INTERIM RECOVERY PLAN NO. 143

NARROW-PETALLED FEATHERFLOWER

(*VERTICORDIA PLUMOSA* VAR. *PLEIOBOTRYA*)

INTERIM RECOVERY PLAN

2003-2008

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Photograph: Rebecca Evans

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Department of Conservation and Land Management
Western Australian Threatened Species and Communities Unit (WATSCU)
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Natural Heritage Trust
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Government of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
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FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (the Department) Policy Statements Nos. 44 and 50.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

The Department is committed to ensuring that Critically Endangered taxa are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans and by ensuring that conservation action commences as soon as possible and always within one year of endorsement of that rank by the Minister.

This Interim Recovery Plan will operate from July 2003 to June 2008 but will remain in force until withdrawn or replaced. It is intended that this IRP will be reviewed after five years and the need for a full Recovery Plan will be assessed.

This IRP was approved by the Director of Nature Conservation on 21 July 2003. The provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting the Department, as well as the need to address other priorities.

Information in this IRP was accurate at June 2003.

SUMMARY

Scientific Name:	*Verticordia plumosa* var. *pleiobotrya*	**Common Name:**	Narrow-petalled featherflower
Family:	Myrtaceae	**Flowering Period:**	October to November
Dept Region:	Swan	**Dept Districts:**	Swan Coastal and Perth Hills
Shires:	Serpentine-Jarrahdale, Swan	**Recovery Team:**	Swan Region Threatened Flora Recovery Team

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; George, A.S. (1991) New taxa, combinations and typifications in *Verticordia* (Myrtaceae: Chamelaucieae). *Nuytsia* 7(3): 231-394; George, E. A. (2002) *Verticordia, the turner of hearts*. University of Western Australia Press, Perth.

Current status: *Verticordia plumosa* var. *pleiobotrya* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* and ranked as Critically Endangered (CR) in September 2000. The variety is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act). It is now recommended to be listed as Vulnerable 'VU' under World Conservation Union (IUCN 2000) Red List criteria B1ab(iii,v)+2ab(iii,v) due to the fragmentation of populations, and a continuing decline in the quality of habitat, and the number of plants. The level of threat to the variety has declined recently as a consequence of the acquisition of the property that contains the largest population of the taxon for conservation, and other recovery actions. The main threats are weed invasion, drainage channel maintenance, rising salinity, road, track and firebreak maintenance, grazing, crushing, degraded habitat, poor regeneration, rabbits, inappropriate fire regimes and dieback disease.

Critical habitat: The critical habitat for *Verticordia plumosa* var. *pleiobotrya* comprises the area of occupancy of the known populations; similar habitat within 200 metres of known populations; remnant vegetation that links populations; additional nearby occurrences of similar habitat that do not currently contain the taxon but may have done so in the past and may be suitable for translocations; and the local catchment for the surface and possibly ground waters that provide the winter-wet habitat of the taxon.

Habitat critical to the survival of the species, and important populations: Given that this taxon is listed as threatened it is considered that all known habitat is habitat critical. The largest populations are numbers 2 and 6, and these are considered particularly significant for the continued existence of the taxon.

Benefits to other species/ecological communities: Populations 5 and 6 are located within occurrences of two Threatened Ecological Communities (TECs). Recovery actions implemented to improve the quality or security of the habitat of *Verticordia plumosa* var. *pleiobotrya* Populations 5 and 6 are likely to improve the status of the TECs in which the populations are located.

International Obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. However, as *Verticordia plumosa* var. *pleiobotrya* is not listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

Role and interests of indigenous people: There are no known indigenous communities interested or involved in the management of areas affected by this plan. Therefore no role has been identified for indigenous communities in the recovery of this taxon.

Social and economic impacts: The implementation of this recovery plan has the potential to have some limited social and economic impact, as some populations are located on private property.

Evaluation of the Plans Performance: The Department of Conservation and Land Management, in conjunction with the Recovery Team will evaluate the performance of this IRP. The plan is to be reviewed within five years.

Habitat requirements: *Verticordia plumosa* var. *pleiobotrya* grows in grey sand, loam and clay on winter-wet flats, in low heath and open shrubland (George 2002).

Existing Recovery Actions: The following recovery actions have been or are currently being implemented:
1. Land managers have been notified of the location and threatened status of the taxon.
2. Declared Rare Flora (DRF) markers have been installed at Populations 2 and 5, and Subpopulation 7a.
3. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed.
4. Concrete bollards were placed around the single plant at Population 4 to protect it from trampling.

