

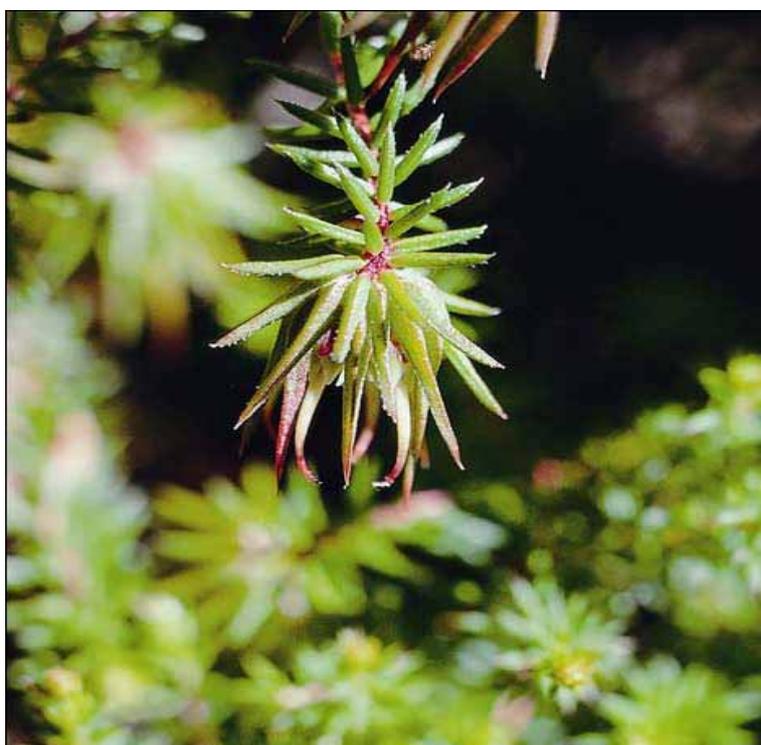
INTERIM RECOVERY PLAN NO. 257

# SCARP DARWINIA

*(Darwinia apiculata)*

INTERIM RECOVERY PLAN

2008-2013



April 2008

Department of Environment and Conservation  
Kensington



## FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in WA Department of Conservation and Land Management (CALM) policy statements Nos 44 and 50. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

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.

DEC is committed to ensuring that Critically Endangered taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Endangered, this IRP will be reviewed after five years and the need for a further recovery actions assessed.

This IRP was approved by the Director of Nature Conservation on 30 April 2008. The allocation of staff time and provision of funds identified in this IRP is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate in April 2008.

This IRP was prepared with financial support from the Australian Government to be adopted as a National Recovery Plan under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

## IRP PREPARATION

This Interim Recovery Plan was prepared by Simon Cherriman<sup>1</sup>, Vanessa Clarke<sup>2</sup>, Nicole Willers<sup>2</sup> and David Mitchell<sup>3</sup>

<sup>1</sup> Project Officer, DEC Swan Region, 20 Dick Perry Ave Bentley, WA, 6102.

<sup>2</sup> Conservation Officer, DEC Swan Region, 20 Dick Perry Ave Bentley, WA, 6102.

<sup>3</sup> Regional Leader, Nature Conservation, DEC Swan Region, 20 Dick Perry Ave Bentley, WA, 6102.

## ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this Interim Recovery Plan:

Andrew Brown	Threatened Flora Coordinator, Species and Communities Branch, DEC.
Anne Cochrane	Manager, DEC's Threatened Flora Seed Centre
Andrew Crawford	Technical Officer, DEC's Threatened Flora Seed Centre
Craig Douglas	Project Officer, Species and Communities Branch, DEC.
Fred Hort	Volunteer, Mundaring District, DEC.
Amanda Shade	Horticulturalist, Botanical Gardens and Parks Authority
Bryan Shearer	DEC's Biodiversity Conservation Group, Kensington

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and DEC's Wildlife Branch for assistance.

**Cover photograph** by Greg Keighery.

## CITATION

This Interim Recovery Plan should be cited as:

Department of Environment and Conservation (2008). Scarp *Darwinia* (*Darwinia apiculata*) Interim Recovery Plan 2008-2013. Interim Recovery Plan No. 257. Department of Environment and Conservation, Perth, Western Australia.

