W13 – Range of wetland habitats on Henley Downs

	<p>W1 - Ephemeral wetland perched within the bands of schist in the Tablelands with standing water and exotic grasses (kneed foxtail). Reinstatement of indigenous diversity would enhance this wetland.</p> <p>WP 207 – 26/11/12</p>
	<p>W2 – Ephemeral wetland with surface ponding at the eastern end of a drainage gully across the hummocks/ tablelands.</p> <p>WP 237 – 26/11/12</p>
	<p>W3 – Wide, gently sloping drainage with silver tussock and rushes, grazing and lack of more diversity in seed sources prevents natural regeneration;</p> <p>WP 246 – 26/11/12</p>

	<p>W4 – Farm pond in a spring fed stream;</p> <p>WP 212 – 26/11/12</p>
	<p>W5 - Farm pond, margins planted with toetoe and weeping willows;</p> <p>WP 215 –/11/12</p>



W6 – Swamp : *Juncus* rushland with leads of open water;

WP 250 – 26/11/12



W9 – *Juncus* rushland in a depression in the central valley, paradise shelduck were breeding on this ephemeral wetland;

WP 271 – 27/11/12



W7 – *Carex* sedgland – red tussocks possibly planted at the head of a swamp (W5).

WP 251 – 26/11/12



W10 – Historic drainage channel with a creek. Reinstatement of indigenous diversity would enhance the value of this wetland

WP 262 – 27/11/12



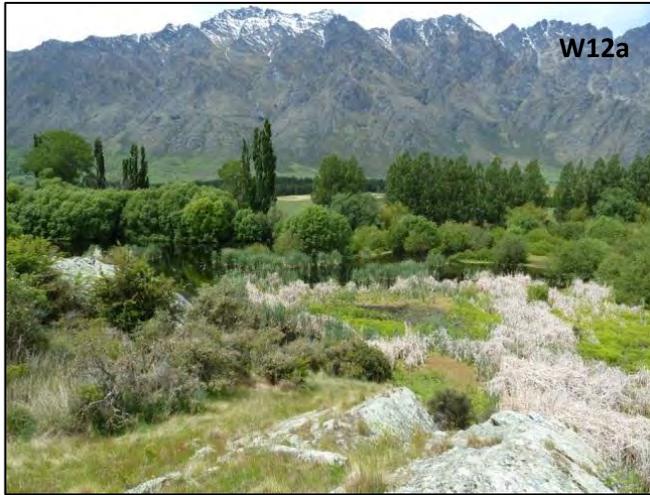
W8 – A high energy creek winds onto the valley floor through groves of willows and pines before emergin into a wide channel (W9);

WP 267 – 27/11/12



W11 – Rank pasture grasses exotic wetland grasses (kneed foxtail) at the margin of the Henley swamp

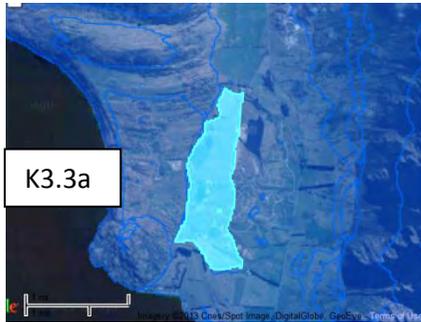
WP 114 – 28/10/12



Henley Downs Swamp

W12 a to d - Henley Downs swamp – *Carex* sedgland- Raupo reedland with an invading canopy of crack and grey willow, celery-leaved buttercup surrounds the raupo bed -- WP 280 – 27/11/12

W13 – Henley Downs swamp, open water fringed by a thicket of over mature crack willows along the northern margin – WP 278 –27/11/12



3.1.2 Wetland Significance

Henley Swamp

The Henley Downs swamp sits within land classified by the LENZ system (Leathwick & et al, 2003) as K3.3a (*inset left*).⁴

On a national scale just 8.4 per cent of the indigenous vegetation associated with the K3.3a environments remains. Of this, just 1.8 per cent is protected⁵ making this an ‘acutely threatened’ land environment.

Fescue tussocks, speargrass, matagouri and shallow *Carex* swamps would have characterised this environment at the time of European settlement (Leathwick & et al, 2003). Succession to beech forest on the land surrounding the swamp may have been prevented by frost but today agricultural uses and exotic grasses have replaced the former vegetation.

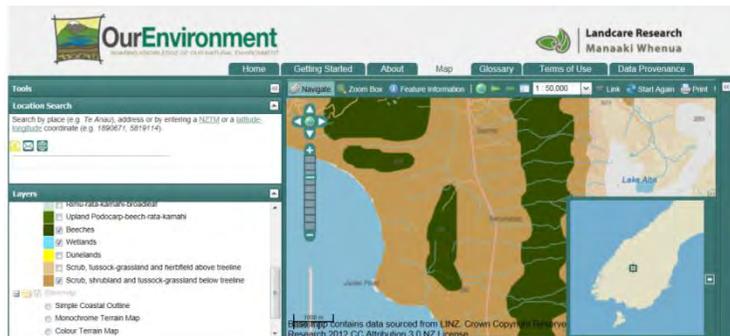


Figure 7: Predicted vegetation prior to human activity.