5. Private property containing Population 6 of *Verticordia plumosa* var. *pleiobotrya* was purchased by the Department of Planning and Infrastructure in 2002. This land will eventually be transferred to the Conservation Commission.
6. Numerous surveys for this taxon have been undertaken in the Bullsbrook and Serpentine areas by Departmental staff and volunteers.
7. Weed control and phosphite spraying has been undertaken at Population 2 by the Shire of Serpentine–Jarrahdale, Jarrahdale Land Conservation District (LCDC) and the Roadside Care Volunteers.
8. The Swan Region Threatened Flora Recovery Team (SRTFRT) is overseeing the implementation of this IRP and will include information on progress in their annual report to the Department's Corporate Executive and funding bodies.
9. Staff from the Department's Swan Coastal and Perth Hills Districts regularly monitor populations of this taxon.

IRP Objective: The objective of this Interim Recovery Plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the taxon in the wild.

Recovery criteria

Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more.

Recovery actions

1. Coordinate recovery actions.
2. Map critical habitat
3. Collect seed and cutting material.
4. Install Declared Rare Flora markers.
5. Undertake weed control.
6. Install fencing.
7. Conduct further surveys.
8. Stimulate the germination of soil-stored seed.
9. Rehabilitate habitat.
10. Develop and implement a drainage management strategy.
11. Develop and implement a fire management strategy
12. Control rabbits.
13. Implement disease hygiene measures.
14. Apply phosphite and monitor effects.
15. Monitor populations.
16. Seek improved security for populations.
17. Promote awareness.
18. Re-evaluate taxonomy.
19. Obtain biological and ecological information.
20. Review the need for a full Recovery Plan.

1. BACKGROUND

History

Verticordia plumosa var. *pleiobotrya* was named from the Greek *pleio-* (more than usual) and *botrys* (a bunch), in reference to the many small lateral groups of flowers. The first known collection of *V. plumosa* var. *pleiobotrya*, housed at the Western Australian Herbarium, was made in 1986 by A. and E. George, near Mundijong. An earlier collection was made from Geographe Bay but is undated (George 2002).

The taxon is thought to be rare due to extensive clearing of suitable habitat for urban development and agriculture. Once possibly occurring between Bullsbrook and Serpentine it now exists only in these two disjunct areas, within which the populations are severely fragmented. If the Geographe Bay record is correct, then the area of potential habitat is much greater. The largest most sustainable population, was, until recently, under significant threat. The owner of this private property had approval for development of this area and had begun subdividing the property to build houses. This area was purchased for conservation in 2002, however.

Numerous surveys for this taxon have been undertaken by staff from the Department's Swan Region and other botanists. However, very little of the winter wet habitat suitable for the taxon still exists in the known distribution, and the probability of finding new viable populations of the taxon is low. Also, the taxon is difficult to distinguish from the other varieties and has an ability to hybridise (Evans and Willers 2003). Nevertheless, a new population was discovered in 2000. A new population of this taxon may have also been discovered near Southern River on private property, but as access has not been permitted to the site, this population cannot be confirmed. Currently, *Verticordia plumosa* var. *pleiobotrya* is known from 7 populations consisting of around 5666 plants.

Description

Verticordia plumosa var. *pleiobotrya* A.S. George is a small shrub 30 to 60 cm tall and 30 to 45 cm wide. It has one to several stems arising from the base that openly branch. The leaves are mostly 4 to 8 mm long and slightly glaucous. Numerous groups of sweetly scented flowers occur on the short lateral branchlets. The peduncles are usually 1.5 to 3 mm long but can be to 8 mm. The hypanthium is 1.8 to 2.4 mm long. Sepals are 2.3 to 2.5 mm long with narrow lobes, and petals are 2 to 2.4 mm long and 1.1 to 1.5 mm wide (George 2002).

The taxon is distinguished from the other six varieties of plumed feather flowers (*Verticordia plumosa*) by its smaller flowers and narrower sepal lobes and petals. It is closely related to the Vasse Featherflower (*Verticordia plumosa* var. *vassensis*) differing in having more groups of flowers on short lateral branchlets (George 2002).

The Bullsbrook population (Population 5), and to a smaller extent at the Serpentine populations, are quickly becoming hybridised with *Verticordia plumosa* var. *brachyphylla*.

Distribution and habitat

Verticordia plumosa var. *pleiobotrya* is known from two areas, one in Bullsbrook north of Perth and the other in Mundijong, south of Perth. The taxon grows in grey sand, loam and clay on winter-wet flats, in low heath and open shrubland (George 2002). Four other taxa of Verticordias are also found with the *Verticordia plumosa* var. *pleiobotrya* including *V. huegelii*, *V. densiflora* var. *densiflora*, *V. plumosa* var. *brachyphylla* and *V. pennigera*.

