NATIONAL RECOVERY PLAN FOR THE TARENGO LEEK ORCHID *Prasophyllum petilum*

Australian Government

NSW GOVERNMENT Environment, Climate Change & Water

Prepared by:
Biodiversity Conservation Section
Environment Protection and Regulation Group
Department of Environment and Climate Change and Water (NSW)
PO Box 2115
Queanbeyan NSW 2620
Tel: 02 6298 9700

Prepared in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the New South Wales *Threatened Species Conservation Act, 1995* in consultation with the Environment ACT.

This plan should be cited as follows:

Department of Environment, Climate Change and Water (NSW) 2010. *National Recovery Plan for Prasophyllum petilum*, Department of Environment and Climate Change and Water (NSW), Hurstville.

ISBN: 9781 1 74232 845 4 DECCW 2010/574

Cover Photo: © Colin Totterdell

DISCLAIMER

The attainment of objectives and the provision of funds may be subject to budgetary and other constraints affecting the parties involved, and may also be constrained by the need to address other conservation priorities. Approved recovery actions may be subject to modifications due to changes in knowledge and changes in conservation status.

Summary

This document constitutes the formal National Recovery Plan for *Prasophyllum petilum*. The plan considers the conservation requirements of the species across its known range, identifies the actions to be taken to ensure its long-term viability in nature and the parties who will undertake these actions.

The Tarengo Leek Orchid is listed as Endangered under the *Threatened Species Conservation Act 1995* (TSC Act), the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the ACT *Nature Conservation Act 1980*.

The Tarengo Leek Orchid (*Prasophyllum petilum* D. Jones & R. Bates) is a rare orchid of grasslands and grassy woodlands of the Southern Tablelands of New South Wales and in the Australian Capital Territory.

The overall objective of this Recovery Plan is to maintain or enhance the populations of Tarengo Leek Orchid at the five known sites, by controlling threatening processes and improving conditions for growth and recruitment.

This objective will be achieved through the following recovery actions:

- Monitor populations
- Monitor encroachment of natives
- Remove threatening weeds
- Conduct further survey
- Develop management plans
- Analyse data
- Conduct fire and grazing experiment
- The extension of Hall Cemetery to adjacent land
- Co-ordinate recovery actions

Abbreviations used in this Plan

CMA	Catchment Management Authority
DECCW	Department of Environment, Climate Change and Water, New South Wales
DTAMS	Department of Territory and Municipal Services, ACT
EPBC Act	*Environment Protection and Biodiversity Act 1999* (Commonwealth)
IUCN	International Union for the Conservation of Nature
LHPA	Livestock Health and Pest Authority (NSW)
MWRC	Mid-Western Regional Council
PSC	Palerang Shire Council
TSC Act	*Threatened Species Conservation Act 1995* (NSW)
TSR	Travelling Stock Reserve

SPECIES INFORMATION AND GENERAL REQUIREMENTS

Description and Taxonomy

Prasophyllum R. Br. includes c. 80 species, mostly endemic to southern Australia (Jones 1988). Approximately one third of the known species are rare or threatened (Briggs & Leigh 1996). All *Prasophyllum* species are tuberous terrestrial herbs with a single cylindrical leaf resembling the leaves of an onion or leek (hence their common name). Flowers are borne in a spike that ruptures the leaf near its midpoint. Most species have pale greenish or cream flowers with a prominent, often crinkled or undulate labellum. The flowers are borne reversed on the spike compared with most other orchids (i.e. with the labellum uppermost).

The Tarengo Leek Orchid is a slender herb to 30 cm, its cylindrical leaf reaching 25 cm. A narrow flowering spike is produced in October to November, with 5 to 18 flowers distributed sparsely along it. Flowers are greenish to pinkish mauve, 5-7 mm across, and sweetly scented. Shiny green, obovoid capsules to 4 mm long are produced after flowering.

The Tarengo Leek Orchid has affinities with the more widespread species *P. campestre* R. Bates & D. Jones. It is distinguished from this by its generally more slender habit with fewer, smaller flowers in a narrow spike and its short, almost vestigial hamulus on the pollinarium. *Prasophyllum campestre* has a more westerly distribution than the Tarengo Leek Orchid, ranging widely on the inland plains of New South Wales (Jones 1991, Bernhardt & Rowe 1993, Bates 1994, D. Jones pers. comm. July 2000).

Distribution

When first described in 1991, the Tarengo Leek Orchid was known only from its type locality at the Hall Cemetery in the ACT. It has since been found at four sites in New South Wales: Captains Flat Cemetery, Ilford Cemetery, Steves TSR (Travelling Stock Route) at Delegate and the Tarengo TSR near Boorowa (Figure 1). The total population size is estimated to be approximately 100 400. All sites but the Tarengo TSR population are very small, with a confined area of occupancy (Table 1).