**SUMMARY**

<b>Scientific Name:</b>	<i>Darwinia apiculata</i>	<b>Common Name:</b>	Scarp Darwinia
<b>Family:</b>	Myrtaceae	<b>Flowering Period:</b>	October to November
<b>DEC Region:</b>	Swan	<b>DEC District:</b>	Perth Hills
<b>Shires:</b>	Kalamunda (Pop 1) and Mundaring (Pop 2)	<b>Recovery Team:</b>	Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT)
<b>City:</b>	Gosnells (Pop 3)		

**Illustrations and/or further information:** Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia*. Department of Environment and Conservation, Western Australia; Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; Evans, R., Willers, N. and Mitchell, D. (2003) Threatened Flora of Swan Region. Unpublished report to the Department of Conservation and Land Management and Environment Australia; Marchant, N. G. and Wheeler, J. R. (1987) *Flora of the Perth Region*, Western Australian Herbarium, Western Australia; Western Australian Herbarium (2008) FloraBase - Information on the Western Australian Flora. Department of Environment and Conservation, Western Australia.  
<http://www.calm.wa.gov.au/science/>.

**Current status:** *Darwinia apiculata* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 1987 and is ranked as Endangered (EN) under Red List (IUCN 1994) criteria B1+2ce due to the severe fragmentation of populations and continuing decline in the number of mature individuals. Threats include inappropriate fire regimes, track maintenance, weed invasion, dieback disease, rubbish dumping, trampling, mining activities, and the development of small tracks bisecting the habitat. The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

**Description:** A densely branched rounded shrub 40-50 cm tall. Its specific name refers to the scattered, linear leaves (6 mm x 0.5 mm) with distinctive sharply point (apiculate) tips. It is largely glabrous, with slender, red young branches and simple 4-8 flowered, terminal inflorescences held erect. Petals are green and often tinged with red. Calyx lobes are short and stamens are half the length of the petals. The style is red. The dried floral parts surround indehiscent fruits, with one or rarely two seeds. Superficially resembling *Darwinia helichrysoides* and *D. oederoides*, it can be distinguished from them by its calyx lobes, corolla tubes, densely branched habitat, and smaller bracts and bracteoles. The species appears to prefer an open canopy and flowering has been recorded in October (Kelly, 1990). Additional details are available in the taxonomic description provided in Section 6.

**Habitat requirements:** *Darwinia apiculata* is endemic to the Darling Range where it is currently known from three populations. Habitat consists of open jarrah-marri woodland on shallow gravely soil over laterite, or open heathland over sandy loams with granite boulders.

**Habitat critical to the survival of the species, and important populations:** Habitat critical to the survival of the species includes the area of occupancy of all known populations, areas of similar habitat surrounding known populations (i.e. shallow gravely soils over continuous laterite and sandy loams with granite boulders - these provide potential habitat for natural range extension); remnant vegetation that surrounds and links populations (this is necessary to allow pollinators to move between populations), the local catchment of the surface and possibly ground waters that maintain the habitat of the species and additional occurrences of similar habitat that may contain the species or be suitable sites for future translocations.

Given that this species is listed as Endangered and known from just three populations, it is considered that all known habitat for wild and any future translocated populations is habitat critical to its survival, and that all wild and any future translocated populations are important populations.

**Benefits to other species or ecological communities:** Recovery actions implemented to improve the quality or security of habitat of *Darwinia apiculata* will help protect other threatened and priority species and the ecological community in which they are located. The habitat of Population 1 supports a population of *Acacia anomala* (DRF, Vulnerable), the habitat of Population 2 supports six conservation-listed flora species and the habitat of Subpopulation 3b supports a further six conservation-listed flora species. These species will benefit from actions that improve the habitat quality of *Darwinia apiculata*.

**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. *Darwinia apiculata* is not specifically listed under any international treaty, and therefore this plan does not affect Australia's obligations under any other international agreements.

**Role and interests of indigenous people:** A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has not identified any sites occurring in close proximity to *Darwinia apiculata* populations. Where no role is identified for the Indigenous community associated with this species in the development of the recovery plan, opportunities may exist through cultural interpretation and awareness of the species. Indigenous involvement in the implementation of recovery actions will be encouraged.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs is being sought to assist in the identification of potential indigenous management responsibilities for land occupied by threatened species, or groups with a cultural connection to land that is important for the species' conservation.

Continued liaison between DEC and the indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

**Social and economic impact:** Some populations of *Darwinia apiculata* occur on private land and negotiations will continue with regard to the future management of these populations. The implementation of this recovery plan has the potential to have some limited social and economic impact, where populations are located on private property. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

**Affected interests:** Stakeholders potentially affected by the implementation of this plan include the Shire of Kalamunda, Conservation Commission, Water Authority, Rinker Australia Pty Ltd (formerly CSR Readymix), Shire of Mundaring, DEC, City of Gosnells, WA Planning Commission (WAPC) and the owners of two private property locations. Western Power is responsible for a transmission line that runs through the vicinity of Population 1c.

