

# Action Statement

Flora and Fauna Guarantee Act 1988 No. 88 (Revised in 2009)

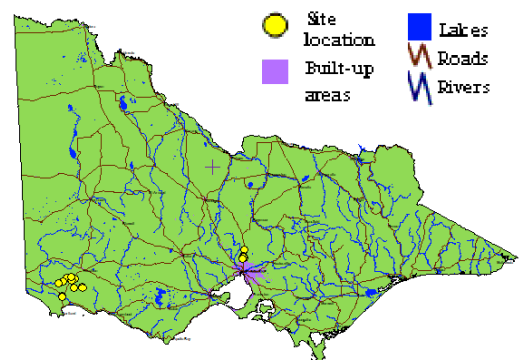
## Curly Sedge *Carex tasmanica*

*This revised Action Statement is heavily based on the Recovery Plan prepared for this species by DSE under contract to the Commonwealth Department of the Environment, Water, Heritage and the Arts.*

### Description

Curly Sedge (*Carex tasmanica* Kük.), of the Cyperaceae, is a wiry, densely tufted, perennial sedge to 50 cm in height. Plants may produce a long rhizome. The culms are erect, more or less terete, smooth, 15 - 20 cm long and approximately 0.8 mm wide. The leaves exceed the culms and are typically curled at the apex (hence the common name, Curly Sedge). The leaves are approximately 1.5 mm wide, the leaf-sheath is pale red-brown, and the ligule is obtuse and red-dotted. The lowest involucre bracts exceed the inflorescence. The inflorescence is narrow and erect, 5 - 25 cm long, with two to four spikes solitary at nodes. The spikes are sessile or on short pedicles, distant, erect at maturity and 1.5 - 2 cm long. The upper spike or two are male, and the lower two or three spikes are female; the lowest spike is often distant from the others. The glumes have a rounded (obtuse) to notched (retuse) apex which is often shortly mucronate and is red-brown with a paler midrib. The female glumes are 2.2 - 3.5 mm long (including the mucro). The utricles (fruits) are approximately 3 mm long (including the beak, which is 0.5 mm in length) and 1.5 mm wide. They are ellipsoid, faintly numerous-nerved, glabrous and pale green to brown with red dots. The nuts are ellipsoid to obovoid, triangular in cross-section and dark-yellow brown (Wilson 1994).

Both Curly Sedge and Plains Sedge (*C. bichenoviana*) have curled leaf tips. Curly Sedge, however, can be distinguished by the red dots on its ligules and the thin portions of the leaf-sheaths, a smaller number of spikes in its inflorescences, utricles which are red dotted, thinner textured and less inflated, and shorter, less red-brown glumes (Wilson 1994).



**Distribution in Victoria**  
(Flora Information System DSE 2007)

## Distribution

*Carex tasmanica* occurs in south-western Victoria and the Midlands region of Tasmania, with a disjunct metapopulation just north of Melbourne. There are few known large populations (i.e. more than 1000 plants), and most of these occur on private land. Most populations in Tasmania consist of less than 100 individuals (Gilfedder and Kirkpatrick 1996). The Craigieburn Nature Conservation Reserve is the only known reserved site in Victoria. Tasmania has sites within council reserves such as at Queens Domain in Hobart, and at Ross.

Scattered records of Stream Sedge (*Carex brownii*) and Tussock Sedge (*Carex iynx*) from the Western Plains of Victoria may also include *C. tasmanica*, as the former two species are superficially similar (Cheal 1990).

Nineteenth century records from Whitestone Swamp west of Ballarat, Lake Jollicum Wildlife Reserve south of Streatham, and Lake Omeo have been attributed to *Carex* sp. aff. *bichenoviana*, (Morcom 1999). Plants from these sites resemble *Carex bichenoviana* but may represent a separate taxon: they have a smaller inflorescence and thickened, narrow leaves which are curly towards the apex (Wilson 1994). The sites require further searching and study to identify their taxonomic status.

## Abundance

In the order of 50 000 – 500 000 plants are estimated to remain in approximately 52 - 59 wild sites (19 in Victoria and 33 - 40 sites in Tasmania). Many new sites have been discovered in Tasmania since 1992, most of which are small and on unprotected tenure such as roadsides (Ball 1995). There are currently estimated to be at least 33 Tasmanian populations, and *C. tasmanica* was removed from state listing (as 'vulnerable') in the mid-1990s (DPIWE Threatened Species Unit pers. comm.). New sites are expected to be discovered in suitable habitat on un-surveyed private land in Tasmania and south-western Victoria.