Site	Year	Numbers	Area
Hall Cemetery	2009	26	0.5 ha
Captains Flat Cemetery	2009	Only leaves (i.e. nos. not known accurately)	0.5 ha
Ilford Cemetery	2009	6	20 m2
Tarengo TSR	2009	Approx. 45000	2.5 ha
Steves TSR	2009	19	1 ha

Table 1: Approximate site population size.

A single flowering plant was also found in November 2000 at Bowning Cemetery near Yass. Seed collected from the Hall Cemetery population was broadcast at Bowning on several occasions prior to 1996 (D. Jones pers. comm.). It is likely that the plant since found at this site is a seedling from these introductions.

Apparent population numbers vary greatly from year to year, probably in relation to soil moisture. Only plants in flower can be readily identified, so it is likely that the true population size is greater than the numbers presented in Table 1. The orchids rely on stored reserves in years when they do not emerge. It is not known how long plants can survive without emergence, but presumably older/larger individuals survive more readily than younger individuals.

The distribution of Tarengo Leek Orchid before European settlement is unknown, but it is likely that it was once more common, since grasslands and grassy woodlands have been targeted for grazing and cultivation since the days of early settlement.

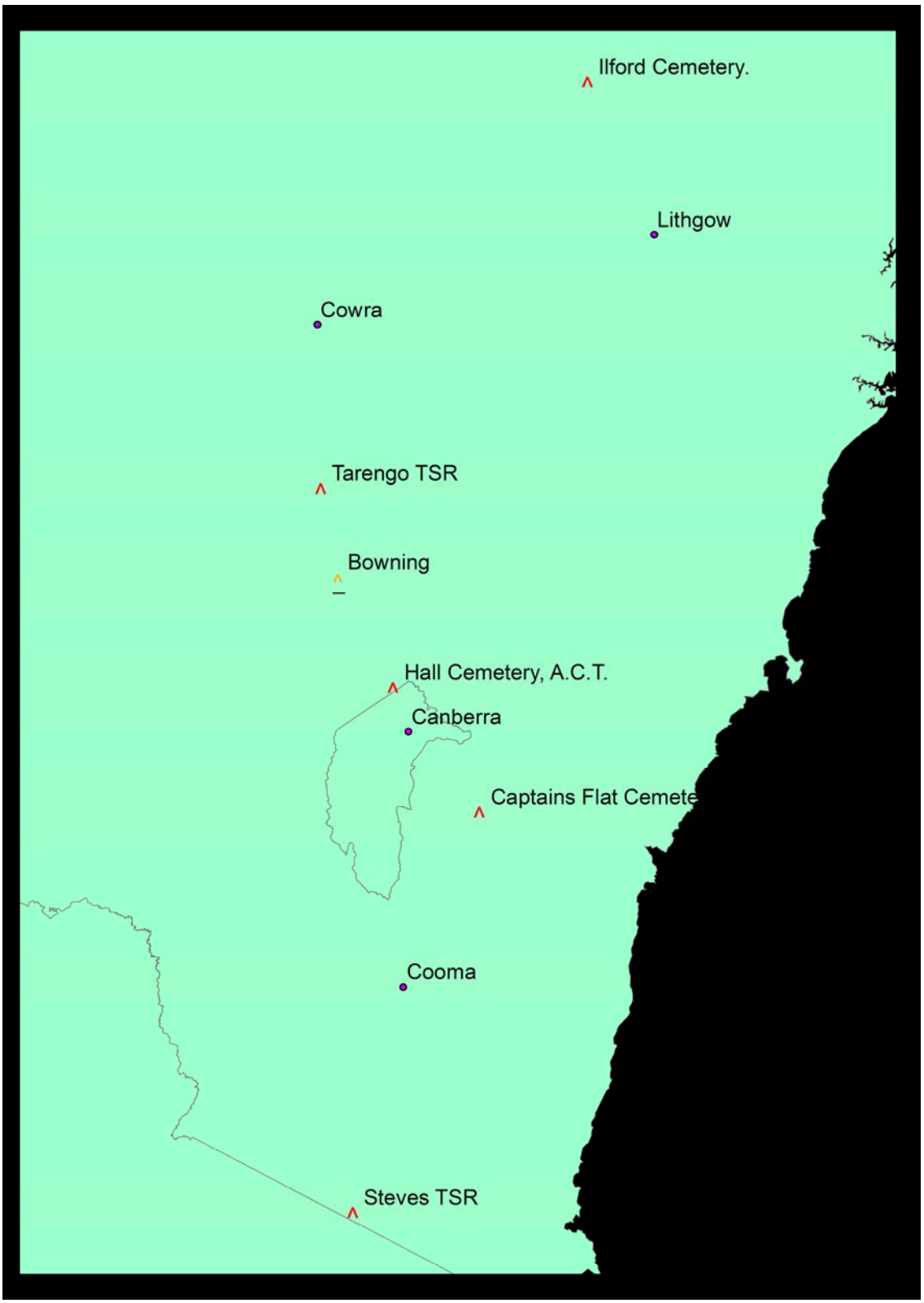

Figure 1. Map showing the five natural populations and the Bowning translocated population of Tarengo Leek Orchid