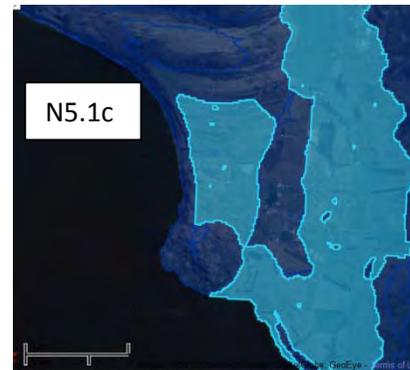
Source:
OurEnvironment
Landcare Research
<http://ourenvironm ent.scinfo.org.nz/ou renvironment>

⁴ www.koordinates.com accessed 22/1/2013

⁵ <http://www.landcareresearch.co.nz/resources/maps-satellites/threatened-environment-classification/downloads> Threat categories Ver3, accessed 22/1/2013

The Henley Downs swamp (A) and those identified as B, and C in **Figure 5**, are readily identifiable examples of a *Carex* sedgeland - Raupo reedland and *Juncus* rushland communities associated with K3.3a environments. Habitat diversity of the Henley Downs swamp is increased by the juxtaposition of a very small band of matagouri dominated shrubland on the western margin among schist outcrops.

Swamps such as those found on Henley Downs are not common within the Remarkables Ecological District within which they lay. They are more



commonly found scattered on the lower terraces of the wider Lake Wakatipu catchment within the Shotover, Richardson and Eyre Ecological Districts as well as around Lake Wanaka. From a landscape perspective, the connectivity between this network of swamps for waterfowl is good with waterfowl likely to move readily between them.

The farm ponds and the Henley Downs swamp have decoys, maimais and camouflage netting suggesting that hunting occurs in these habitats. Waterfowl (particularly grey teal and NZ shoveler) were easily flushed during the site visits.

Ephemeral wetlands, including drainage gullies, streams and basins within N5.1c environments (e.g. **W1 to 11** above) are low diversity, open communities affected by cattle browsing and trampling. However, the underlying hydrological network continues to the potential for the reinstatement of healthy ecological processes within them.

The N5.1c⁶ environment – *inset above* - (Leathwick & et al, 2003), is also acutely threatened with just 2.7 per cent of the indigenous vegetation associated with this environment remaining and 0.8 per cent protected⁷.

At the time of European settlement, N5 environments supported almost continuous grassland. Swamps within N5 such as those identified in **Figures 5 and 6**, were dominated by silver tussock on rises, red tussock on damp ground, *Carex sinclairii* and *C. coriacea* in wet hollows and *C. secta* in deeper water. These wetlands, although their scale was too small for LENZ classification, tend to be classified as N7. N7 are chronically threatened environments with about 12 to 15 per cent of the indigenous vegetation remaining and 3 to 3.4 per cent⁸ of that protected (Leathwick & et al, 2003).

Trampling and grazing, introduced grasses and rushes are replacing natives throughout wetlands at this site as they are throughout these environments.

Summary of Significance

None of the wetlands noted on the Henley Downs land are listed in Schedule 9 or 10 of the Otago Regional Plan⁹ or Appendix 5 of the Queenstown Lakes District Council District Plan¹⁰.

No threatened plants were recorded at any of the wetlands visited and the level of intactness or naturalness in the vegetation communities is low for Henley

⁶ www.koordinates.com accessed 24/1/2013

⁷ <http://www.landcareresearch.co.nz/resources/maps-satellites/threatened-environment-classification/downloads> Threat categories Ver3, accessed 22/1/2013

⁸ Ibid.

⁹ ORC Regional Plan: Water as amended up to 1 March 2012 and accessed on line 22/1/2013

¹⁰ QLDC District Plan as updated October/ November 2011 and accessed on line 22/1/2013.

Downs and the smaller swamp labelled **B** in **Figure 5**. Swamp B is outside the proposed urban area.

Seasonal migrants, black-fronted terns South Island (NZ) pied oystercatchers forage over damp and recently ploughed paddocks to the north and open water and margins of Lake Tewa to the south of the proposed urban areas and may continue to do so following the urbanisation of Henley Downs albeit over a potentially reduced area.

The Henley Downs swamp provides roosting, nesting, foraging habitat for protected (but not threatened) waterfowl as well as Australian coot and pukeko, none are threatened.

The Henley Downs swamp and the swamp **B** near **waypoint 250** in **Figure 5**, are representative examples of wetlands found within the acutely threatened K3.3a and N5 or N7 wetlands. They support the ecological pattern and processes of swamps found in the wider Wakatipu Basin within the Shotover, Richardson and Eyre Ecological Districts more so than for the Remarkables Ecological District where they are located.

The Henley Downs swamp has a high aesthetic amenity value, but the presence of invasive woody and herbaceous weeds will require substantial management to control and or potentially remove. The swamp is considered to be of low value in terms of the proposed criteria identified in Appendix 5 of the Queenstown Lakes District Plan or for Schedule 9 of Regional Plan: Water for Otago, Plan Change 2.

The small swamp labelled **B** in **Figure 5** is considered to be valuable in terms of its contribution to the ecological pattern and processes of wetlands within the wider Wakatipu Basin but not significant due to its small size, low diversity, degree of modification, absence of rare or threatened species. No waterfowl or pukeko were recorded at this wetland. It has been fenced to exclude stock and would benefit from the reinstatement of indigenous diversity.

The network of ephemeral wetlands support connectivity between similar wetlands within the broader Wakatipu Basin. However, much of their value rests in their potential to be enhanced and improve the contribution to wetland ecosystem diversity within the Lakes Ecological Region. They are not considered to be significant.