**Evaluation of the plan's performance:** DEC will evaluate the performance of this IRP in conjunction with the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT). In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

#### Completed Recovery Actions:

1. All relevant land managers have been notified of the presence and threatened status of *Darwinia apiculata*.
2. Declared Rare Flora markers have been installed at Populations 1 and 2, and are being installed at Population 3.
3. Specimens have been collected and each population is now represented at the Western Australian Herbarium.
4. Cuttings have been collected by BPGA and several plants are currently in cultivation, however more are required.
5. Opportunistic surveys conducted in areas of similar habitat close to the known populations have failed to locate any other plants. DEC volunteers continue to look for more plants and reports will be made immediately following any new discoveries.

#### Ongoing and future recovery actions

1. DEC is liaising with the relevant Government agencies about the acquisition of the unvested Reserve 22897 for vesting with the CC for the purpose of Conservation of Flora and Fauna.
2. DEC is liaising with the Kalamunda Shire about the acquisition of Reserve 24657, which will combine the two largest sub-populations of Population 1 into a DEC managed reserve.
3. Staff from DEC's Perth Hills District regularly monitor all populations of this species.
4. The Swan Region Threatened Flora and Communities Recovery Team is overseeing the implementation of this IRP and will include information on progress in its annual report to DEC's Corporate Executive and funding bodies.

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

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

#### Recovery actions

- |  |   |
|--|---|
| 1. Coordinate recovery actions                           | 9. Implement weed control                                 |
| 2. Liaise with relevant land managers                    | 10. Conduct further surveys                               |
| 3. Install Declared Rare Flora markers                   | 11. Reduce impact of recreational activities              |
| 4. Monitor populations                                   | 12. Develop community involvement                         |
| 5. Collect seed and cutting material                     | 13. Map habitat critical to survival                      |
| 6. Develop and implement a fire management strategy      | 14. Obtain biological and ecological information          |
| 7. Map and manage dieback disease                        | 15. Review the plan and need for further recovery actions |
| 8. Pursue acquisition/transfer of Reserves 24657 & 22897 |   |

## 1. BACKGROUND

### History

The type specimen of *Darwinia apiculata* was made from the Kalamunda area in 1982 by N.G. Marchant who described the species in 1984. At the time this was the only known population and the species was declared as Rare Flora in September 1987. Plants were then located in the Helena Valley in 1990 and at Gosnells in 2002. Opportunistic surveys conducted in areas of similar habitat close to known populations have failed to locate further plants.

### Description

*Darwinia apiculata* is a densely branched, rounded shrub 40-50 cm tall with red, slender young branchlets. Leaves are linear, scattered with erect petioles with prominent, decurrent leaf bases; 3-5 mm long on young stems, 5-6.5mm long on mature stems with apiculate apices. The flowers are pale green with involucre bracts narrowly ovate; green, yellow-green or yellow and red. The floral tube is slightly enlarged, hardened, pale-coloured; lower part brown and upper part yellow-green. The calyx lobes broadly ovate to broadly obovate, 1 mm long by 1 mm wide, entire, and obtuse with 10 filaments and a red style, 6-9 mm long. One or two tiny seeds 0.6-0.8 mm diameter are produced.

### Distribution and habitat

*Darwinia apiculata* is endemic to the Darling Range where it is known from three populations. All three sites are slightly different in their habitat characteristics.

- Population 1 occurs on shallow gravelly soil over laterite in open jarrah-marri woodland with *Allocasuarina fraseriana*, *Dryandra sessilis* and *Xanthorrhoea preissii*.
- Population 2 occurs on sandy loam soils amongst granite boulders in open marri-wandoo woodland with *Xanthorrhoea preissii*, *Dryandra nivea*, *Hibbertia hypericoides*, *Hakea lissocarpha* and *Hypocalymma angustifolium*.
- Population 3 occurs on sandy loams amongst granite boulders in open to semi-closed sites with *Kingia australis*, *Dryandra armata* and other perennial shrubs.

### Summary of population land vesting, purpose and tenure

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1a. Kalamunda	Perth Hills	Kalamunda	Conservation Commission.	Conservation of Flora and Fauna	DEC
1b. Kalamunda	Perth Hills	Kalamunda	Shire of Kalamunda	Hospital	Shire of Kalamunda
1c. Kalamunda	Perth Hills	Kalamunda	Water Corporation	Water	Water Corporation
1d. Kalamunda	Perth Hills	Kalamunda	Private	Private	Private property
2. Mundaring	Perth Hills	Mundaring	Not Vested	Parklands	Shire of Mundaring
3a. Gosnells	Perth Hills	Gosnells	Rinker Australia Pty Ltd	Private	Rinker Australia Pty Ltd
3b. Gosnells	Perth Hills	Gosnells	WA Planning Commission		WAPC

### Biology and ecology

The genus *Darwinia* is confined to Australia where forty-six of the sixty known species occur (Marchant & Wheeler 1987). Little is known about the pollination of *Darwinia apiculata* but most other members of the genus are known to be pollinated by insects (entomophilous) or birds (ornithophilous) (WAHERB 2006).