The largest population (Population 6) of *Verticordia plumosa* var. *pleiobotrya* occurs within the threatened ecological community (TEC) the "Herb-rich shrublands in clay pans" (Swan Coastal Plain Community type 8 as described in Gibson *et al.* 1994) which is listed as Vulnerable in Western Australia. This community is dominated by *Viminaria juncea* and numerous herbs including *Centrolepis aristata*, *Chorizandra enodis*, *Drosera menziesii* subsp. *menziesii*, *Drosera rosulata*, *Goodenia micrantha*, *Haemodorum simplex*, *Hyalosperma cotula* and *Schoenus odontocarpus*. Adjacent to this community is the TEC "*Eucalyptus calophylla* - *Kingia australis* woodlands on heavy soils" (Swan Coastal Plain Community type 3a as described in Gibson *et al.* 1994). This TEC is listed as Critically Endangered in Western Australia and Endangered under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). This location has been

recognised as a Bush Forever site (Number 65), and purchased for conservation, because it is an area of 'regional significance bushland to be retained and protected forever' (State of Western Australia 2000).

Also Population 5 of *Verticordia plumosa* var. *pleiobotrya* occurs within the TEC "Herb-rich saline shrublands in clay pans, Swan Coastal Plain Community type 7, Gibson *et al.* 1994" (listed as Vulnerable in Western Australia) threatened ecological community. This community is dominated by *Melaleuca viminea* and numerous herbs including *Brachyscome bellidioides*, *Centrolepis polygyna*, *Goodenia micrantha*, *Pogonolepis stricta*, *Polypompholyx multiflora*, *Schoenus odontocarpus* and *Siloxerus humifusus*. This location has also been recognised as a Bush Forever site (Number 292) because it is an area of 'regional significance bushland to be retained and protected forever' (State of Western Australia 2000).

Habitat critical to the survival of the species, and important populations

Given that this taxon is listed as threatened it is considered that all known habitat is habitat critical. In addition all populations, are considered important to the survival of the taxon. Recovery actions include survey for further populations that would lead to the identification of additional habitat critical. The largest populations are numbers 2 and 6, and these are considered particularly significant for the taxon's continued existence.

Benefits to other species/ecological communities

Populations 5 and 6 are also located within occurrences of two Threatened Ecological Communities (TECs) (English and Blyth 1997). Gibson *et al*. (1994) describe the communities as 'Herb-rich shrublands in clay pans' and 'Herb-rich saline shrublands in clay pans'. Recovery actions implemented to improve the quality or security of the habitat of Populations 5 and 6 of *Verticordia plumosa* var. *pleiobotrya* are likely to improve the status of the TECs in which these populations are located.

International Obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. However, as *Verticordia plumosa* var. *pleiobotrya* is not listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

Role and interests of indigenous people

There are no known indigenous communities interested or involved in the management of areas affected by this plan. Therefore no role has been identified for indigenous communities in the recovery of this taxon.

Social and economic impacts

The implementation of this recovery plan has the potential to have some limited social and economic impact, as some populations are located on private property. Areas on private land that are considered to be 'habitat critical' may be regarded as having potential for uses other than conservation by landholders. Approaches that may minimise this potential impact could include covenants, management agreements or land acquisition.

Evaluation of the Plans Performance

The Department of Conservation and Land Management, in conjunction with the Swan Region Threatened Flora and Communities Recovery Team will evaluate the performance of this Interim Recovery Plan. The plan is to be reviewed within five years of its implementation. Any changes to management / recovery actions will be documented accordingly.

Critical habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or listed threatened ecological community. Habitat is defined as the biophysical medium or media occupied (continuously, periodically or occasionally) by an organism or group of organisms or once occupied

(continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind have the potential to be reintroduced (*Environment Protection and Biodiversity Conservation Act 1999*).

The critical habitat for *Verticordia plumosa* var. *pleiobotrya* comprises:

- the area of occupancy of known populations;
- areas of similar habitat within 200 metres of known populations, ie. grey sand, loam and clay on winter-wet flats, in low heath and open shrubland (these provide potential habitat for natural range extension);
- remnant vegetation that surrounds and links several populations (this is necessary to allow pollinators to move between populations);
- additional occurrences of similar habitat that do not currently contain the taxon but may have done so in the past (these represent possible translocation sites); and
- the local catchment for the surface and possibly ground waters that maintain the winter-wet habitat of the taxon (it occurs on clay flats that are seasonally inundated and depend on the local hydrology).