## Important populations

The most important Victorian sites occur in the following locations:

### Conservation Reserves

#### Craigieburn Grassland Nature Conservation Reserve

- 2000 - >10 000 plants across 10 - 15 sites along Curly Sedge Creek (2003, O. Carter).

The population size for about five of these sites was inferred or estimated based on habitat mapping rather than direct site visits.

## Private Land

### Breakfast Creek, Macarthur

- "Hundreds of thousands" of plants (probably >300 000 plants).

This site was assessed in 2001 by Andrew McMahon of Ecology Australia during a pipeline easement Environmental Impact Statement process (A. Pritchard pers. comm.). This may be the largest known population of *C. tasmanica*.

### Crawford River (Branxholme)

- 22 000 - >330 000 plants across 11 ha (2003, O. Carter).

This estimate was based on a range of observed densities of adult plants, estimated in 1 ha of the site (i.e. 0.2 - 3 plants per 1 m<sup>2</sup>) and extrapolated across the known 11 ha of the site. Further assessment of the whole site is needed to obtain a more accurate estimate of abundance.

### Inverary Lane, East of Branxholme (Road Reserve – DSE Crown Land Management)

- 1000 - 5000 plants across approximately one hectare (2003, O. Carter and A. Govanstone).

### Heywood Township (DSE Crown Land Management)

- 200 - 400 plants across about 0.5 ha (2003, O. Carter and A. Govanstone).

### Hotspur-Condah Rd (95% private, 5% Glenelg Shire Council managed)

- 50 000 plants (A. Pritchard).

### Lake Condah (Private land owned by local Aboriginal community)

- Population size is unknown but presumed to be small. A cover-abundance of 1 is given in Appendix 1 of Aboriginal Affairs Victoria (1993), but no plants have been located in recent surveys.

## Habitat

In Victoria, populations of *C. tasmanica* occur in seasonally wet, fertile, heavy clayey soils derived from basalt. In Tasmania, plants reside over a range of soil types derived from dolerite, basalt, sandstone and windblown sands. In Victoria, plants are generally confined to the upper margin of vegetation around slightly saline drainage lines or freshwater swamps. In Tasmania, *C. tasmanica* is found in soaks and seepage lines on sandy clay loam soils within grasslands or grassy woodlands (Gilfedder 1991). Mean annual rainfall across the species' known geographic range is mostly c. 300-600 mm (rarely to 800 mm in the Portland area and the Tasmanian midlands), with a moderate to pronounced winter maximum (Cheal 1990; Australian Bureau of Meteorology 2003).

The dominant vegetation type varies but sites are often grassy, sedgey or otherwise lacking in trees. Woolly Tea-tree (*Leptospermum lanigerum*), however, occurs close to a number of sites in south-western Victoria. Native species commonly associated with *C. tasmanica* include Common Spike-sedge (*Eleocharis acuta*), Nodding Club-sedge (*Isolepis cernua*), Shiny Bog-sedge (*Schoenus nitens*) and Shiny Swamp-mat (*Selliera radicans*). Its habitat is usually too wet to support otherwise dominant grasses such as Common Tussock-grass (*Poa labillardierei*), and too dry to support abundant Water Ribbons (*Triglochin procerum* s.l.) or the introduced Water Buttons (*Cotula coronopifolia*). Commonly occurring introduced species include Sea Barley-grass (*Critesion marimum*), Yorkshire Fog (*Holcus lanatus*), Cat's Ear (*Hypochoeris radicata*), Hairy Hawkbit (*Leontodon taraxacoides*), Rye Grass (*Lolium* spp.), Buck's-horn Plantain (*Plantago coronopus*), Sharp Buttercup (*Ranunculus muricatus*), Sow Thistle (*Sonchus* spp.) and Strawberry Clover (*Trifolium fragiferum* var. *fragiferum*). Numerous weed species occur near to stands, notably Cape Weed (*Arctotheca calendula*) and Sharp Rush (*Juncus acutus* subsp. *acutus*).