Habitat

The Tarengo Leek Orchid occurs on relatively fertile soils in grassy woodland or natural grassland. The three cemetery sites originally contained grassy woodland, dominated by *Eucalyptus pauciflora* (Snow Gum) and *E. aggregata* (Black Gum) at Captains Flat, and *E. blakelyi* (Red Gum) and *E. melliodora* (Yellow Box) at Hall and Ilford. The Hall Cemetery vegetation is an example of the Yellow Box/Blakely's Red Gum Grassy Woodland which is listed as an Endangered Ecological Community under the ACT *Nature Conservation Act, 1980*. Records indicate that parts of the Hall Cemetery were cleared of trees in 1907, and a similar clearing or thinning of trees probably occurred at the Captains Flat Cemetery (John Roach, pers. comm.). Scattered eucalypts now occur at both sites, with regrowth particularly strong in parts of the Captains Flat Cemetery.

Tarengo TSR is within the "Corcoran's Plains", an area of approximately 200 ha regarded by local farmers and historians to have been a largely treeless grassy plain at the time of European settlement. Steves TSR at Delegate is a natural grassland in a frost hollow, surrounded by Snow Gum on the slopes above. Both sites meet the definition of the EPBC Act Endangered Ecological Community 'Natural Temperate Grassland of the Southern Tablelands'.

Shrubs are generally sparse at the Hall Cemetery and the Tarengo TSR. A patchy shrub layer of *Hakea microcarpa*, *Acacia dealbata* and *Leptospermum brevipes* occurs in the Captains Flat Cemetery.

The section of Ilford Cemetery where the plants occur has been excluded from regular mowing for several decades, apparently because the area became too boggy to mow easily. There is significant regeneration of trees, both *Eucalyptus blakelyi* and some *E. camphora*. In 2009 there was a dense cover (>90%) of *Themeda australis* and *Sorghum leiocladum* where the *P. petilum* occurred.

Poa sieberiana and *Themeda australis* are the dominant grasses at Hall and Captains Flat, although at Captains Flat the Tarengo Leek Orchid occurs mainly in patches of *Schoenus apogon* that occur amongst the *Poa*. Dense swards of *Themeda australis* also occur at the Tarengo TSR but the orchid occurs only occasionally within these areas, favouring instead more open swards of *Bothriochloa macra, Pentapogon quadrifidus* and *Austrodanthonia* spp. that dominate the south-western section of the TSR.

While the vegetation differs somewhat between sites, it is notable that the orchid occurs in relatively moist areas within both the Hall, Ilford and Captains Flat Cemeteries. At Hall, the water table is high (ACT Government 1997), and standing free water is known to occur in the orchid habitat for up to 24 hours after storms (J. Laity, pers. comm.). Tarengo TSR is not visibly wet for much of the year, but after rain standing water is evident in the area where the orchid occurs, and co-occurring species such as *Pentapogon quadrifidus, Schoenus apogon, Drosera peltata, Sebaea ovata* and *Haloragis heterophylla* confirm that the site is poorly drained. Occurrence in moist depressions and swamps is typical for the genus *Prasophyllum* (Jones 1988).

Site status and information

Captains Flat cemetery has not been actively used since the early 1980s. The tenure of Captains Flat is at present uncertain. Palerang Shire Council have requested clarification on the status of a number of lots, including the Captains Flat Cemetery, from the Lands Department in NSW.

Ilford Cemetery is active, although there are very few burials. Mid Western Regional Council at the time of writing was not aware of the record of *P. petilum* in the cemetery. Co-incidentally, a conservation area has been established over an area of the cemetery that has not been mowed for over 15 years. Fortunately the population occurs inside the area recognised for conservation.

Action Plan No. 4 (ACT Government 1997) and the ACT Lowland Woodland Strategy (ACT Government 2004), provide measures for the management of *P. petilum* at Hall Cemetery. Further, the species requirements feature in the Hall Cemetery Management Plan (ACT Government 2005).

Tarengo TSR is managed by the Lachlan Livestock Health and Pest Authority (LHPA), although the Lachlan CMA provides assistance with funding of some activities. The site is only grazed in the autumn to minimise impacts on the Tarengo Leek Orchid.

Steves TSR is spelled from grazing through the spring and early summer by the South East LHPA. A sign was erected to inform the public of the significance of the site. There is no formal management plan or agreement.

Biology and ecology

Tarengo Leek Orchid plants sprout from a tuber, emerging in late autumn or winter. Inflorescences are produced mainly in October and November (extending into December for the Captains Flat and Delegate populations). Flowering in different species of *Prasophyllum* may depend on, be stimulated by, or be inhibited by summer fires (Jones 1988). Tarengo Leek Orchid flowers prolifically without fire.