Biology and ecology

The genus *Verticordia* is well known for its colourful, showy flowers and most taxa in the genus have horticultural potential. Few species have proved reliable in cultivation, however, and frequently a large percentage of seed is infertile and germination is low (Wrigley and Fagg 1979). Most species make excellent cut flowers and a considerable market has been established (Leigh *et al.* 1984).

Propagation of Verticordias has been mainly from cuttings with a few grown from seed. In general, Verticordias produce only one seed per flower in the wild. Germination occurs from within old flowers that have fallen to the ground. Research by the Department's Threatened Flora Seed Centre (TFSC) has shown that seed set is generally low in Verticordias (less than 51%) and is variable between species, within the same species in different locations, and in different years at the same location (Cochrane and McChesney 1995). The taxon has successfully been cultivated from cuttings by local enthusiasts (personal communication N. Skade[1]).

Verticordias are generally considered to be fire sensitive with post-fire regeneration occurring mainly from seed. They grow relatively rapidly and are often at their most floriferous stage within five years (George 2002).

Threats

Verticordia plumosa var. *pleiobotrya* was declared as Rare Flora and ranked as Critically Endangered (CR) in September 2000 under the Western Australian *Wildlife Conservation Act 1950*. It is also listed as Endangered under the EPBC Act. It currently meets World Conservation Union (IUCN 2000) Red List Category Vulnerable (VU) under criteria B1ab(iii,v)+2ab(iii,v) due to the severe fragmentation of populations, and a continuing decline in the quality of habitat and the number of plants. The level of threat to the taxon has declined recently as a consequence of the acquisition of the property that contains the largest population for conservation, and other recovery actions. The main threats are weed invasion, drainage channel maintenance, salinisation, road, track and firebreak maintenance, grazing, crushing, degraded habitat, poor regeneration, rabbits, inappropriate fire regimes and dieback disease.

- **Weed invasion** is a major threat to all populations. At Population 2 the major weeds include *Babiana angustifolia* and other grasses; at Subpopulations 6a and 6b *Watsonia* sp. and *Eragrostis curvula* (African Lovegrass), at Subpopulations 6c and 6d *Leptospermum laevigatum* (Victorian tea-tree) and *E. curvula*. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase the fire hazard due to the easy ignition of high fuel loads, which are produced annually by many weed species.

- **Drainage channel maintenance** is a major threat to Populations 1 and 3, and Subpopulations 6d and 7a. Drainage channels run parallel through the road reserves that contain *Verticordia plumosa* var. *pleiobotrya*. Maintenance may include scouring of the channel to alleviate flooding of agricultural lands and the existing

[1] Nancy Skade, Jarrahdale Land Conservation District

road. This disturbs or destroys the vegetation and has the potential to exacerbate weed invasion into the narrow road reserve.

- **Salinisation** is a result of a rise in the water table due to widespread clearing of deep rooted vegetation. This leads to degradation of the taxon's habitat. If not addressed, this decline will continue in the medium to long term.

- **Road, track and firebreak maintenance activities** threaten most populations. Threats include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Several of these actions also encourage weed invasion.

- **Grazing** by horses is a major threat to Subpopulation 7b on private property, and the plants located along the fenceline on the road reserve at Subpopulation 7a. Apart from being subject to grazing, increased nutrient levels from droppings are resulting in the proliferation of weeds, and trampling of vegetation is impacting on the habitat of the taxon. Grazing may also have an impact on the establishment of *Verticordia plumosa* var. *pleiobotrya* seedlings thereby limiting the natural recruitment of the taxon.

- **Crushing** by vehicles is a threat to plants at Population 5. In the process of illegally driving through the reserve after accessing the site from the main road, vehicles are crushing the *Verticordia plumosa* var. *pleiobotrya* plants.

- **Degraded habitat:** Subpopulation 7b of *Verticordia plumosa* var. *pleiobotrya* occurs on private property which is quite degraded and has little associated native vegetation to support pollinators and seed dispersers.

- **Poor regeneration**, due to lack of appropriate disturbance threatens most populations as very few young plants of *Verticordia plumosa* var. *pleiobotrya* have been observed, with the exception of Population 6 where some seedlings occur.

- **Rabbits** (*Oryctolagus cuniculus*) are present throughout Populations 5 and 6 and although there is no evidence that the *Verticordia plumosa* var. *pleiobotrya* is being grazed, rabbits are impacting on the habitat by causing soil disturbance. Increased nutrient levels in the soil from rabbit droppings may also occur, and result in increased weed invasion. Grazing is most likely to have an impact on the establishment of young shoots of *V. plumosa* var. *pleiobotrya* thereby limiting natural recruitment.