Adult *Darwinia apiculata* plants are killed by fire but regenerate from soil-stored seed. A wildfire during early 1999 killed many of the adult plants in Population 1. Seedlings appeared the next year and by November 2000 plants were vigorous. The majority of these seedlings then died from very dry conditions experienced over the next two years.

Members of the genus *Darwinia* show mixed responses to dieback disease caused by the pathogen *Phytophthora cinnamomi*, with some being highly susceptible and others resistant. It is not known if *Darwinia apiculata* is susceptible, but initial trials indicate the taxon may be resistant. Four plants were infected with the disease, none of which died. However, it is considered that at least 10 plants need to be tested for an accurate assessment of susceptibility (Shearer pers. comm.). Dieback disease is thought to have already impacted on the habitat of Subpopulation 1b.

Cultivation of *Darwinia apiculata* has been successful from cuttings when using hormone powders to promote root growth. In 1989, 14 plants were potted on from 21 cuttings taken from a plant in cultivation. In 1991, 230 cuttings were taken from Population 1. Of these, 136 were potted on and 59 grew successfully. The species is currently in cultivation at BGPA. These plants were grown from cuttings from the same clone and show little genetic diversity (Shade pers. comm.).

## Threats

*Darwinia apiculata* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 1987 and is ranked as Endangered (EN) under Red List (IUCN 1994) criteria B1+2ce due to the severe fragmentation of populations and continuing decline in the number of mature individuals. The main threats are inappropriate fire regimes, road and firebreak maintenance, dieback disease, recreational activities, weed invasion, rubbish dumping, and mining. The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- **Inappropriate fire regimes** may affect the viability of all populations as the soil seed bank would rapidly be depleted if fires recurred before regenerating or juvenile plants reached maturity and replenished the soil seed bank. However, occasional fires are needed for reproduction of this species. Many populations have weeds currently restricted to the edges of the habitat, but they are likely to invade post-fire without prompt and effective weed control.
- **Road and firebreak maintenance** threatens Population 1. Grading occurs on an annual basis in the area of Subpopulation 1b and firebreak maintenance affects the other subpopulations. Further threats associated with maintenance include construction of drainage channels and slashing of roadside vegetation. These actions also encourage weed invasion.
- **Dieback disease** (*Phytophthora cinnamomi*) may pose a threat to *Darwinia apiculata*. It is not known how susceptible the species is to the pathogen, however, it is thought to have already impacted on the habitat of Subpopulations 1a and 1b. Even if the species is resistant, the presence of dieback poses a threat to the highly susceptible jarrah-marri woodland in which it grows.
- **Recreational activities** are a threat to Subpopulations 1a and 1b. Bush-walking and bike-riding are known to occur in this area, and have the potential to cause damage to *Darwinia apiculata* plants. BMX riders have constructed jumps by moving dirt from bushland near Subpopulation 1b. Bush-walking also occurs to a lesser extent in the area of Population 2 and in the bushland that adjoins Subpopulations 3a and 3b. It is, however, unlikely to have a severe impact on *Darwinia apiculata* plants due to their isolation from walk trails and the large area over which plants occur.
- **Weeds** are currently a significant threat to Population 1, and a minor threat to Population 3. Weeds compete with native seedlings and plants for soil nutrients, moisture and space. They could dramatically increase in numbers if a fire or other disturbance occurred in the area. 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 grass weed species.
- **Grazing** and trampling by rabbits and is thought to be a minor problem in Population 1. Soil disturbance, weed invasion and the addition of nutrients are secondary effects of animal movement in areas inhabited by the species.
- **Mining** and associated clearing activities may be an issue at Subpopulation 3a.

## Summary of population information and threats

Pop. No. & Location	Land status	Year	No. plants	Condition	Threats
1a. Kalamunda	Reserve 23076	1999	63	Healthy	Inappropriate fire, road and firebreak maintenance, disease, recreational activities, weeds
		2000	15 (400)*		
1b. Kalamunda	Reserve 24657	1999	264	Poor	Inappropriate fire, road and firebreak maintenance, disease, recreational activities, weeds
		2000	170 (400)*		
		2002	53 (37)		
1c. Kalamunda	Reserve 34563	1999	129	Healthy	Inappropriate fire, road and firebreak maintenance, disease, weeds
		2000	170 (400)*		
1d. Kalamunda	Private	2000	21 (4)	Healthy	Clearing for development, weeds
		2006	166 (6)		
2. Mundaring	Reserve 22897	1999	1646	Healthy	Inappropriate fire, recreational activities
3a. Gosnells	Private	2003	200*	Healthy	Mining activities, weeds, inappropriate fire
3b. Gosnells	Crown	2003	200*	Healthy	Weeds, inappropriate fire

Numbers in brackets = number of juveniles. \* = total for both/all subpopulations combined.