Non flowering individuals cannot be accurately distinguished from *Microtis* spp, so most of the population data collected only relates to flowering plants. There is a high annual fluctuation in flowering population numbers. Monitoring over the period 1995-2000 at the Tarengo TSR (Ecological Interactions, unpublished data) shows that mean number of flowering stems per m^2 has varied from 2 to 29, with a maximum of up to 100 stems per m^2. Similarly, the flowering population at Hall has varied from 5 to 90 since 1991, however in most years numbers are between 20 and 70.

Analysis of the Hall flowering population and annual, spring and autumn rain did not demonstrate any clear trend. Both the Hall and Tarengo populations showed a similar response, with low numbers in the same years, and higher numbers in others.

At Hall individual plants have been marked since 1995, and these data provide some insights into the life history of the Tarengo Leek Orchid and its dynamics at the site:

- 162 plants have been tagged since 1995.
- Only three plants flowered more than five years.
- Only two plants flowered for five years consecutively, whereas 52 plants flowered two years in a row.
- Plants are often dormant for a year, but only seven plants were dormant for more than three years.
- 37 of the 162 tagged plants have not been seen for five years or more.

It is not known how long individuals take to produce an inflorescence, as younger plants are difficult to see among the vegetation. It is also not clear how long plants live, as the maximum period a plant may be dormant is not known. Tuber dormancy of up to five (but more commonly one or two) years has been recorded for the related species Gaping Leek Orchid (*Prasophyllum correctum*, Coates et al. 1999).

An experiment was established at Tarengo to examine the influence of burning and grazing on *P. petilum*. The experiment was commenced in 2001 and monitored until 2005. The burn occurred in autumn 2003. Burning increased the number of flowering plants, but this effect diminished by 2005 when numbers were similar to 2001 (Fig 2).

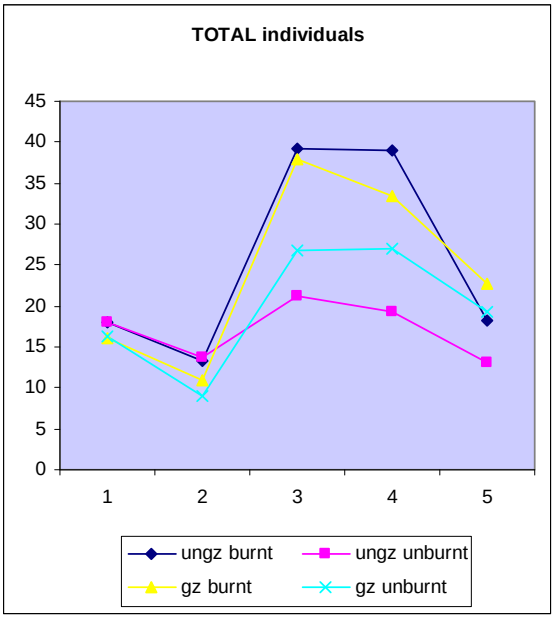

Figure 2. Mean number of *P. petilum* per plot (4 plots) in the Tarengo brazing/burning trial.

Prasophyllum species, like most orchids, are generally outcrossers, pollinated by bees, wasps and other insects attracted by scents and nectar released from the labellum (Jones 1988). A generalist thynnine wasp has been noted as an important pollinator for Tarengo Leek Orchid (D. Jones, pers. comm.).

Prasophyllum species reproduce mostly from seed, although plants occasionally produce daughter tubers close to the parent plant (Jones 1988). Coates et al. (1999) noted that 9% of the total population of Gaping Leek Orchid, were clonal. Close groups of flowering stems have been observed at Tarengo and it is likely that limited clonal reproduction also occurs in Tarengo Leek Orchid.

Like all orchid seed, *Prasophyllum* seeds are very small and light, so theoretically could spread over wide distances. In practice, however, they probably generally only disperse over several metres (D. Jones pers. comm.). Successful germination of *Prasophyllum* species requires the presence of a fungal symbiont (Hunyh 1999, Coates et al. 1999).

Legal Status

The Tarengo Leek Orchid is listed as Endangered under the *Threatened Species Conservation Act 1995* (TSC Act), the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the ACT *Nature Conservation Act 1980*.

International obligations

The species is not listed under International agreements. However, this plan is consistent with the aims and recommendations of the Convention on Biological Diversity, which has been ratified by Australia, and will assist in meeting Australia's responsibilities under that convention.

Role and interests of indigenous people

In NSW, local Aboriginal Land Councils were consulted in the preparation of this plan. At the time of publication no role or interest of indigenous people had been identified for this species. The comments of indigenous communities in south eastern and central NSW on this Recovery Plan were sought, but

none were forthcoming. The interests of these communities will be considered in the implementation of recovery actions where a role is identified.