- **Inappropriate fire regimes** may affect the viability of populations of *Verticordia plumosa* var. *pleiobotrya*. The fire response of the taxon is not known, but, verticordias are generally considered to be fire sensitive, with post fire regeneration occurring mainly from seed. Too frequent fire is likely to destroy the populations before regenerating or juvenile plants reach maturity and replenish the soil seed bank; however, occasional fires or other disturbances are likely to be required for the taxon to propagate from soil stored seed.

- **Dieback disease** is a potential threat to populations of *Verticordia plumosa* var. *pleiobotrya*. Dieback caused by the plant pathogen *Phytophthora* spp. causes the roots to rot and results in susceptible plants dying of drought stress. Many species of Verticordia are susceptible to the disease, and it seems likely that *Verticordia plumosa* var. *pleiobotrya* is susceptible. The habitat is susceptible and there are signs of infestation at Populations 2 and 5.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1. Mundijong (S)	Shire Road Reserve	1999 0 2002 0	Poor	Road and drain maintenance, weeds, inappropriate fire regimes, salinisation, poor regeneration, dieback
2. Mundijong (S)	Shire Road Reserve	1995 500+ 1999 323 (3) 2002 315 [50 dead]	Moderate	Road maintenance, weeds, inappropriate fire regimes, salinisation, poor regeneration, dieback
3. Mundijong (S)	Shire Road Reserve	1999 0 2002 0	Poor	Road and drain maintenance, weeds, inappropriate fire regimes, salinisation, poor regeneration, dieback
4. Serpentine (PH)	Shire Cemetery	1994 1 1999 1 2001 1 2002 1	Moderate/ Poor	Weeds, inappropriate fire regimes, salinisation, poor regeneration, dieback
5. Bullsbrook (PH)	Nature Reserve	1992 1 1999 13 (54) [1 dead]	Healthy	Salinisation, road maintenance, rabbits, inappropriate fire regimes, dieback, crushing
6A. Byford (S)	Private Property (being transferred to State Planning Commission)	1998 200 1999 2974 [10 dead]	Moderate	Firebreak maintenance, rabbits, weeds, inappropriate fire regimes, salinisation, poor regeneration, dieback
6B. Byford (S)	Private Property (being transferred to State Planning Commission)	1999 2301 [5 dead]	Moderate	Weeds, rabbits, firebreak maintenance, inappropriate fire regimes, salinity, poor regeneration, dieback
6C. Byford (S)	Shire Road Reserve	1999 39 2002 19	Moderate/ Poor	Road maintenance, weeds, inappropriate fire regimes, salinisation, poor regeneration, dieback
6D. Byford (S)	Shire Drain Reserve	1999 26+ 2002 4	Poor	Weeds, drain maintenance, road and firebreak maintenance, inappropriate fire regimes, salinisation, poor regeneration, dieback
7A. Mundijong (S)	Shire Drain Reserve	2000 *30 2001 *65 2002 29	Poor	Drain maintenance, grazing, road maintenance, weeds, inappropriate fire regimes, salinity, poor regeneration, dieback
7B. Mundijong (S)	Private Property	2000 *30 2001 *65 2002 ~10	Poor	Grazing, weeds, firebreak maintenance, inappropriate fire regimes, salinity, degraded habitat, poor regeneration, dieback

PH = Perth Hills District, S = Swan Coastal District
Numbers in brackets = number of seedlings.
* = total for subpopulations combined.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of the population or within the defined critical habitat of *Verticordia plumosa* var. *pleiobotrya* require assessment. No developments should be approved unless the proponents can demonstrate that they will have no significant impact on the taxon, or its habitat or potential habitat, or the local surface and possibly ground water hydrology.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

The objective of this Interim Recovery Plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the taxon in the wild.

Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more.

3. RECOVERY ACTIONS

Existing recovery actions

Land managers have been notified of the location and threatened status of the taxon. The notification details the Declared Rare status of *Verticordia plumosa* var. *pleiobotrya* and the legal responsibility to protect it.

Declared Rare Flora (DRF) markers have been installed at Populations 2 and 5, and Subpopulation 7a. These serve to alert people working in the vicinity to the presence of DRF, and the need to avoid work that may damage plants or their habitat. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed.

Concrete bollards were placed around the single plant at Population 4 to protect it from being trampled.

Private property containing Population 6 of *Verticordia plumosa* var. *pleiobotrya* was purchased by the Department of Planning and Infrastructure in 2002. This land will eventually be transferred to the Conservation Commission.

Numerous surveys for this taxon have been undertaken in the Bullsbrook and Serpentine areas by Departmental staff and volunteers.