## Guide for decision-makers

Section 1 provides details of current and possible future threats. Any on-ground works (clearing, firebreaks, road works etc) in the immediate vicinity of populations or within the defined critical habitat of *Darwinia apiculata* will require assessment. On-ground works should not be approved unless the proponents can demonstrate that they will have no significant impact on the species, its habitat or potential habitat, or have the potential to spread or amplify plant diseases such as that caused by *Phytophthora cinnamomi*.

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

Habitat critical to the survival of the species includes the area of occupancy of all known populations, areas of similar habitat surrounding all known populations (i.e. shallow gravelly soils over continuous laterite and sandy loams with granite boulders - these provide potential habitat for natural range extension), remnant vegetation that surrounds and links populations (this is necessary to allow pollinators to move between populations), the local catchment of the surface and possibly ground waters that maintain the habitat of the species and additional occurrences of similar habitat that may contain the species or be suitable sites for future translocations.

Given that this species is listed as Endangered and is known from just three populations, it is considered that all known habitat for wild and any future translocated populations is habitat critical to its survival, and that all wild and any future translocated populations are important populations.

## Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of habitat containing *Darwinia apiculata* will also protect other threatened and priority species and the ecological community in which populations are located. The habitat of Population 1 contains a population of *Acacia anomala* (DRF, Vulnerable), the habitat of Population 2 contains six Priority flora species and the habitat of Subpopulation 3b also contains six Priority flora species. These species will benefit from actions implemented under this IRP.

## Conservation-listed flora species occurring in habitat of *Darwinia apiculata*

Species Name	Conservation Status (Western Australia)	Conservation Status (EPBC Act)
<i>Anthocercis gracilis</i>	DRF, Vulnerable	Vulnerable
<i>Acacia oncinophylla</i> subsp. <i>patulifolia</i>	Priority 2	-
<i>Acacia oncinophylla</i> subsp. <i>oncinophylla</i>	Priority 3	-
<i>Allocasuarina grevilleoides</i>	Priority 3	-
<i>Asteridea gracilis</i>	Priority 3	-
<i>Boronia tenuis</i>	Priority 3	-
<i>Olax scalariformis</i>	Priority 3	-
<i>Calothamnus rupestris</i>	Priority 4	-
<i>Grevillea pimeleoides</i>	Priority 4	-
<i>Halgania corymbosa</i>	Priority 4	-
<i>Senecio leucoglossus</i>	Priority 4	-

DRF – Declared Rare Flora. For a description of Priority flora categories see Atkins (2008)

### **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. *Darwinia apiculata* is not specifically listed under any international treaty, and therefore this plan does not affect Australia's obligations under any other international agreements.

### **Role and interests of indigenous people**

A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has not identified any sites occurring in close proximity to *Darwinia apiculata* populations. Where no role is identified for the Indigenous community associated with this species in the development of the recovery plan, opportunities may exist through cultural interpretation and awareness of the species. Indigenous involvement in the implementation of recovery actions will be encouraged.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs is being sought to assist in the identification of potential indigenous management responsibilities for land occupied by threatened species, or groups with a cultural connection to land that is important for the species' conservation.

Continued liaison between DEC and the indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

### **Social and economic impact**

Some populations of *Darwinia apiculata* occur on private land and negotiations will continue with regard to the future management of these populations. The implementation of this recovery plan has the potential to have some limited social and economic impact, where populations are located on private property. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

### **Affected interests**

Stakeholders potentially affected by the implementation of this plan include the Shire of Kalamunda, Conservation Commission, Water Authority, Rinker Australia Pty Ltd (formerly CSR Readymix), Shire of Mundaring, DEC, City of Gosnells, WAPC and the owners of two private property locations. Western Power is responsible for a transmission line that runs through the vicinity of populations.

### **Evaluation of the plan's performance**

DEC will evaluate the performance of this IRP in conjunction with the Swan Region Threatened Flora and Communities Recovery Team. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

## **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 species 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 over the term of the plan.

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

### 3. RECOVERY ACTIONS

#### Completed recovery actions

All relevant land managers have been notified of the location and threatened status of the species. The notification details the Declared Rare status of *Darwinia apiculata* and associated legal obligations.