*C. tasmanica* is often restricted to a narrow belt of vegetation parallel to intermittent drainage lines. These areas may correspond to optimum (or tolerable) soil moisture, drainage or flooding conditions. Alternatively, they may reflect an inability of *C. tasmanica* to compete with associated species at other topographic positions (e.g. Tussock Grass (*Poa* spp.) at higher, drier sites, or Water Ribbons in lower, wetter sites). *C. tasmanica* appears to tolerate complete submersion for short periods.

Most *C. tasmanica* sites currently contain a high cover of introduced plants. In most instances, the surrounding landscape has been severely altered through vegetation clearing and altered drainage for agriculture or urbanization. These alterations are likely to have led to contractions or geographic shifts in populations of *C. tasmanica*, and contributed to the ingress of many introduced species. Many introduced species may have established following intentional introduction for agriculture or via dispersal of propagules along waterways.

*C. tasmanica* has been known to persist, and sometimes even thrive, under certain livestock grazing regimes. For example, at one of the largest known sites, on private land adjacent to the Crawford River in south-western Victoria, *C. tasmanica* abundance has increased annually for at least the last 23 years under controlled grazing (D. Fenton pers. comm.). This site has not been ploughed for at least 60 years, but has been grazed lightly by sheep (at an annual average of approximately four sheep per acre). *C. tasmanica*

may have persisted, and flourished, at this site because the sheep preferentially graze fresh introduced pasture species (e.g. Strawberry Clover (*Trifolium fragiferum* var. *fragiferum*) and Perennial Rye-grass (*Lolium perenne*)) when *C. tasmanica* is setting seed in late spring. Grazing is generally excluded from this site during summer months, allowing new *C. tasmanica* seedlings to establish.

Conversely, heavy grazing is likely to be detrimental to the species, particularly winter grazing by cattle when soil pugging is likely to be greatest and first-year plants would be trampled. Investigation of suitable grazing regimes for the persistence of *C. tasmanica* and associated wetland habitat is included as a recovery action in this Action Statement.

Gilfedder & Kirkpatrick (1996) identified two broad floristic groupings in which *C. tasmanica* occurs in Tasmania. One group, which occurred at higher elevation (mean altitude of 278 m above sea level), was comprised of sites which were more northern in their distribution and was characterised by the presence of the exotic species Perennial Rye Grass (*Lolium perenne*) and Spear Thistle (*Cirsium vulgare*), and the native species Bidgee-widgee (*Acaena novae-zelandiae*), Slender Speedwell (*Veronica gracilis*) and Austral Cranesbill (*Geranium solanderi*). The second floristic group was comprised of sites from the Derwent Valley (mean elevation of 95 m above sea level), and was distinguished by the presence of Swamp Sedge (*Carex gunniana*) and the exotic Wild Teasel (*Dipsacus sylvestris*). Commonly associated plants across most sites included Common Tussock Grass (*Poa labillardierei*) and many of the exotic species associated with Victorian sites, such as Yorkshire Fog (*Holcus lanatus*), Brown-top Bent (*Agrostis capillaries*), Cat's Ear, Hairy Hawkbit, Rough Sow-thistle (*Sonchus asper*) and various Plantain species (*Plantago* spp).

### Life history and ecology

All known populations of *Carex tasmanica* occur within areas heavily modified by agriculture. Because populations are usually confined to a narrow ecological band on the margins of drainage depressions or swamps, further modifications to drainage patterns or flooding regimes are likely to be detrimental (Morcom 1999). Completely submerged but living *C. tasmanica* have been observed in creeks at Craigieburn Grassland Nature Conservation Reserve. It is not known, however, how long the species can tolerate such inundation. Permanent flooding or drying of creeks and swamps inhabited by *C. tasmanica* is likely to destroy populations, due to the species' apparent habitat specificity to certain soil moisture and/or drainage conditions.

This species appears to require disturbance for its regeneration (DPIWE Threatened Species Unit pers. comm.). Regeneration of new individuals has been observed *in situ* at Craigieburn Grassland Nature Conservation Reserve and at the Crawford River private property site. These sites have reduced competition from introduced plants, especially grasses, at times when seedlings normally establish (i.e. late spring and summer). Both sites are lightly grazed by sheep. Many populations in Tasmania also appear to persist well under livestock grazing. At other sites, *C. tasmanica* populations may mainly persist through the division of standing individuals. Conditions that favour recruitment (including rainfall timing and amount, soil structure, and drainage characteristics) need further investigation.