3.1.3 Threats

Henley Downs and smaller swamps

1. Willows and the invasive and poisonous celery-leaved buttercup will require management in order to arrest further invasion and degradation of the natural values of this wetland.
2. The provision for passive recreation around the wetland may disrupt feeding, roosting and breeding of waterfowl and pukeko however, it is also likely to result in the cessation of hunting which is considered to be beneficial. Waterfowl will adapt to the presence of humans as they have in settings such as Lake Hayes and Millbrook.
3. Residential development may bring pets (dogs and cats) into the wetland habitat interface. However, the potential for adverse effects on wildlife will need to be managed through signage to increase public awareness of the threats to waterfowl and wetland birds posed by uncontrolled pets. Feral cat populations will already be present.
4. The establishment of high density residential land uses in Activity Areas F, G, J and K may result in sediments or contaminants entering the wetland, but this can be managed through appropriately designed

buffer planting and storm water treatment systems prior to discharge into the wetland.

Ephemeral wetlands, small swamps gullies and creeks

1. Trampling and grazing, introduced grasses and rushes are replacing natives throughout these habitats while farm drains maintain lowered water tables on the open valley floor.
2. These wetlands are mostly outside of the proposed urban area and will not be adversely affected by development. The stream and wetlands within Areas A, B, C and D have low indigenous diversity.

3.1.4 Recommendations

Henley Downs and Swamp B

Enhance the natural values and mitigate effects associated with proposed urban development by:

1. Controlling the spread of further spread of willows within the Henley Downs swamp (**W12**);
2. Undertake a programme of progressive limbing and potentially the removal of crack and grey willows from the margins, particularly from the shallow northern end;
3. Consider a programme to kill in-situ willows within the shallow open water to facilitate the natural expansion of *Carex* sedgeland and Raupo beds and maintenance of open water;
4. Protect from further unmitigated loss or drainage if disturbed by development under the proposed plan change.

5. The reinstatement of indigenous diversity along the margins of the Henley Downs swamp to :
 - a) Provide or bolster feeding and breeding habitat with an appropriately designed buffer around the Henley swamp¹¹ secured as part of an outline development plan. Provision for small clearings enabling a view of the water, and screening of residential activity, variation in wetland habitat and open roosting and foraging areas with ready access to water or cover for waterfowl and pukeko could be incorporated into these designs;
 - b) Reinstatement diversity lost from the terrestrial and aquatic communities associated with the Henley Downs swamp and the swamp at waypoint 250, refer **Figure 5, photographs W6 and W7**;
 - c) Avoid or minimise the discharge of contaminants into the Henley Downs swamp through appropriately designed storm water treatment and buffer planting.

Ephemeral wetlands, small swamps and creeks

1. Restrict cattle from grazing within paddocks where wetlands with remnant indigenous communities have been identified (refer to **Figure 5, habitats highlighted by waypoints 212, 237, 246 and 250; photographs W1 to W3, W6 and W7**).
2. Prevent further unmitigated loss, drainage and contamination, and support the reinstatement and or enhancement of indigenous diversity if disturbed by development under the proposed plan change.

¹¹ Resort Zone rules – 12.2.3.5 Non-Complying Activitiesx wetlands – earthworks within 7 metres of a wetland identified on a structure plan are non-complying; Rural Areas - 5.3.5.1 Site Standards - Indigenous vegetation x (a) iv no clearance fo indigenous vegetation unless it is more than 20 metres from a waterbody.

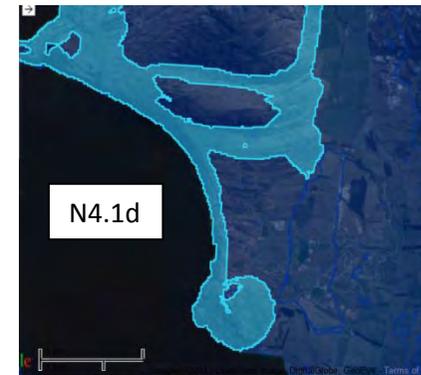
3. Reinstatement seed sources that can supplement the indigenous diversity within the degraded, low diversity communities.
4. Improve connectivity between the network of ephemeral wetlands and swamps and adjacent Jacks Point and lakeside public conservation land.
5. Support community led projects to reinstatement and enhance the wetland habitats.

3.2 Shrublands

3.2.1 Shrubland Values

Low diversity grey shrubland is present within areas classified as N5.1c (refer to **section 3.1.2**) and N4.1d environments.

As previously noted, at the time of European settlement the N5.1c environment supported extensive grasslands.



The original vegetation of N4 environments in gullies and rocky slopes was woodland including matagouri, small-leaved Coprosmas and *Olearias*, native brooms, kowhai with lianes such as bush lawyer (*Rubus*) and *Muellenbeckia*. Finer soils supported grasslands of hard and silver tussock as well as *Elymus* spp. (Leathwick & et al,

2003). N4.1d environments are chronically threatened with 18.6 per cent of the indigenous vegetation remaining and just 2.3 of that protected.¹²

¹² <http://www.landcareresearch.co.nz/resources/maps-satellites/threatened-environment-classification/downloads> Threat categories Ver3, accessed 22/1/2013

Figures 6 and 9 illustrate the distribution of low diversity grey shrubland, and the location of **Photographs S1 to S8**. This community is regenerating from previous clearance (browsing, burning or spraying). Matagouri dominates all areas of grey shrubland. The highest diversity is found among the schist outcrops marked by waypoints **197** and **198**; **Figure 9**) where mikimiki (*Coprosma propinqua*), *C crassifolia*, *Olearia odorata*, native broom (*Carmichaelia petrei*) and porcupine shrub (*Melicactus alpinus*) as well as a range of other common herbs, native grasses including silver tussock (*Poa cita*) and blue wheat grass (*Elymus solandri*), and ferns are present. A list of species recorded during site visits is provided in **Table 1** at the end of this report.