There has been no recent seed or cuttings material collected for *Verticordia plumosa* var. *pleiobotrya*. Some material was collected in 1995 by the TFSC and germination material forwarded to the Botanic Garden and Parks Authority. However, as locational information for this population was incorrect, the material collected was actually *V. densiflora* var. *densiflora*. There is some evidence that an early unofficial collection of *V. plumosa* var. *pleiobotrya* was made from Population 2 by local enthusiasts. Some of this material has appeared as a ornamental garden plant in some nurseries (personal communication N. Skade).

Weed control and phosphite spraying has been undertaken at Population 2 by the Shire of Serpentine – Jarrahdale, Jarrahdale Land Conservation District Committee (LCDC) and the Roadside Care Volunteers.

The Swan Region Threatened Flora Recovery Team (SRTFRT) is overseeing the implementation of this IRP and will include information on progress in their annual report to the Department's Corporate Executive and funding bodies.

Staff from the Department's Swan Coastal and Perth Hills Districts regularly monitor populations of this taxon.

Future recovery actions

Where populations occur on lands other than those managed by the Department, permission has been or will be sought from appropriate land managers prior to recovery actions being undertaken.

1. Coordinate recovery actions

The Swan Region Threatened Flora Recovery Team (SRTFRT) will continue to coordinate recovery actions for *Verticordia plumosa* var. *pleiobotrya* and other Declared Rare Flora in their region. They will include information on progress in their annual report to the Department's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: The Department (Swan Coastal and Perth Hills Districts) through the SRTFRT
Cost: $1,600 per year.

2. Map critical habitat

It is a requirement of the EPBC Act that spatial data relating to critical habitat be determined. Although critical habitat is described in Section 1, the areas as described have not yet been mapped and that will be done under this action. If any additional populations are located, then critical habitat will also be determined and mapped for these locations.

Action: Map critical habitat
Responsibility: The Department (Perth Hills and Swan Coastal Districts, WATSCU) through the SRTFRT
Cost: $2000 in the first year

3. Collect seed and cutting material

Preservation of germplasm is essential to guard against extinction if wild populations are lost. Such collections are also needed to propagate plants for translocations. Seed is required from all populations to maximise the genetic diversity of the *ex situ* material. Cuttings will also be obtained to establish a living collection at the Botanic Garden and Parks Authority (BGPA).

Action: Collect seed and cutting material
Responsibility: The Department (TFSC) and BGPA, through the SRTFCRT
Cost: $4,200 in first year and $2,800 in second and third years.

4. Install Declared Rare Flora markers

Declared Rare Flora (DRF) markers are required for road reserve Subpopulations 6c, 6d and 7a, and on the firebreak for Subpopulations 6a, 6b and 7b. Their purpose is to alert people operating in the area to the presence of DRF and to help prevent habitat disturbance. Markers installed at Population 2 are in the wrong position and need to be moved approximately 300 m to the east.

Action: Install DRF markers
Responsibility: The Department (Swan Coastal District) through the SRTFCRT
Cost: $700 in first year.

5. Undertake weed control

Weed control will be undertaken in consultation with the land managers. Appropriate methods of weed control are found in Brown and Brooks (2002) and may include hand weeding or localised application of herbicide. All applications of weed control will be followed by a report on the method, timing and success of the treatment against weeds, and the effect on *Verticordia plumosa* var. *pleiobotrya* and associated native plant species. It is anticipated that native species in the habitat will regenerate after weed competition is removed.

Action: Undertake weed control
Responsibility: The Department (Swan Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $800 per year.

6. Fence Populations 5 and 7b

Agreement will be sought to fence Subpopulation 7b on private land including a buffer of surrounding habitat, to protect *Verticordia plumosa* var. *pleiobotrya* from grazing by horses. Funding assistance for this fencing may be obtained through the Remnant Vegetation Protection Scheme as part of the covenanting process. In addition a barrier, such as bollards or stakes, will be erected along the road adjacent to Population 5 to prevent vehicles driving through the reserve.

Action: Fence Populations 5 and 7b
Responsibility: The Department (Swan Coastal District) through the SRTFCRT
Cost: $1,400 in first year.

7. Conduct further surveys

The taxon is known from two areas in Bullsbrook and Serpentine, and it is possible that there are additional populations between the sites. Further surveys will be conducted for this taxon during its flowering period (October to November) in appropriate habitat, including on private lands wherever possible. Volunteers from the local community, Wildflower Societies and Naturalist Clubs will be encouraged to be involved in surveys supervised by Departmental staff. In particular, if permission for access is obtained, a possible new population of this taxon on private property near Southern River will be surveyed and the taxon identity confirmed. Areas considered suitable for translocation will also be noted.