Habitat critical to the survival of the species

Given the small number of extant populations and the low population size at most sites, all populations and the habitat they occupy are critical to the survival of *Prasophyllum petilum*. The minimum area that could be considered for the Tarengo Leek Orchid is the boundary of the TSRs and the cemeteries in which the populations occur. More habitat than is actually occupied is needed for organisms such as the pollinator and the fungal partners. It may be that the requirements of these organisms stretch beyond the boundaries of the cemeteries and the TSRs. Due to uncertainties in the requirements of other biota the habitat critical to the survival of the species has not been mapped.

Biodiversity Benefits

The preparation and long term implementation of Recovery Plans for threatened species, populations and ecological communities, contributes to, and highlights the importance of, conserving biodiversity. The conservation of biodiversity has a number of wider community benefits. These include providing and maintaining a range of ecosystem processes and contributing to increased ecological knowledge of species, habitats and broader ecosystems.

Hall and Ilford Cemeteries are important for the Yellow Box (*Eucalyptus melliodora*) - Red Gum (*Eucalyptus blakelyi*) community, listed as endangered on the ACT *Nature Conservation Act 1980* and the TSC Act respectively. The Hall Cemetery and the Captains Flat Cemetery are both known locations of the regionally rare grasshopper Key's Matchstick (*Keyacris scurra*).

The Golden Sun Moth (*Synemon plana*) has been recorded from Tarengo TSR. This site may also contain other threatened grassland fauna such as the Striped Legless Lizard (*Delma impar*) or the Grassland Earless Dragon (*Tympanocryptis pinguicolla*). Both Tarengo and Steves TSR represent important remnants of Natural Temperate Grassland of the Southern Tablelands, listed as an Endangered Ecological Community under the EPBC Act.

Social and economic impacts

The implementation of this Recovery Plan is not expected to cause significant adverse social or economic impacts. The cost of implementation will be offset by the social benefits of preventing further loss in biodiversity and the potential cost of recovery should this species become close to extinction. Actions on public land are consistent with current land management practices identified for such land.

Plan review and evaluation

DECCW in consultation with the DTAMS will evaluate the performance of the recovery plan against the criteria identified below. The Plan will be formally reviewed within five years from the date of its adoption under the EPBC Act.

Threats

Competition from other native species

At Tarengo TSR, Tarengo Leek Orchid predominates in a *Bothriochloa-Danthonia* sward and is uncommon within *Themeda australis* swards which occur along the southern edge. Three permanent monitoring plots indicate that the *Themeda australis* has been advancing into the *Bothriochloa-Danthonia* sward over the last five years, and thus is a potential threat to the orchid population. The Golden Sun Moth is also disadvantaged by *T. australis*, requiring a sward of *Austrodanthonia* spp. for survival. At the Hall Cemetery, Tarengo Leek Orchid currently grows within a *T. australis* sward. However, the density of *T. australis* may be increasing as a result of the change to the historical

management. Native shrubs, particularly *Hakea microcarpa*, have increased at the Captains Flat Cemetery in the last two decades (J. Roach, pers. comm.), possibly particularly so in the last few years (C. Binet pers. comm.). This may limit the Tarengo Leek Orchid population through shading and/or increased root competition.

Weed invasion

The introduced grasses *Anthoxanthum odoratum* (Sweet Vernal Grass) and *Holcus lanatus* (Yorkshire Fog) are abundant in the Hall and Captains Flat Cemeteries. These grasses appear to invade without disturbance, and have become more prominent at Hall over the last five years (D. Jones pers. comm.). Other introduced grasses that may be similarly increasing at Hall include *Festuca arundinacea* (Tall Fescue) *Bromus molliformis* (Soft Brome), *Bromus diandrus* (Great Brome), *Vulpia* sp. (Fescue), and *Avena fatua* (Wild Oats). Exotic grasses probably pose the most serious threat to the Tarengo Leek Orchid at Hall Cemetery.

Romulea rosea (Onion Grass) is present in large numbers in some areas of Tarengo TSR that may otherwise be habitat for the orchid. *Hypericum perforatum* (St John's Wort), a declared noxious weed, is also present in parts of Tarengo TSR, and is sprayed by the Lachlan LHPA staff. At Ilford and Delegate that plants occur in native grassland with few weeds.

Grazing

The Tarengo and Delegate populations are potentially at risk from grazing, especially during flowering and fruiting. The sections of the TSRs with *P. petilum* should not be stocked from October-December, and preferably from August. Any loss of individuals due to grazing pressure, and reduction in recruitment due to grazing of flowering stems, particularly from the Delegate site, is detrimental to long term survival.

Increased browsing/grazing pressure from animals such as kangaroos and rabbits has been identified as a major threat to the Gaping Leek Orchid. Grazing of emerging plants, particularly in the first season after fire, significantly reduced flowering (Coates et al. 1999). While it appears that Tarengo Leek Orchids can withstand some grazing (cf. historical grazing at Tarengo TSR), it is likely that there is a critical level of grazing above which its survival would be reduced.