Wildlife

A single eastern falcon (nationally vulnerable) (Miskelly, 2008), was recorded on a north facing rock outcrop near the northern boundary (waypoint 221) and outside of the proposed urban area on the 26th November, 2012, refer **Figure 8**. A pair of eastern falcon was also observed to chase a harrier away from rock outcrops above the Remarkables Road 5.3 kilometres distant from this sighting on 21st January, 2013. The behaviour observed was indicative of territorial defence around a nest site. It is not known if the pair on the northern spur of the Remarkables include the Henley Downs habitats in their territory but it should be assumed they do.

The shrubland communities are therefore be considered to be providing habitat for this nationally vulnerable species.

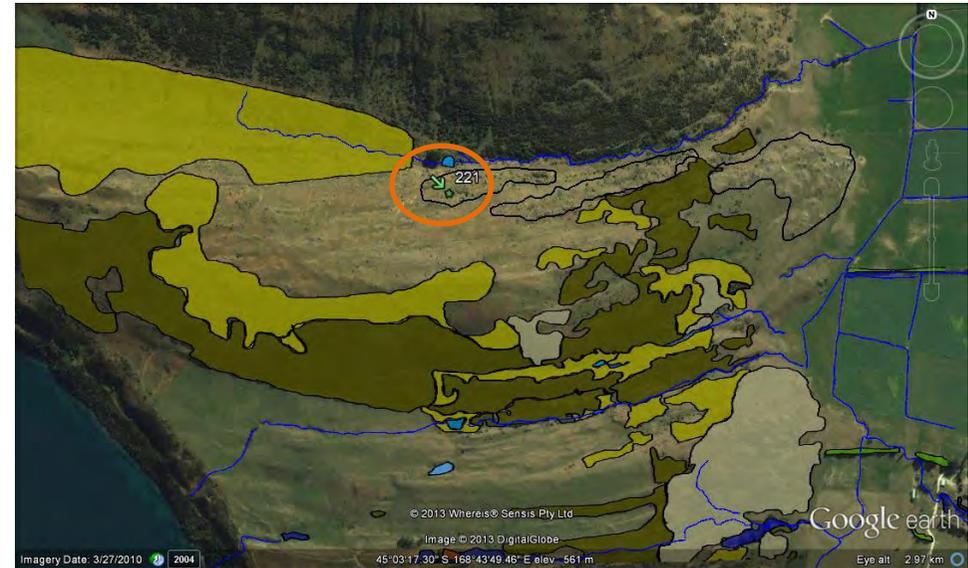


Figure 8: Location of the eastern falcon sighting.

3.2.2 Significance

The denser and most diverse grey shrubland and remnant tussocks grasslands present among the largest area grey shrubland among schist outcrops (marked by waypoints **197** and **198**; **Figure 9**), contains some of the historic diversity associated with N4.1d environments. However, elsewhere the grey shrublands are dominated by matagouri with little other indigenous diversity present. Open grey shrublands are predominantly a mix of briar and regenerating matagouri.

The grey shrubland associated with the largest area of schist outcrops in particular has retained sufficient diversity so as to be considered locally valuable warranting protection from further unmitigated loss.

The shrubland communities are likely to be within the territorial range of at least one pair of eastern falcon.

3.2.3 Threats

1. Most of the shrubland vegetation is outside of the proposed urban areas identified on the Henley Downs Structure Plan and would only be vulnerable if clearance were to be proposed to facilitate agricultural or recreational uses.
2. It is likely that any loss of grey shrubland, tussock grassland or wetland habitats resulting from development can be mitigated by reinstatement or enhancement of these indigenous communities. Such mitigation would include planting to increase diversity and the exclusion of cattle.

3.2.4 Recommendations

1. Given the extent of loss of the native vegetation in N5.1c and N4.1d environments, the remaining low diversity shrubland present should be protected from further unmitigated losses where possible as they represent one of the largest remaining assemblages of grey shrubland at lower elevation sites within the open Wakatipu Basin (between Wye Creek and Arrowtown)¹³.
2. There is a very low weed burden on the Henley Downs land, removal of broom, buddleia, hawthorn, conifers and sycamores can be readily achieved, it is recommended that a schedule to implement this be prepared.
3. Where grey shrubland encompasses ephemeral wetlands, it is suggested that cattle be excluded from grazing marked by waypoints

244 to 246 in Figure 9 and the habitats highlighted by waypoints **212, 237, 246** and east and west of **250; photographs W1 to W3, W6 and W7.**

4. It is recommended that cattle be excluded from the largest area of schist outcrops with grey shrubland (**Figure 6**).
5. Where enhancement planting is undertaken, priorities are to:
 - a) increase diversity within the shrublands around the schist outcrops,
 - b) increasing the diversity of ephemeral wetlands, swamps in the transition areas between these and grey shrublands,
 - c) fence stock out of areas where enhancement planting is undertaken,

The list of species suitable for enhancement planting provided in the Coneburn Area Study is equally appropriate for use in the Henley Downs zone. It has been reproduced here as **Table 3**.

Photographs illustrating the range of grey shrubland habitats remaining

	<p>S1 – Waypoint (WP) 198</p> <p><i>Poa colensoi</i> on schist outcrops over Matagouri, <i>Olearia odorata</i>, <i>Coprosma propinqua</i> and briar</p> <p>24/11/12</p>
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¹³ i.e. not on the flanks of the surrounding mountain slopes.