Declared Rare Flora (DRF) markers have been installed at Populations 1 and 2, and actions are being taken to install them at Population 3. These alert road maintenance workers to the presence of each population, and enable them to take appropriate care.

Voucher specimens have been collected and each population is now represented in the Western Australian Herbarium.

Cuttings have been collected by BGPA and six plants are currently in cultivation, however more are required. All plants at Kings Park are clones of the same original plant and show little genetic diversity.

Opportunistic surveys conducted in areas of similar habitat close to the known populations have failed to locate any more plants.

#### Ongoing and future recovery actions

DEC is liaising with the Kalamunda Shire regarding the combination of the two largest subpopulations of Population 1 into a DEC managed reserve.

Staff from DEC's Perth Hills District regularly monitor all populations of this species.

The Swan Region Threatened Flora and Communities Recovery Team is overseeing the implementation of this IRP and will include information on progress in its annual report to DEC's Corporate Executive and funding bodies.

Where populations occur on lands other than those managed by DEC, permission has been or will be sought from appropriate land managers prior to recovery actions being undertaken. The following recovery actions are roughly in order of descending priority, influenced by their timing over the term of the Plan. However this should not constrain addressing any of the priorities if funding is available for 'lower' priorities and other opportunities arise.

#### 1. Coordinate recovery actions

The Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) will coordinate recovery actions for *Darwinia apiculata* and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

**Action:** Coordinate recovery actions  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$1,400 per year

#### 2. Liaise with relevant land managers

Staff from DEC's Perth Hills District will continue to liaise with relevant land managers and landowners to ensure that populations are not accidentally damaged or destroyed and that current threats are addressed. DEC is liaising with the Kalamunda Shire regarding the combination two subpopulations of Population 1 into a DEC managed reserve. Input and involvement will also be sought from any Aboriginal groups that have an active interest in areas that are habitat for *Darwinia apiculata*.

**Action:** Liaise with relevant land managers  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$600 per year

### 3. Install Declared Rare Flora markers

Declared Rare Flora (DRF) markers are required at Population 3. The installation of these will occur during the flowering period of *Darwinia apiculata*, to ensure that all road verge plants occur within the markers.

**Action:** Install DRF markers  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$300 in the first year

### 4. Monitor populations

Annual monitoring of threats including habitat degradation (including weed invasion, salinity and plant diseases such as *Phytophthora cinnamomi*), and population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation is essential. The visibility of DRF markers will also be monitored to ensure they remain effective and have not faded or been obscured by vegetation growth.

**Action:** Monitor populations  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$400 per year in years 1, 3 and 5

### 5. Collect seed and cutting material

It is necessary to store seed and cutting material to propagate for translocations and as an *ex situ* genetic 'blueprint' of the species. No seed is currently in storage; therefore seed collection is urgently required from all populations.

**Action:** Collect seed and cutting material  
**Responsibility:** DEC (TFSC, Perth Hills District) through the SRTFCRT  
**Cost:** \$1,500 per year in years 1 and 3

### 6. Develop and implement a fire management strategy

It is known that fire kills adult plants of *Darwinia apiculata* and regeneration occurs largely from a soil-stored seed bank. Frequent fire may kill plants before they mature and prevent the accumulation of sufficient soil-stored seed for recruitment to occur. Fire also promotes the introduction and proliferation of weed species. Fire should 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 in consultation with land managers, and will include recommendations on prescription fire frequency and intensity; precautions to prevent fire; a strategy for reacting to wild fire; and the need, method of construction, and maintenance of firebreaks.

**Action:** Develop and implement a fire management strategy  
**Responsibility:** DEC (Perth Hills District) with relevant land managers through the SRTFCRT  
**Cost:** \$1,200 in first year, and \$1,200 in subsequent years

### 7. Map and manage dieback disease

Disease spread and levels of plant death in Subpopulations 1a and 1b should be monitored, as the pathogen is thought to have already impacted on these areas. After disease mapping has been conducted, a management strategy will be developed and implemented, including the need for adequate disease hygiene measures, monitoring programs (for habitat and specific taxa) and the possibility of control using phosphite.

Disease hygiene measures as outlined in *Phytophthora cinnamomi* Management Guidelines (CALM 2003) may then need to be applied at Population 1, and later at other populations if deemed necessary. Hygiene measures will primarily involve restricting access to the area, especially when the soil is wet. The need for phosphite application at a site will be assessed through evaluation of the impact of the disease on the habitat and on *Darwinia apiculata*.