Cemetery management

Two of the five sites are active cemeteries. Ongoing development of the sites for fresh graves potentially conflicts with conservation management for *P. petilum*. This issue has been addressed in the ACT, with a proposal to extend Hall Cemetery into land adjacent to the current site, preserving the existing habitat for *P. petilum*. The proposal has not yet been enacted, but should be completed within the life of this plan. There are a small number of ongoing sales of burial plots (a few per year), and over 70 pre-sold plots. New burial plots are located away from existing plants, but it is possible that recruits will establish on ground reserved for burials. Recently in this circumstance, the plants have been translocated within the cemetery. However, it is not known whether the translocated plants have survived.

At Ilford Cemetery, in the next 10-20 years it is not likely that sufficient burials would occur as to threaten *P. petilum.*

Other issues are associated with site management, such as spraying herbicide, mowing, the operation of machinery such as backhoes, and inappropriate horticultural planting.

Potential threats:

Drift of dust and fertilizers from neighbouring paddocks at Tarengo (superphosphate and herbicide could interfere with mycorrhizal fungi and potentially kill the orchids).

Guidance for Environmental Assessment

Although this recovery plan cannot prescribe decision-making under Commonwealth or State environmental legislation, it is clear from the review conducted as the basis for this plan that all populations are critical to the long-term survival of the species.

Management Practices

To avoid significant impacts on the species, any of the following management practices or on ground works in the immediate vicinity of *P. petilum* require assessment.

- Clearing
- Herbicide and pesticide spraying
- Grazing and/or mowing, especially in spring and summer when above-ground parts are present
- Burning
- Drainage works
- Grave digging
- Removal of vegetation

RECOVERY OBJECTIVES AND CRITERIA

Objectives

Over the life of this Recovery Plan:

- to ensure that all natural populations of *Prasophyllum petilum* are stable or increasing in size.

Performance Criteria

Over the life of this Recovery Plan:

- all populations have remained stable or have increased in size over a five year period.

RECOVERY ACTIONS

Previous Recovery Actions

Annual monitoring of Hall has been underway since 1995.

Encroachment of the Tarengo TSR population by *Themeda australis* was monitored from 1995 to 2002.

The Tarengo population was monitored from 1995 to 2004

An Action Plan for the recovery of the Tarengo Leek Orchid in the ACT details management actions for the protection of the species within the Hall Cemetery (ACT Government 1997). This plan is implemented by the ACT Cemeteries Trust and Environment ACT.

To protect the Tarengo Leek Orchid the Territory Plan was modified in November 2005 to incorporate adjacent blocks of land to the existing cemetery, so that no further graves would be dug in the existing cemetery. The Hall Cemetery Management Plan of 2005 provides for the development of the adjacent lands by 2006, but these measures have not been implemented. The plan contains other specific measures to minimise impacts on *P. petilum*. The recovery team considers the cessation of burials in

the existing cemetery and development of the adjacent blocks as critical for minimizing damage to the orchid and other natural values of the existing site.

A leaflet describing the Tarengo Leek Orchid and calling for reports of potential new populations has been prepared and distributed to local communities.

Public meetings have been held at the Tarengo TSR in May 2000 and Captains Flat Cemetery in July 2000 as part of the development of this Recovery Plan, to discuss management needs with local residents, landholders and RLPB rangers and Board members.

A follow-up meeting was held with NPWS and Yarrowlumla Shire Council to discuss potential for negotiating a management agreement.

A BIOCLIM model for the Tarengo Leek Orchid was prepared based on the three known localities.

A survey of sites considered to be potential habitat for the Tarengo Leek Orchid (based on the BIOCLIM model and site survey data held at NSW NPWS) was undertaken in Spring 2000. No new populations were discovered.

An experiment was established at Tarengo to examine the influence of burning and grazing on *P. petilum.*

Trials of control strategies for *Hakea microcarpa* and *Leptospermum brevipes* were conducted at Captains Flat cemetery. Cutting and painting with Roundup proved to be the best method of long term control (Prober & Thiele 2006).

The Lachlan Catchment Management Authority employed a contractor to prepare a management plan for Tarengo TSR in 2009. The intention is that the agreement will become a property agreement between the Lachlan CMA and the Lachlan Livestock Health and Pest Authority (LHPA). A number of recommendations were made, including:

- Weed control.
- Careful monitoring of the kangaroo grass sward to determine if it is expanding.
- Revegetating the disused holding yards.
- Protecting the site from fertiliser run-off and spray drifts by creating a 30m buffer of perennial native pasture along the south western boundary of the western portion. This recommendation was successfully negotiated with the adjoining landholder.
- Continue to graze in autumn when required, that is when there is sufficient growth to warrant biomass reduction; 100-400 head of cattle onsite for 1-3 days.
- Monitor individuals and populations and research the most effective management techniques.
- Discuss the possible re-commencement of Prober and Thiele's disturbance trials with DECCW.