	<p>S2 - WP 210</p> <p>Matagouri in flower making it difficult to identify <i>Olearia</i> in the canopy without closer inspection. A cool, late summer delayed leaf bud development in deciduous <i>Olearia</i>.</p> <p>26/11/12</p>		<p>S5 - WP 245</p> <p>Bands of grey shrubland on southern aspects with grazed farmland between; brighter briar is visible within the matagouri dominated shrubland.</p> <p>26/11/12</p>
	<p>S3 - WP 217</p> <p>Open matagouri shrubland. Grazing, spraying or burning will continue to inhibit regeneration.</p> <p>26/11/12</p>		<p>S6 - WP 197</p> <p>Blue tussock (<i>Poa colensoi</i>), porcupine shrub (<i>Melicytus alpinus</i>), and the native slender chickweed (<i>Stellaria gracilentia</i>) within the rock outcrops.</p> <p>24/11/12</p>
	<p>S4 - WP 246</p> <p>Spray damage evident on the margin of a wide drainage channel across the hummocks.</p> <p>26/11/12</p>		<p>S7 - WP 226</p> <p>A single sycamore (<i>Acer pseudoplatanus</i>) and regenerating bracken on the grazed, north facing boundary slope.</p> <p>26/11/12</p>

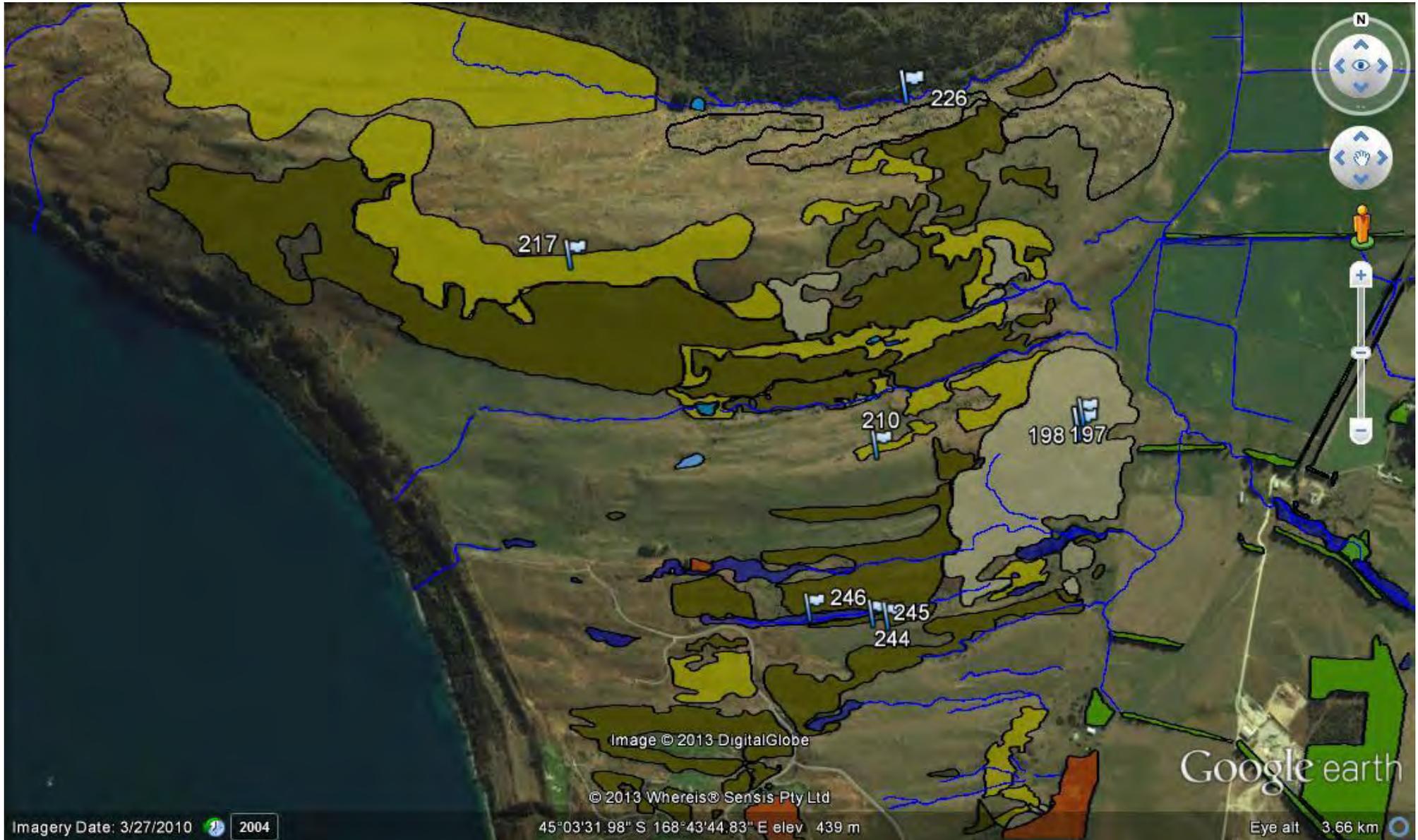


S8 - WP 244

Open matagouri dominated grey shrubland with briar within a wide drainage gully between bands of schist, view north east.

26/11/12

Figure 9: Location of Photographs S1 to S8 - Shrublands



4.0 Summary

Ecological values of interest within the Henley Downs portion of the Jacks Point Zone were:

- Those associated with the Henley Downs swamp, and
- The area of grey shrubland found among the largest area of outcropping schist bedrock

Other areas of lower value were:

- The broader areas of matagouri shrubland, and
- The network of smaller swamps, ephemeral basins, wide natural drainage gullies and streams.

All are modified by a history of agricultural land use and retain a low level of indigenous diversity. Areas of indigenous habitat are outside the area of proposed urban development with the exception of :

- The Henley Downs swamp which is surrounded by areas of proposed urban development including the highest density area of proposed development to the east in Area G; and
- A stream draining through margins of Urban Activity Area A, B and D outside the areas proposed for urban development. No indigenous values of significance were noted within Urban Activity Areas A, B and D.