Anecdotal evidence suggests that *C. tasmanica* may resprout after fire and that it tolerates some levels of sheep grazing but not cattle grazing (Gilfedder and Kirkpatrick 1996). Although plants may tolerate some mechanical disturbance (Gilfedder and Kirkpatrick 1996), increases in weed-cover following soil disturbance are likely to be generally detrimental to *C. tasmanica* and associated native species. In other situations on disturbed land, *C. tasmanica* has appeared to be adventive or 'weedy'. Management approaches for threatened native species that act as weeds in certain situations have not been developed.

Tall Wheatgrass (*Lophopyrum ponticum*) and Toowoomba Canary-grass (*Phalaris aquatica*) are promoted by the Department of Primary Industries as suitable pasture grasses in wet and/or saline discharge areas (Warn & Hunter 1996). These species are known to be highly invasive in Victoria (Carr *et al.* 1992), especially in otherwise undisturbed native wetland vegetation. DSE discourages sowing of *Lophopyrum ponticum* in native wetland habitat, especially at sites which contain threatened species (Nichols 2002). The threat remains, however, as *L. ponticum* can easily spread into nearby native wetland habitats, including locations which contain *C. tasmanica*.

### **Conservation status**

*Carex tasmanica* is listed as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

*Carex tasmanica* is listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988*.

It is considered endangered in Victoria according to the Department of Sustainability and Environment's *Advisory List of Rare or Threatened Vascular Plants in Victoria - 2005* (DSE 2005).

### **Potentially threatening processes**

The processes listed below are considered to have the potential to threaten populations or habitat. They may or may not be listed as potentially threatening processes under the *Flora and Fauna Guarantee Act 1988*.

#### Modified drainage or flooding regimes

Sites on private land are threatened by destruction or contraction of appropriate habitat due to drainage or redirection of farm creeks, or alterations to farm irrigation patterns.

#### Weed invasion

Weed species are present in all known sites, and comprise a high proportion of the ground cover at most sites. Where cover or infestation is severe enough to clearly interfere with persistence of *Carex tasmanica*, appropriate weed management should be implemented. Most introduced species do not appear to be excluding *C. tasmanica* when considered independently. The sum effect of all introduced species at a site, however, may be to limit the availability of sites for *C. tasmanica* recruitment. Problematic weeds in Victoria include Sharp Rush (*Juncus acutus* subsp. *acutus*) and various thistles: these species clearly displace *C. tasmanica*. On at least one site along the Curly Sedge Creek near Craigieburn Grassland Nature Conservation Reserve, problematic weeds include the woody species Hawthorn (*Crataegus monogyna*), Briar (*Rosa rubiginosa*), Gorse (*Ulex europaeus*) and Blackberry (*Rubus fruticosus* spp. agg.).

#### Reservation status

Few sites are within secure tenure. Many are on private land and are threatened with a lack of/inappropriate management or by potential future alterations to current management practices.

#### Roadside works

Activities such as gravel dumping on roadsides or firebreak construction would damage populations.

#### Inappropriate Livestock Grazing

Many sites persist under sheep grazing at relatively low stocking rates (e.g. less than five sheep/acre). Intensification of stocking, however, may have negative impacts on *C. tasmanica* populations, particularly during summer when seedlings are recruiting. Cattle cause soil pugging (especially during winter grazing) and remove plants, both of which are presumed to be deleterious. Cessation of grazing at sites which are currently grazed may also be deleterious: when released from grazing, introduced species may increase in cover and form closed swards. Some introduced species, notably Strawberry Clover (*Trifolium fragiferum* var. *fragiferum*), Toowoomba

Canary-grass (*Phalaris aquatica*) and a range of introduced graminoids, may exclude *C. tasmanica*.

### **Previous management actions**

#### Condah-Hotspur Road

- Population is monitored annually.
- Threats, including weed invasion, are monitored regularly.
- DSE has ensured that the local government and councils are aware of the importance of the site and sought their cooperation in protecting the species. Information on species' management has been provided to these authorities.

#### Craigieburn Grassland Nature Conservation Reserve

- Parks Victoria undertakes weed control annually at this site. Species controlled include Sharp Rush, Artichoke Thistle (*Cynara cardunculus*), Needle-grass (*Nasella* spp.) and Sweet Briar (*Rosa rubiginosa*).
- The population has been surveyed and mapped.
- Threats to the population have been assessed.
- Stock have been moved to manage threats.
- DSE is working with Yarra Valley Water to provide recycled water to the site.