Proposed recovery actions

1. Monitor populations

All populations will be monitored annually. The ACT monitors the Hall populations annually. NSW will establish a representative monitoring program at Tarengo, since there is a belief that the decline in numbers in the 10 permanently marked plots are not representative of the population (S. Prober pers. comm.). A sampling procedure will be established at Captains Flat, Delegate and Ilford.

The population at Bowning cemetery (from seed collected at Hall) will be monitored to better understand the translocation potential of the species.

Responsibility: DECCW and DTAMS

Cost: $10000 over 5 years.

2. Monitor the encroachment of native species that may adversely affect *P. petilum* at Tarengo TSR, Hall Cemetery and Captains Flat, and control if required.

Monitor the spread and changes in density of *Themeda australis* at the Tarengo TSR to establish whether it is having a detrimental effect on Tarengo Leek Orchid numbers.

Themeda australis was considered to be spreading at Tarengo TSR from 1995 to 2002, and perhaps due to the low intensity of grazing at the time. A similar expansion of *Themeda australis* has recently been noted at Hall Cemetery. The effect of this on Tarengo Leek Orchid numbers needs to be understood so that appropriate management can be undertaken if necessary.

Observations at Captains Flat Cemetery suggest that *Hakea microcarpa* and other shrubs may be spreading into areas where Tarengo Leek Orchid is growing. Trials of burning, slashing and poisoning for *Hakea microcarpa* and *Leptospermum brevipes* were conducted, with the most effective technique being application of glyphosate. All methods resulted in a decline in the abundance of *Poa*, and an increase in the abundance of *Themeda*. There were no orchids present in the areas where the trial was conducted. A significant proportion of the *Microtis* or *Prasophyllum* leaves found in 2009 were underneath, or on the margin of shrubs.

The numbers and approximate projected cover of shrubs within the area of occupancy at Captains Flat will be monitored. If shrub cover is found to be increasing, any new recruits directly competing with individual *P. petilum* plants will be removed.

Eucalypt regeneration will be monitored at Hall Cemetery. Any plants directly impacting on *P. petilum* plants will be removed.

The cover of native grasses at Ilford Cemetery is very high, such that there is almost no exposed ground. Small herbaceous species such as *P. petilum* are probably seriously disadvantaged at present. Burning or mowing of the habitat is required in autumn to reduce the density of the grass sward. If the site is burned, it should not be burned again for 5 to 10 years. In the interim, if the grass sward becomes too dense again, mowing would be simplest option.

Responsibility: DECCW

Cost: $2500 over 5 years

3. Weed control

At times, weeds such as *Anthoxanthum odoratum*, *Festuca arundinacea* and *Holcus lanatus* may provide competition to *P. petilum* at Hall. However, the abundance fluctuates with seasonal conditions. According to the Hall Cemetery Management Plan, 2005, there were no weeds that were of concern, although in 2009 40-50% of the cover was exotic grasses, and there are patches within 10 m of *P. petilum* plants with 100% cover of exotics.

Hand weeding is the only method that is appropriate for weeds among or near *P. petilum*, until there is a proven non-harmful alternative. Broadscale control of widespread weeds such as sweet vernal grass, fog grass or *Phalaris* without affecting *P. petilum* or other natives requires research. Burning and herbicide (e.g. FusilladeTM) may be applicable, but trials will need to be undertaken.

Responsibility: DECCW, Lachlan LHPA, DTAMS

Cost: $5000 over 5 years.

4. Conduct further survey

Continue to survey areas suitable for Tarengo Leek Orchid at appropriate times, either as part of other survey work or as time and resources permit.

Considerable survey has already been completed in the context of other projects undertaken (NSW NPWS). Largely as a result of these, a list of 57 sites considered suitable for searching for *P. petilum* was prepared (Appendix 2, Table 1). Forty-seven sites (Appendix 2, Table 2) were searched (unsuccessfully) for *P. petilum* during spring 2000. Further sites will be searched during other surveys and field work carried out in these localities.

Responsibility: DECCW

Cost: $ *In kind*

5. Develop and implement management plans for populations

Liaise with South East LHPA, Palerang Shire Council and Mid Western Regional Council to protect the *P. petilum* populations at Steves TSR and Captains Flat and Ilford Cemeteries respectively. Ideally, each organisation should have a management plan for the site that recognises the environmental significance and management requirements of the orchid.

Appropriate signage could be erected to inform the public of the cultural and natural heritage significance of sites, and provide contact numbers for further information.

Responsibility: DECCW, Palerang Shire Council, Mid Western Regional Council, South East LHPA.

Cost: $ 10000 over 5 years.