Action: Conduct further surveys
Responsibility: The Department (Swan Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $1,300 per year.

8. Stimulate the germination of soil-stored seed

Burning, smokewater and soil disturbance may be effective in stimulating the germination of soil-stored seed. These trials will be conducted near existing populations in areas newly cleared of weeds, and/or in areas where *Verticordia plumosa* var. *pleiobotrya* was known to occur previously. After treatment, annual monitoring will include recording the time when flowering first occurs, seed is produced and the age at which of senescence is reached. This will enable formulation of a recommended interval time between disturbances to maintain populations.

Action: Stimulate the germination of soil-stored seed
Responsibility: The Department (Swan Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $3,400 in second, third and fourth years.

9. Rehabilitate habitat

Habitat of *Verticordia plumosa* var. *pleiobotrya* will be rehabilitated by re-introduction of endemic plant species at Subpopulations 6a, 6b and 7b.

Action: Rehabilitate habitat
Responsibility: The Department (Swan Coastal District) through the SRTFCRT
Cost: $2,400 in first, second and third years.

10. Develop and implement a drainage management strategy

A drainage control strategy for the habitat of Subpopulations 6d and 7a will be developed and implemented in liaison with relevant stakeholders including the Water Corporation and local Shire.

Action: Develop and implement a drainage management strategy
Responsibility: The Department (Swan Coastal District) through the SRTFCRT
Cost: To be determined

11. Develop and implement a fire management strategy

The response of *Verticordia plumosa* var. *pleiobotrya* to fire is not known; however, *Verticordia* species are thought to be killed by fire and regenerate from soil-stored seed. Fire will therefore be prevented from occurring in the area of populations, except where it is being used experimentally as a recovery tool. A fire management strategy will be developed that recommends fire frequency, intensity, season, and control measures.

Action: Develop and implement a fire management strategy
Responsibility: The Department (Swan Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $2,500 in first year and $1,000 in subsequent years.

12. Control rabbits

Populations 5 and 6 are affected by rabbits. Although there is no evidence of grazing on the plants themselves, young shoots are extremely vulnerable to grazing. In addition, the soil is being disturbed, and this combined with the increased nutrient levels and the presence of weed seed in their droppings is increasing weed invasion in the habitat. Baiting will be undertaken in and around these areas.

Action: Control rabbits
Responsibility: The Department (Swan Coastal District) through the SRTFCRT
Cost: $600 in first, second and third years.

13. Implement disease hygiene measures

It is necessary to maintain disease hygiene measures, to reduce the likelihood of introducing or amplifying the impacts of the disease in the habitat of *Verticordia plumosa* var. *pleiobotrya*. Dieback hygiene measures, including restricting access wherever possible, and placing signage, will be implemented.

Action: Implement disease hygiene measures
Responsibility: The Department (Swan Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $1,000 in the first year

14. Apply phosphite and monitor effects

Phosphite will be applied to areas where dieback is present and has the potential to threaten the *Verticordia plumosa* var. *pleiobotrya*. The impact of the application of phosphite on the taxon and in the control of *Phytophthora* sp. will be monitored.

Action: Apply phosphite and monitor effects
Responsibility: The Department (Swan Coastal and Perth Hills Districts, Dieback Disease Coordinator) through the SRTFCRT
Cost: $700 per year

15. Monitor populations

Annual monitoring of factors such as habitat degradation (including weed invasion and plant diseases), population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation is essential. All populations will be inspected annually with special attention given to any impacts from increased salinisation. In areas that are possibly under threat from salinisation, soil salinity and pH readings will be taken annually during winter.

Action: Monitor populations
Responsibility: The Department (Swan Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $900 per year.

16. Seek improved security for populations

Staff from the Department's Perth Coastal District will continue to liaise with land managers and landowners to ensure that populations are not accidentally damaged or destroyed. Owners of land adjacent to Population 2, and Subpopulations 6c and 6d, located on road reserves have not been notified of the presence of *Verticordia plumosa* var. *pleiobotrya*.

Habitat around Population 4 may be impacted by clearing for cemetery purposes. The Perth Hills District will liaise with the Shire to seek protection of the population.

Ways and means of improving the security of populations and their habitat will be investigated. For Population 7b, that occurs on private property, this may include conservation covenants with a range of agencies, the Land for Wildlife scheme, or possibly acquisition.

Action: Seek improved security for populations
Responsibility: The Department (Swan Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $700 per year.

17. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of this taxon will be promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals will also be encouraged. An information sheet, which includes a description of the plant, its habitat, threats, recovery actions and photos will be produced.