#### Crawford River

- Opportunistic spraying of Sharp Rush has been undertaken by the landholder.

- The landholder has applied sympathetic grazing management.
- The extent of known stands was surveyed in 2006/07 and 2008 - the population appears to be stable.

#### Portland

- Seed has been collected for local reintroduction programs.
- DSE and Glenelg Shire are working with local nurseries to grow Curly Sedge for reintroduction populations.
- Curly Sedge was reintroduced to suitable sites at Fawthrop Lagoon (approximately 2000 plants) and Walook Swamp in 2002 - 2006.
- Weeds have been controlled in the reintroduced populations.

#### Heywood

- In 2000, as part of the Fitzroy River Restoration Project, Willow (*Salix* spp.) removal was conducted at Heywood before *Carex tasmanica* was discovered at the site.
- The extent of known stands was surveyed in 2006/07.
- Weeds have been controlled.

#### Lake Condah

- Population was surveyed but no plants were located in 2006/07 or 2007/08.

## Objectives and intended management actions

The intended management actions listed below are further elaborated in DSE's Actions for Biodiversity Conservation (ABC) system. Detailed information about the actions and locations, including priorities, is held in this system and will be provided annually to land managers and other authorities.

### Long term objective

To ensure that Curly Sedge can survive, flourish and retain its potential for evolutionary development in the wild.

### Specific Objectives, Actions and Targets

#### Objective I To improve knowledge of biology, ecology and management requirements

Action	Targets	Responsible
1. Clarify the identity of unconfirmed populations to enable an accurate conservation status assessment.	<ul style="list-style-type: none"> <li>▪ The taxonomic identity of <i>Carex</i> species at Whitestone Swamp west of Ballarat, Lake Jollicum Wildlife Reserve south of Streatham, and Lake Omeo confirmed to determine possible new populations of <i>Carex tasmanica</i>.</li> </ul>	DSE, Royal Botanic Gardens
2. Acquire baseline population data by conducting detailed field and desktop surveys including (a) identification of the area and extent of populations; (b) estimates of the number, size and structure of populations, and (c) inference or estimation of population change.	<ul style="list-style-type: none"> <li>▪ Baseline data collected.</li> <li>▪ Conservation status reassessed.</li> <li>▪ Populations accurately mapped.</li> </ul>	DSE, Parks Victoria
3. Assess habitat characteristics and/or condition. Accurately survey known habitat and collect floristic and environmental information relevant to community ecology and condition.	<ul style="list-style-type: none"> <li>▪ Habitat data collected and analysed.</li> <li>▪ Important habitat mapped.</li> </ul>	DSE, Parks Victoria
4. Conduct survey to identify and search suitable habitat. Identify and survey potential habitat, using ecological and bioclimatic information that may indicate habitat preference.	<ul style="list-style-type: none"> <li>▪ Predictive model for potential habitat developed and tested.</li> <li>▪ Potential habitat searched.</li> </ul>	DSE, Parks Victoria
5. Undertake research to identify key biological functions.	<ul style="list-style-type: none"> <li>▪ Critical life history stages identified.</li> <li>▪ Recruitment and dispersal identified at known sites.</li> <li>▪ Age at reproductive maturity determined.</li> <li>▪ Seed bank/regenerative potential quantified for each/target population.</li> <li>▪ Stimuli for recruitment/regeneration identified.</li> </ul>	DSE
6. Undertake detailed population monitoring and collect demographic information.	<ul style="list-style-type: none"> <li>▪ Techniques for monitoring developed and established.</li> <li>▪ Census data for target populations collected.</li> </ul>	DSE, Parks Victoria
7. Analyse population trends. Collate, analyse and report on census data and compare with management histories.	<ul style="list-style-type: none"> <li>▪ Population growth rates determined and Population Viability Analysis completed for target populations.</li> </ul>	DSE