6. Analyse the data from the burning/grazing trials at Tarengo

The data from the experiment was never formally analysed. At this stage it is unclear whether there was a significant increase in numbers after the fire. Maximum value for the works and money expended will only be obtained when the data has been properly assessed and documented.

Responsibility: DECCW.

Cost: $6000

7. Conduct the burning and grazing trials again

The experimental plots from the grazing and burning trial at Tarengo are still in place. If the analysis of the results suggests an extension of the experiment is worthwhile, it could be continued, with another round of treatments.

Responsibility: DECCW.

Cost: $10000

8. The development of extensions to Hall cemetery be expedited.

To protect the population of the Tarengo Leek Orchid at Hall Cemetery, further burials within the existing cemetery should cease, and the (approved) expansion of the cemetery into the adjacent blocks should be pursued as soon as possible.

Responsibility: ACT Parks Conservation and Lands and Canberra Cemeteries.

Cost: $*In kind*

9. Co-ordinate recovery actions

DECCW will co-ordinate the implementation of the recovery actions identified for *P. petilum.*

Responsibility: DECCW.

Cost: $ *In kind*

Summary of costs and actions identified in the Recovery Plan

Action No.	Action Title	Cost Estimate ($1000s/year)					Total Cost ($)	Responsible Party	Priority
		Year 1	Year 2	Year 3	Year 4	Year 5			
1	Monitor populations	2	2	2	2	2	**10**	DECCW, DTAMS	1
2	Monitor encroachment of natives	0.5	0.5	0.5	0.5	0.5	**2.5**	DECCW, LHPA	1
3	Remove threatening weeds	1	1	1	1	1	**5**	DECCW, LHPA, DTAMS, SELHPA	1
4	Conduct further survey							DECCW	3
5	Develop management plans	10					**10**	DECCW, MWRC, SELHPA, PSC	2
6	Analyse data	6					**6**	DECCW	2
7	Experiment	2	2	2	2	2	**10**	DECCW	3
8	Move cemetery							ACT PCL & CC.	
9	Co-ordinate recovery actions							DECCW	4
Total		**21.5**	**5.5**	**5.5**	**5.5**	**5.5**	**43.5**		

a: Minimal cost will be borne by agencies in their normal operating budgets.

Affected Interests

Stakeholders and those involved in implementing the plan include:

- NSW DECCW
- ACT DTAMS
- Palerang Shire Council
- Mid-Western Regional Council
- Lachlan Livestock Health and Pest Authority
- South East Livestock Health and Pest Authority

References

ACT Government (1997). *A leek orchid* (Prasophyllum petilum): *An endangered species.* Action Plan No. 4. Environment ACT, Canberra.

ACT Government (2001). Master Plan for the Village of Hall. Draft for Public Discussion. Planning and Land Management, Urban Projects. Department of Urban Services. Master Plan No. 20011438-May 2001.

ACT Government (2004) Lowland Woodland Strategy. Department of Territory and Municipal Services ACT

ACT Government (2005). Hall Cemetery Management Plan

Bates, R.J. (1994). *Prasophyllum*, in N.G. Walsh & T.J. Entwisle (eds) *Flora of Victoria*, vol. 2, Inkata Press, Melbourne.

Bernhardt, P. & Rowe, R.R. (1993). *Prasophyllum*, in G.J. Harden (ed.) *Flora of New South Wales*, vol. 4, New South Wales University Press, Sydney.

Briggs, J.D. & Leigh, J.H. (1996). *Rare or Threatened Australian Plants: 1995 Revised Edition,* pp. 466. CSIRO Publishing: Melbourne.

Coates, F., Lunt, I., and Wapstra, H. (1999). Draft Recovery Plan 2000-2002 *Prasophyllum correctum* D. L. Jones (Gaping leek-orchid). School of Botany, La Trobe University, Victoria.

Huynh, T. (1999). In vitro propagation of the endangered Gaping Leek Orchid, *Prasophyllum correctum*. Honours thesis, Bachelor of Applied Science, RMIT University, Melbourne.

Jones, D.L. (1988). *Native Orchids of Australia*. Reed Books, Sydney.

Jones, D.L. (1991). New Taxa of Australian Orchidaceae, *Australian Orchid Research* **2**:1-207.

Prober, S. & Thiele, K. (2006) Management trials for control of woody weeds at Captains Flat Cemetery. Unpublished report to DECCW.

Acknowledgments

DECCW would like to thank the following people and their respective agencies/organisations for their assistance with the preparation of this Recovery Plan and with the implementation of recovery actions to date for this species.

Ron Duggan - Lachlan LHPA

Graham Hillier – SE LHPA

Shireen Murphy – MWRC

Emma Cook – ACT PC&L

Melanie Strang – Ecoedge

Suzanne Prober – CSIRO

Rainer Rehwinkel – DECCW

Funding for the preparation of this plan was provided by the Australian Government.