Indigenous vegetation of the 7.9 hectare Henley Downs swamp is dominated by *Carex* sedgeland - Raupo reedland. This dominance is shared by an invasive deciduous canopy of grey and crack willow and the poisonous celery-leaved buttercup in areas of shallow water.

A large area of open water and dense marginal vegetation provide cover that supports small flocks of New Zealand shoveler, mallard, paradise shelduck, grey teal, scaup as well as Australian coot. A good population of pukeko breed and forage in the damp margins and adjacent paddocks.

No rare or threatened species were recorded in the Henley Downs Swamp, a low diversity, modified representative of wetlands found within the acutely threatened K3.3a environment.

The Henley Downs swamp has a high aesthetic amenity value, but invasive woody and herbaceous weeds will require substantial management to control and potentially remove. The swamp is considered to be of low significance in terms of the proposed criteria identified in Appendix 5 of the Queenstown Lakes District Plan or for Schedule 9 of Regional Plan: Water for Otago, Plan Change 2.

The Henley Downs swamp and the network of smaller swamps, ephemeral basins, wide natural drainage gullies and streams support the ecological pattern and to a lesser extent given the degree of modification, the ecological processes of wetlands in the wider Wakatipu Basin and terraces surrounding Lake Wakatipu within the adjoining Shotover, Richardson and Eyre Ecological Districts.

Effects on wildlife of the Henley Downs swamp from passive recreation or potentially contaminated stormwater discharges can be mitigated.

Grey shrubland is dominated by matagouri with the greatest diversity being found among the largest area of outcropping schist bedrock (**Figure 6**) within a chronically threatened N4.1d environment. The shrubland bounds the eastern side of Urban Activity Area F and although supporting limited diversity, it is considered locally valuable warranting protection from further unmitigated loss. It falls within the territory of at least one pair of eastern falcon.

Black-fronted terns, a nationally endangered, seasonal migrant were observed feeding on recently ploughed pastures on the farm flats within the Agricultural Activity Area north of and outside the proposed Urban Activity Areas, and on the margins of Lake Tewa to the south. The damp farm pastures are likely to provide an abundant invertebrate resource for these species and urbanisation of the flats may potentially reduce the available foraging area for terns. Terns from the Shotover colony are also known to forage within the wider Wakatipu Basin.

Recommendations provided aim to avoid unmitigated loss of grey shrubland, wetland habitats and protect the potential for the reinstatement of indigenous diversity to mitigate or compensate where loss is unavoidable as a result of the proposed development of Henley Downs.

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Table 1 Species recorded in the Habitats found on Henley Downs

* denotes the species is exotic

Botanical name	Common name	Henley Swamp	Ephemeral wetlands	Shrublands	Schist outcrops
Ephemeral Wetlands					
	Pasture grasses	*	*	*	*
<i>Acer pseudoplatanus</i> *	Sycamore	*		*	*
<i>Agrostis capillaris</i> *	browntop		*	*	*
<i>Alopecurus genticulatus</i> *	Kneed foxtail	*	*		
<i>Anoxthanthum odoratum</i> *	Sweet vernal	*	*	*	*
<i>Austroderia richardii</i>	toetoe	*	*		
<i>Carex secta</i>	Purei	*	*		
<i>Buddleja davidii</i> *	buddleia	*	*		
<i>Chionochloa rubra</i>	Red tussock		*		
<i>Cardis tenuifolium</i> *	Winged thistle				*
<i>Carmichaelia petrei</i>	Native broom				*
<i>Cirsium arvense</i> *	California thistle				*
<i>Coprosma crassifolia</i>					*
<i>Coprosma propinqua</i>	mikimiki	*	*	*	*
<i>Crataegus monogyna</i> *	hawthorn	*	*	*	*
<i>Dactylis glomerata</i> *	cocksfoot	*	*	*	*
<i>Digitalis purpurea</i> *	foxglove	*	*	*	*
<i>Discaria toumatou</i>	matagouri	*	*	*	*
<i>Elymus solandri</i>	Blue wheat grass				*
<i>Erodium cicutarium</i> *	storksbill				*
<i>Eucalyptus spp.</i> *	Eucalypt				
<i>Holcus lanatus</i> *	Yorkshire fog	*	*	*	*
<i>Juncus edgariae</i>	Edgars rush	*	*		
<i>Juncus effusus</i> *	Soft rush	*	*		
<i>Juncus sp.</i> *	Rush				
<i>Lemna disperma</i>	Common duckweed	*			
<i>Leucopogon fraseri</i>	patotara				*
<i>Lupinus spp.</i> *	lupin				*
<i>Melicytus alpinus</i>	Porcupine shrub		*	*	*
	moss		*		*
<i>Muehlenbeckia australis</i>	pohuehue			*	*
<i>Muehlenbeckia complexa</i>	Small-leaved pohuehue	*		*	*
<i>Myosotis laxa</i> *	Water forget me not	*			
<i>Olea europaea</i> *	European Olive	*			
<i>Olearia odorata</i>	Scented tree daisy	*	*		*
<i>Phormium tenax</i> (planted)	NZ flax	*			
<i>Pilosella officianum</i>	Mouse-eared hawkweed				*
<i>Pinus radiata</i> *	Radiata pine				*
<i>Pittosporum tenuifolium</i>	kohuhu				*