**Objective II To secure populations or habitat from potentially incompatible land use or catastrophic loss.**

<i>Action</i>	<i>Targets</i>	<i>Responsible</i>
8. Negotiate management agreement with land managers.	<ul style="list-style-type: none"> <li>▪ All known public land sites identified and protected by agreement.</li> <li>▪ Effective statutory protection of important populations on public land, including Inverary Lane, Heywood Township and Hotspur-Condah Road sites.</li> <li>▪ Fencing and signposting completed.</li> </ul>	DSE, Parks Victoria
9. Negotiate a voluntary management agreement with private landholders. Encourage negotiations to implement conservation-based land management regimes at important private land sites. Negotiate options for purchasing (and subsequently reserving) the private land portion of the Condah-Hotspur Road bridge crossing site, such as using the new corporate sponsorship process via Glenelg Hopkins Catchment Management Authority or encouraging the involvement of Trust for Nature.	<ul style="list-style-type: none"> <li>▪ Private land owners approached to enter into voluntary conservation agreements at Crawford River (Branxholme) and Macarthur sites.</li> <li>▪ All known private land sites protected through planning processes and/or agreements.</li> </ul>	DSE Trust for Nature
10. Incorporate actions in relevant park or reserve management plan.	<ul style="list-style-type: none"> <li>▪ Park management plans identify species and provide for its protection and active management.</li> </ul>	Parks Victoria
11. Provide information and advice to local government authorities for inclusion in planning processes.	<ul style="list-style-type: none"> <li>▪ All known sites identified and protected through planning processes.</li> <li>▪ Fencing and signposting completed.</li> <li>▪ Management actions to reduce the risks of roadside ploughing documented and communicated.</li> </ul>	DSE Glenelg Shire Council
12. Collect and store reproductive material as a safeguard against catastrophic loss.	<ul style="list-style-type: none"> <li>▪ Reproductive material securely stored.</li> </ul>	Royal Botanic Gardens

**Objective III To improve the extent and/or condition of habitat**

<b>Action</b>	<b>Targets</b>	<b>Responsible</b>
13. Identify disturbance regimes to maintain habitat.	<ul style="list-style-type: none"><li>Management strategies identified to maintain, enhance or restore habitat.</li><li>Livestock grazing management prescriptions prepared to achieve persistence of <i>Carex tasmanica</i> and native wetland habitat at Crawford River (Branxholme), Macarthur, Inverary Lane and Craigieburn Nature Conservation Reserve.</li><li>Knowledge of the life-history of <i>Carex tasmanica</i> incorporated into fire management plan prepared for Craigieburn Nature Conservation Reserve.</li></ul>	Parks Victoria, DSE
14. Manage stock grazing regimes. Fence out populations or adjust grazing regimes to benefit <i>C. tasmanica</i> on public land. Negotiate modified grazing regimes with landholders.	<ul style="list-style-type: none"><li>Measurable reduction in damage or loss of <i>C. tasmanica</i> due to stock.</li></ul>	Parks Victoria, DSE
15. Manage environmental weeds. Control woody weeds at Craigieburn Nature Conservation Reserve and Heywood Township. Control introduced grasses at Craigieburn Nature Conservation Reserve. Control Spiny Rush ( <i>Juncus acutus</i> subsp. <i>acutus</i> ) and Artichoke Thistle ( <i>Cynara cardunculus</i> ) at Crawford River (Branxholme) and Craigieburn Nature Conservation Reserve. Monitor important sites to determine the extent of weed invasion and prepare weed management prescriptions for those sites including the use of livestock grazing to reduce weed competition.	<ul style="list-style-type: none"><li>Measurable reduction in cover abundance of environmental weeds.</li><li>Extent of weed invasion at important sites determined.</li><li>Weed management prescriptions prepared for important sites .</li></ul>	Parks Victoria, DSE

**Objective IV To increase community awareness and support**

<b>Action</b>	<b>Targets</b>	<b>Responsible</b>
16. Involve community groups and volunteers in recovery activities.	<ul style="list-style-type: none"><li>Opportunities for involvement identified, promoted and supported.</li></ul>	DSE, Parks Victoria
17. Develop, publish and distribute education material for community groups. For example, prepare an article on how to recognise <i>C. tasmanica</i> and where it is likely to be found for Landcare group newsletters.	<ul style="list-style-type: none"><li>Relevant community groups provided with educational material on <i>C. tasmanica</i>.</li></ul>	DSE
18. 18. Liaise with Trust for Nature.	<ul style="list-style-type: none"><li>Trust for Nature aware of private property where Curly Sedge occurs.</li></ul>	DSE



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