**Action:** Map and manage dieback disease

**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$6,100 year 1; \$9,900 year 2; \$4,200 year 3; \$9,800 year 4; \$4200 year 5

### 8. Pursue acquisition/transfer of Reserves

To increase the security of *Darwinia apiculata* populations, DEC will pursue the acquisition and/or change of tenure of two reserves in the Shire of Kalamunda which contain two of the largest subpopulations.

**Action:** Pursue acquisition/transfer of two reserves  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$1,500 per years 2 and 3

### 9. Implement weed control

The current level of threat from weeds is high at Population1 and may impact on *Darwinia apiculata* by competing for resources, degrading habitat, exacerbating grazing pressure, and increasing the risk and severity of fire. Weed control will be undertaken in consultation with land managers and will include hand weeding or localised application of herbicide. All weed control will include a report on the method, timing and success of the treatment, and any deleterious effect on *Darwinia apiculata* and associated native plant species.

**Action:** Implement weed control  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT; relevant land managers  
**Cost:** \$1,500 per year

### 10. Conduct further surveys

Further surveys by DEC staff and community volunteers, in areas identified as suitable habitat, will be conducted during the species' flowering period (October and November). Records of areas surveyed will be sent to Species and Communities Branch and retained at the district, even if no *Darwinia apiculata* plants are found.

**Action:** Conduct further surveys  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$1,500 per years 2 and 3

### 11. Reduce impact of recreational activities

Degradation of the habitat of this species through motorbike riding and unrestricted bushwalking has been observed in Subpopulations 1a and b. Liaison with Shire of Kalamunda should occur to restrict access in these areas.

**Action:** Reduce impact of recreational activities  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$650 in year 2

### 12. Develop community involvement

A Friends Group, coordinated by the Kalamunda Shire, does on-ground works at a reserve in the vicinity of Population 1. Liaison between DEC and Kalamunda Shire would ensure actions taken by the Friends Group help conserve this population.

**Action:** Develop community involvement  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$2,000 in first year, and \$500 in subsequent years

### 13. Map habitat critical to survival

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

**Action:** Map habitat critical to survival  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$700 in the first year

#### 14. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Darwinia apiculata* will provide a scientific basis for its management in the wild. An understanding of the following is necessary for effective management:

1. Soil seed bank dynamics, including seedbank location and viability.
2. The role of various disturbances (including mechanical disturbance and fire), competition, rainfall and grazing in germination and recruitment.
3. The pollination biology of the species.
4. The requirements of pollinators.
5. The reproductive strategies, phenology and seasonal growth of the species.
6. The population genetic structure, levels of genetic diversity and minimum viable population size.

**Action:** Obtain biological and ecological information  
**Responsibility:** DEC (Science Division, Perth Hills District) through the SRTFCRT  
**Cost:** \$7,500 per year in years 2, 3 and \$10, 500 in year 4

#### 15. Review the plan and need for further recovery actions

At the end of its five-year term this Interim Recovery Plan will be reviewed and the need for further recovery actions assessed.

**Action:** Review the plan and need for further recovery actions  
**Responsibility:** DEC (Perth Hills District) through the SRTFCRT  
**Cost:** \$200 in the fifth year

#### Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion date
Coordinate recovery actions	High	DEC (Perth Hills District) through the SRTFCRT	Ongoing
Liaise with relevant land managers	High	DEC (Perth Hills District) through the SRTFCRT	Ongoing
Install Declared Rare Flora markers	High	DEC (Perth Hills District) through the SRTFCRT	2008
Monitor populations	High	DEC (Perth Hills District) through the SRTFCRT	2008
Collect seed and cutting material	High	DEC (Perth Hills District) through the SRTFCRT	2008 & ongoing
Develop and implement a fire management strategy	High	DEC (Perth Hills District) through the SRTFCRT	2009
Map and manage dieback disease	Medium	DEC (Perth Hills District) through the SRTFCRT	2011
Pursue acquisition/transfer of Reserves 24657 & 22897	Medium	DEC (Perth Hills District) through the SRTFCRT	Ongoing
Implement weed control	Medium	DEC (Perth Hills District) through the SRTFCRT	Ongoing
Conduct further surveys	Medium	DEC (Perth Hills District) through the SRTFCRT	2008 & ongoing
Reduce impact of recreational activities	Medium	DEC (Perth Hills District) through the SRTFCRT	2009
Develop community involvement	Medium	DEC (Perth Hills District) through the SRTFCRT	Ongoing
Map habitat critical to survival	Medium	DEC (Perth Hills District) through the SRTFCRT	2013
Obtain biological and ecological information	Medium	DEC (Perth Hills District) through the SRTFCRT	2013
Review the plan and need for further recovery actions	Medium	DEC (Perth Hills District) through the SRTFCRT	2013

#### 4. TERM OF PLAN

##### Western Australia

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. If *Darwinia apiculata* is still ranked Endangered after five years, the need for further recovery actions will be determined.

##### Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) this adopted recovery plan will remain in force until revoked.

The recovery plan must be reviewed at intervals of not longer than 5 years.

#### 5. REFERENCES

- Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia*. Department of Environment and Conservation, Western Australia.
- Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia.
- Department of Conservation and Land Management (2003) *Phytophthora cinnamomi and disease caused by it Volume 1. – Management Guidelines*. Department of Conservation and Land Management, Western Australia.
- Department of Conservation and Land Management (1995) Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. Department of Conservation and Land Management, Western Australia.
- Department of Conservation and Land Management (1994) Policy Statement No. 50 *Setting Priorities for the Conservation of Western Australia's Threatened Flora and Fauna*. Department of Conservation and Land Management, Western Australia.
- Department of Environment and Conservation (2008) *Threatened Ecological Community database*. Department of Environment and Conservation, Western Australia.
- Department of Environment and Conservation (2008) *Threatened Flora Database (DEFL)*. Department of Conservation & Land Management, Western Australia. Accessed 2008.
- Department of Environmental Protection (2000). *Bush Forever Volume 2 Directory of Bush Forever Sites*, Department of Environmental Protection, Perth WA.
- Department of Environment and Conservation (2008) *Western Australian Herbarium FloraBase 2 – Information on the Western Australian Flora*. Department of Environment and Conservation, Western Australia. Accessed 2008. <http://www.calm.wa.gov.au/science/>.
- Evans, R., Willers, N. and Mitchell, D. (2003) Threatened Flora of Swan Region. Unpublished report to the Department of Conservation and Land Management and Environment Australia.
- World Conservation Union (2001) *IUCN Red List Categories prepared by the IUCN Species Survival Commission, as approved by the 51<sup>st</sup> meeting of the IUCN Council*. Gland, Switzerland.
- Marchant, N. G., and Wheeler, J. R. (1987) *Flora of the Perth Region*, Western Australian Herbarium, Western Australia.

#### 6. TAXONOMIC DESCRIPTION

##### Marchant, N.G. (1984)

Densely branched, rounded **shrub** 40-50 cm tall with slender, red branchlets with prominent, decurrent leaf bases. **Leaves** scattered; petioles erect, 0.2-0.3 mm long; laminae horizontally spreading, linear – triquetrous, adaxial surface convex with a raised keel, 3-5 mm long on young stems, 5-6.5mm long on mature stems irregularly ciliolate towards apices, acute, apiculate. **Inflorescences** fusiform in bud, becoming ovoid or broadly ovoid, cernuous. Floral leaves patent, pale green and petiole 0.5-1 mm long lamina narrowly ovate, acuminate, 6.5-8 mm long abaxial surface gibbous at the base. Outer involucral bracts narrowly ovate, long acuminate, 8-10mm long, abaxial surface gibbous at the base, adaxial surface with narrow lateral wings near the base, upper part triquetrous and sparsely ciliolate. Inner involucral bracts narrowly ovate long acuminate, triquetrous, 10-15

mm long, green, yellow-green or yellow and red, ciliolate, abaxial surface gibbous at the base, adaxial surface deeply concave. Flowers 4-8. **Bracteoles** 2, cymbiform, ovate when opened out, 3-4 mm long, 1.5-2.5mm wide, acuminate. Floral tubes obconical 2.5-3 mm long, with 5 prominent costae which continue into the calyx lobes; intercostal regions with 1 or more minute horizontal ridges and wrinkles; lower part brown; upper part yellow – green. **Calyx lobes** broadly ovate to broadly obovate, 1 mm long 1 mm wide, entire, and obtuse. **Corolla lobes** trullate-ovate, 2.5-3mm long, 1.5-2.5 mm wide acute, entire, margins slightly involute with 10 filaments slightly dilated at base, fused to staminodes in lower part, free part less than 1mm long; anthers ovoid. Style falcate, introrse, slightly dilated at the middle, 6-9 mm long red. Style end tapering to a truncate apex which is subtended by a 1 mm wide band of diffuse hairs with 2 ovules. **Fruit** apparently rarely developed indehiscent, with all dried flora parts attached. **Floral tube** slightly enlarged, hardened, pale-coloured. **Seed** 1, rarely 2 exalbuminous; testa thin, Embryo consisting almost entirely of the turgid radicle 0.6-0.8 mm diameter; *plumule* sub-apical, appressed to radicle, consisting of a pair of minute terminal cotyledons c. 0.1 mm long and a slightly flattened hypocotyl c. 0.3mm long.