A reply paid postal drop of a pamphlet that illustrates *Verticordia plumosa* var. *pleiobotrya* and describes its distinctive features and habitat will be distributed to residents in Shires that contain possible habitat for the taxon. Postal drops aim to stimulate interest, provide information about threatened species and provide a name and number to contact if new populations are located by members of the community.

Action: Promote awareness
Responsibility: The Department (Swan Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $2,100 in first year and $700 in second year and $600 in remaining years.

18. Re-evaluate taxonomy

The taxon is one of seven varieties of the species *Verticordia plumosa*. There is some debate as to the separation of these varieties and the taxonomy will be re-evaluated following recent collections of these varieties. This may include genetic work, if required.

Action: Re-evaluate taxonomy
Responsibility: The Department (Science Division) through the SRTFCRT
Cost: $10,000 in first year

19. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Verticordia plumosa* var. *pleiobotrya* will provide a better scientific basis for management of the wild populations. An understanding of the following is particularly necessary for effective management:

1. Soil seed bank dynamics and the role of various disturbances (including fire), competition, rainfall and grazing in germination and recruitment.
2. The pollination biology of the taxon, and the requirements of pollinators.
3. The reproductive strategies, phenology and seasonal growth of the taxon.
4. The population genetic structure, levels of genetic diversity and minimum viable population size.
5. The impact of salinity on *Verticordia plumosa* var. *pleiobotrya* and its habitat.
6. Investigation of the impacts of dieback disease and control techniques on *Verticordia plumosa* var. *pleiobotrya* and its habitat.

Action: Obtain biological and ecological information
Responsibility: The Department (Science Division, Swan Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $18,200 per year for the first three years.

20. Review the need for a full Recovery Plan

At the end of the fourth year of the five-year term of this Interim Recovery Plan, the need for further recovery will be assessed.

Action: Review the need for a full Recovery
Responsibility: The Department (WATSCU, Swan Perth Coastal and Perth Hills Districts) through the SRTFCRT
Cost: $22,900 in the fifth year (if required).

4. TERM OF PLAN

This Interim Recovery Plan will operate from June 2003 to May 2008 but will remain in force until withdrawn or replaced. After five years, the need to review this IRP or to replace it with a full Recovery Plan will be determined.

5. ACKNOWLEDGMENTS

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Andrew Crawford	Technical Officer, the Department's Threatened Flora Seed Centre
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Amanda Shade	Horticulturalist, Botanic Garden and Parks Authority
Nancy Skade	Jarrahdale Land Conservation District
Nicole Willers	Previously Conservation Officer, the Department's Swan Region
Alan Wright	Nature Conservation Officer, the Department's Perth Hills District

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7. TAXONOMIC DESCRIPTION

George, A.S. (1991) New taxa, combinations and typifications in *Verticordia* (Myrtaceae: Chamelaucieae). *Nuytsia* 7(3): 231-394.

Seven varieties of *Verticordia plumosa* are recognized in the following key.

1a Sepals 4-5 mm long; petals 3.5-4.5 mm long; sepals and petals white, rarely mauve
var. *grandiflora* (Benth.) A. S. George

1b Sepals 1.5-4 mm long; petals 2-3.8 mm long; sepals and petals pink or mauve, rarely white

2a Sepals 1.5-2.5 mm long

3a Flowers in many small groups on short lateral branches; sepal lobes narrow; petals 1.1-1.5 mm wide; Mundijong district
var. *pleiobotrya* A.S. George

3b Flowers in groups towards main branch apices; sepal lobes broad; petals 2 mm wide; Busselton - Bunbury district
var. *vassensis* A. S. George

2b Sepals 2.5-4 mm long

4a Leaves 7-14 mm long, slender; peduncles 3-7 mm long

5a Bushy shrub to 80 cm; leaves slightly glaucous; occurs on granite hills of the western Darling Plateau and between Windy Harbour and Albany
var. *plumosa*

5b Tufted shrub to 40 cm; leaves not glaucous; probably grows on low-lying flats, between Serpentine and Busselton
var. *ananeotes* A. S. George

4b Leaves 1.5-7 mm long, somewhat thickened; peduncles usually 4-11 mm long

6a Leaves 0.5-0.6 mm thick; peduncles 7-11 mm long; hypanthium 2 mm long; sepals 2.5-3.5 mm long
var. *brachyphylla* (Diels) A. S. George

6b Leaves usually 0.7-0.9 mm thick; peduncles 4-8 mm long; hypanthium 1.4-1.5 mm long; sepals 3-4 mm long
var. *incrassata* A. S. George