<i>Poa colensoi</i>	Blue tussock		*	*	*
<i>Poa cita</i>	Silver tussock		*	*	*
<i>Populus alba</i> *	White poplar	*	*		
<i>Populus nigra</i> *	Lombardy poplar	*	*		
<i>Pseudotsuga menziesii</i> *	Douglas fir				*
<i>Pteridium esculentum</i>	bracken			*	*
<i>Ranunculus glabrifolius</i>	Waoriki		*		
<i>Ranunculus sceleratus</i> *	Celery-leaved buttercup (very poisonous)	*			
<i>Raoulia australis</i>	Common mat daisy				*
<i>Raoulia subsericea</i>	Turf mat daisy				*
<i>Rosa rubiginosa</i> *	briar	*	*	*	*
<i>Rubus schmidelioides</i>	Bush lawyer	*		*	*
<i>Rumex acetosella</i> *	Sheeps sorrel				*
<i>Rumex crispus</i> *	Curled leaf dock		*		
<i>Salix fragilis</i> *	Crack willow	*	*	*	
<i>Solanum dulcamara</i> *	bittersweet	*			
<i>Stellaria gracilentia</i>	Slender chickweed				*
<i>Stellaria graminea</i> *	stitchwort	*	*		
<i>Salix babylonica</i> *	Weeping willow	*	*		
<i>Salix cinerea</i> *	Grey willow	*			
<i>Salix fragilis</i> *	Crack willow	*			
<i>Sambucca nigra</i> *	elder	*	*		*
<i>Trifolium dubium</i> *	Suckling clover				*
<i>Trifolium repens</i> *	White clover		*		
<i>Trifolium striatum</i> *	Striated clover				*
<i>Typha orientalis</i>	Raupo	*			-

Table 2 Wildlife observed on Henley Downs

Wildlife	
Scientific name	Common name
<i>Alauda arvensis</i> *	skylark
<i>Anas gracilis</i>	Grey teal
<i>Anas platyrhynchos</i> *	Mallard
<i>Anas rhynchosotis variegata</i>	NZ Shoveler
<i>Anthornis melanura</i>	Bellbird
<i>Aythya novaeseelandiae</i>	NZ scaup
<i>Callipepla californica</i> *	California quail
<i>Carduelis carduelis</i> *	goldfinch
<i>Carduelis chloris</i> *	Greenfinch
<i>Chlidonias albostratus</i> (Nationally endangered)	Black fronted tern
<i>Circus approximans</i>	Swamp harrier
<i>Columba livia</i> *	Rock/ feral pigeon
<i>Emberiza citronella</i> *	yellowhammer
<i>Falco novaeseelandiae</i> "eastern" (Nationally vulnerable)	NZ falcon
<i>Fringilla coelebs</i> *	Chaffinch
<i>Fulica atra</i> (coloniser)	Coot
<i>Gerygone igata</i>	Grey warbler
<i>Gymnorhina tibicen</i> *	Magpie
<i>Haemantopus finschi</i> (declining)	NZ pied oystercatcher
<i>Porphyrio melanotus</i>	Pukeko
<i>Prothemadera novaeseelandiae</i>	Tui
<i>Prunella modularis</i> *	Dunnock
<i>Sturnus vulgaris</i> *	Blackbird
<i>Tadorna variegata</i>	Paradise shelduck
<i>Turdus merula</i> *	Starling
<i>Turdus philomelos</i> *	Song thrush
<i>Vanellus miles novaehollandiae</i>	Spur-winged plover
<i>Zosterops lateralis</i>	silvereve

Table 3 Plants recommended for enhancement planting

Consistent with the Coneburn Area Resource Study, Darby Partners Ltd

Wetlands		small tree	tall shrub	small shrub	sedge, rush, tussock	Comments
Golden speargrass	<i>Aciphylla aurea</i>				*	open sites, tolerates a range of soils, sharp leaf tips
Toetoe	<i>Austroderia richardii</i>				*	colonising species, tolerant of moist soils in a range of habitats
Rautahi	<i>Carex coriacea</i>				*	open sites, hardy, tolerant of wet soils
Purei	<i>Carex secta</i>					colonising species, hardy and tolerant to inundation
Sedge	<i>Carex sinclairii</i>				*	open sites, hardy, tolerant of wet soils
bush tussock	<i>Chionochloa conspicua</i>				*	open sites, requires moist soils in a range of habitats
Red tussock	<i>Chionochloa rubra</i>				*	open sites, requires moist soils in a range of habitats
Mingimingi	<i>Coprosma propinqua</i>			*		colonising species, tolerates a range of soils and habitats, margins
Sharp spiked sedge	<i>Eleocharis acuta</i>				*	colonising species requires moist soils
	<i>Hebe rakaiensis</i>			*		open sites, requires moist soils nad habitats
koromiko	<i>Hebe salicifolia</i>			*		requires initial shelter, tolerant of a range of soils and habitats
	<i>Hebe subalpina</i>			*		open sites, montane locations, slow growing
two story rush	<i>Juncus distegus</i>				*	open sites, dry hill sites to poorly drained clay soils
Edgar's rush	<i>Juncus edgariae</i>				*	colonising species requires moist soils
fan-flowered rush	<i>Juncus sarophorus</i>				*	open sites, requires moist soils
Manuka	<i>Leptospermum scoparium</i>		*			colonising specis, tolerant of a range of soils and habitats
Porcupine shrub	<i>Melicytus alpinus</i>			*		open sites, tolerant of dry soils, good lizard habitat and food
Shrub daisy	<i>Olearia bullata</i>		*			open sites, requires damp soils
Shrub daisy	<i>Olearia cymbifolia / nummulariifolia</i>			*		open sites
Hector's tree daisy	<i>Olearia hectorii</i>	*				open sites, requires moist soils on higher margins, threatened species
	<i>Olearia lineata</i>		*			open sites, tolerant of a range of soils and habitats

Scented tree daisy	<i>Olearia odorata</i>			*		open sites, on drier margins, good invertebrate habitat
Mountain flax	<i>Phormium cookianum</i>				*	colonising species, tolerant of dry soils in a range of habitats
NZ flax	<i>Phormium tenax</i>				*	colonising species, tolerant of a range of soils in a range of habitats
kohuhu	<i>Pittosporum tenuifolium</i>	*				requires initial shelter, release from competition, tolerant of a range of soils and habitats
Silver tussock	<i>Poa cita</i>				*	colonising species, tolerates drier soils on margins
Bog rush	<i>Schoenus pauciflorus</i>				*	open sites, requires moist soils
raupo	<i>Typha orientalis</i>				*	colonising species, wastewater treatment, wetland bird habitat

Shrubland		small tree	tall shrub	small shrub	sedge, rush, tussock	Comments
Golden speargrass	<i>Aciphylla aurea</i>				*	open sites, tolerates a range of soils, sharp leaf tips
Mountain wineberry	<i>Aristotelia fruticosa</i>			*		requires initial shelter, tolerates dry soils and a range of habitats
NZ broom	<i>Carmichaelia petriei</i>			*		open sites, hardy, N fixer, tolerate a range of soils and habitats
Narrow-leaved snow tussock	<i>Chionochoa rigida</i>				*	colonising species, requires moist soils
	<i>Coprosma crassifolia</i>			*		tolerates a range of soils and habitats
	<i>Coprosma linariifolia</i>	*				requires initial shelter, tolerates a range of soils
Mingimingi	<i>Coprosma propinqua</i>			*		colonising species, tolerates a range of soils and habitats
	<i>Coprosma virescens</i>			*		open sites
Korokia	<i>Corokia cotoneaster</i>			*		open sites, palatable, tolerant of a range of soils and habitats

Matagouri	<i>Discaria toumatou</i>		*			coloniser, N fixer, tolerant of dry soils and habitats
Inaka	<i>Dracophyllum longifolium</i>			*		open sites, requires moist soils
Hard tussock	<i>Festuca novae-zelandiae</i>				*	open sites, tolerates dry soils
	<i>Hebe cupressoides</i>			*		open sites, tolerates dry soils
Prickly mingimingi	<i>Leptecophylla juniperina</i> subsp. <i>juniperina</i>			*		requires initial shelter, good lizard habitat
Manuka	<i>Leptospermum scoparium</i>		*			colonising species, tolerant of a range of soils and habitats
Porcupine shrub	<i>Melicactus alpinus</i>			*		open sites, tolerant of dry soils, good lizard habitat and food
Shrub daisy	<i>Olearia bullata</i>		*			open sites, requires damp soils
Shrub daisy	<i>Olearia cymbifolia / nummulariifolia</i>			*		open sites
Scented tree daisy	<i>Olearia fragrantissima</i>		*			requires initial shelter, tolerant of a range of soils and habitats, threatened species
Hector's tree daisy	<i>Olearia hectorii</i>	*				open sites, requires moist soils, threatened species
	<i>Olearia lineata</i>		*			open sites, tolerant of a range of soils and habitats
Scented tree daisy	<i>Olearia odorata</i>			*		open sites, good invertebrate habitat
Mountain cottonwood	<i>Ozothamnus vauvilliersii</i>			*		open sites, requires damp soils
Silver tussock	<i>Poa cita</i>				*	colonising species, tolerates dry soils
Hall's totara	<i>Podocarpus cunninghamii</i>	*				slow growing
Kowhai	<i>Sophora microphylla</i>	*				requires initial shelter, tolerates a range of soils, prefers moist, well drained areas

Tussockland		small tree	tall shrub	small shrub	sedge, rush, tussock	Comments
Golden speargrass	<i>Aciphylla aurea</i>				*	open sites, tolerates a range of soils, sharp leaf tips
Toetoe	<i>Austroderia richardii</i>				*	colonising species, tolerant of moist soils in a range of habitats
Rautahi	<i>Carex coriacea</i>				*	open sites, hardy, tolerant of wet soils
NZ broom	<i>Carmichaelia petriei</i>			*		open sites, hardy, N fixer, tolerate a range of soils and habitats
bush tussock	<i>Chionochloa conspicua</i>				*	open sites, requires moist soils in a range of habitats
Narrow-leaved snow tussock	<i>Chionochloa rigida</i>				*	colonising species, requires moist soils
Inaka	<i>Dracophyllum longifolium</i>			*		open sites, requires moist soils
Blue wheat grass	<i>Elymus solandri</i>					open sites, tolerates dry soils
Hard tussock	<i>Festuca novae-zelandiae</i>				*	open sites, tolerates dry soils
	<i>Hebe cupressoides</i>			*		open sites, tolerates dry soils
	<i>Hebe odora</i>			*		open sites, requires moist soils
	<i>Hebe subalpina</i>			*		open sites, montane locations, slow growing
Porcupine shrub	<i>Melicytus alpinus</i>			*		open sites, tolerant of dry soils, good lizard habitat and food
Mountain cottonwood	<i>Ozothamnus vauvilliersii</i>			*		open sites, requires damp soils
Mountain flax	<i>Phormium cookianum</i>				*	colonising species, tolerant of dry soils in a range of habitats
NZ flax	<i>Phormium tenax</i>				*	colonising species, tolerant of a range of soils in a range of habitats
NZ Daphne, Toroheke	<i>Pimelea aridula</i>			*		open sites, tolerates dry soils, difficult to propagate, uncommon
Silver tussock	<i>Poa cita</i>				*	colonising species, tolerates dry soils

(Faint, illegible table content)