

INTERIM RECOVERY PLAN NO. 139

# **ABBA BELL**

## **(*DARWINIA SP WILLIAMSON*)**

### **INTERIM RECOVERY PLAN**

**2003-2008**

Gillian Stack & Val English



Photograph: G. Keighery

March 2003

Department of Conservation and Land Management  
Western Australian Threatened Species and Communities Unit (WATSCU)  
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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 replaces number 34 Abba Bell (*Darwinia* sp. Williamson) (Gillian Stack, Rebecca Evans and Val English, 1999). It incorporates current information on factors such as population, land tenure plant numbers and threats that, if changed from the previous plan, may affect appropriate recovery actions. In addition, it provides an update of which recovery actions have occurred.

This Interim Recovery Plan will operate from March 2003 to February 2008 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be reviewed after five years and the need for a full Recovery Plan assessed.

This IRP was approved by the Director of Nature Conservation on 11 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 March 2003.

## SUMMARY

<b>Scientific Name:</b>	<i>Darwinia</i> sp Williamson	<b>Common Name:</b>	Abba Bell
<b>Family:</b>	Myrtaceae	<b>Flowering Period:</b>	October
<b>Dept Region:</b>	South West	<b>Dept District:</b>	Blackwood
<b>Shire:</b>	Busselton	<b>Recovery Team:</b>	South West Region Threatened Flora Recovery Team

**Illustrations and/or further information:** A. Brown, C. Thomson-Dans and N. Marchant (Eds) (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Perth.; V. English (1999) *Shrubland Association on Southern Swan Coastal Plain Ironstone, Draft Interim Recovery Plan*. Department of Conservation and Land Management, Perth.

**Current status:** *Darwinia* sp. Williamson was declared as Rare Flora under the Western Australian *Wildlife Conservation Act* 1950 in October 1996 and ranked as Critically Endangered (CR) in November 1998. It currently meets World Conservation Union (IUCN, 2000) Red List category 'CR' under criteria A4ce; B1ab(iii)+2ab(iii) and C2a(ii) (IUCN 2000), as it is only known from a single population of less than 250 mature individuals, with continued decline in the quality of the habitat. *Darwinia* sp. Williamson is also listed as Endangered under the Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

An Interim Recovery Plan was developed for the species in 1999 (Stack *et al.* 1999). Information accumulated since that plan was completed has been incorporated into this plan and this document now replaces Stack *et al.* (1999). This IRP will be implemented in conjunction with the IRP for the 'Shrublands on southern Swan Coastal Plain Ironstones' (English 1999) and with IRPs for other CR taxa that occur at the same locality (*Brachysema papilio*, *Lambertia echinata* subsp. *occidentalis* and *Petrophile latericola*).

**Critical habitat:** The critical habitat for *Darwinia* sp. Williamson comprises the area of occupancy of the known wild and translocated populations; similar habitat within 200 metres of wild and translocated populations; corridors of remnant vegetation that link wild and translocated populations; the local catchment area for the surface and groundwaters that supply the wetland habitat; and additional nearby occurrences of similar habitat that do not currently contain the species but may have done so and may be suitable for additional translocations.

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

Given that this species is listed as Critically Endangered it is considered that all known habitat for wild and translocated populations is critical to its survival

### Benefits to other species/ecological communities

Population 1 is located within an occurrence of a Threatened Ecological Community (TEC) listed as Endangered under the EPBC Act, and Critically Endangered in Western Australia. Other listed flora also occur in the wider habitat of Population 1 of *Darwinia* sp. Williamson (*Gastrolobium papilio* (previously *Brachysema papilio*), *Lambertia echinata* subsp. *occidentalis*, and *Petrophile latericola*). Recovery actions implemented to improve the quality or security of the habitat of *Darwinia* sp. Williamson Population 1 are likely to improve the status of the TEC in which this population is located, and also that of other listed flora that occur in the wider habitat.

### 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 *Darwinia* sp. Williamson 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 species.

### Social and economic impacts

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts. There are mineral leases over the area that contains population 1 of *Darwinia* sp. Williamson, however, an agreement has been negotiated with the mining company with regard the future management of the area that is to be mined immediately adjacent to the population. Recovery actions refer to continued liaison between stakeholders with regard this area.

### 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. 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.

**Habitat requirements:** *Darwinia* sp. Williamson is known from a single wild population (Population 1) at the base of the Whicher Range, and is confined to a highly restricted ironstone habitat. The habitat is a winter-wet area of shrubland over shallow red clay over ironstone. A fire in 1993 resulted in the death of almost all mature individuals, however, 100 seedlings were located at the site in October 1994. Associated species are *Hakea varia*, *Loxocarya magna* and *Chamelaucium roycei*. The plant association in which the species occurs is the Critically Endangered Threatened Ecological Community (TEC) 'Shrublands on southern Swan Coastal Plain Ironstones' (English 1999). There are six priority species and six additional Declared Rare Flora (DRF) species in the ironstone community in the vicinity of *Darwinia* sp. Williamson. Three of these DRF are also ranked Critically Endangered.

**Existing Recovery Actions:** The following recovery actions have been or are currently being implemented:

1. All appropriate land managers have been notified of the presence and threatened status of the species.
2. Four areas that contain the ironstone habitat have been purchased as conservation reserves.
3. Seed has been collected from Population 1 on three occasions, and is stored in the Department's Threatened Flora Seed Centre at -18°C.
4. The Botanic Garden and Parks Authority currently have eleven plants of *Darwinia* sp. Williamson from three clones.
5. An experimental translocation has been implemented in stages in 2001 and 2002, with planting occurring into two recently acquired reserves. Actions implemented in association with the translocations include treatment of translocates with phosphite, weed and rabbit control, and fencing to prevent grazing.
6. In 1997, samples were taken by staff of the Department's Science Division which positively identified the presence of the plant pathogen *Phytophthora cinnamomi* (dieback) in the habitat.
7. The site of the wild *Darwinia* sp. Williamson population has been sprayed with phosphite a number of times to combat dieback disease. Spraying and monitoring of the effects of treatment are ongoing. Disease hygiene procedures are implemented during all operations.
8. A fire response plan has been developed, and is being implemented.
9. An information sheet about the TEC habitat of the species has been produced by the local catchment group in liaison with the Department.
10. Implementation of the recovery actions outlined in the IRP for the TEC 'Shrublands on southern Swan Coastal Plain Ironstones' (English 1999) has commenced and is ongoing. Various actions that protect the community in which it occurs also protect this taxon.
11. An information sheet that describes and illustrates the taxon, threats to it and recovery actions has been produced.
12. Blackwood District staff have developed a map that defines areas not available for commercial wildflower picking to help prevent accidental damage or spread of disease to the population.
13. Staff from the Department's Blackwood District regularly monitor wild and translocated populations of the species.
14. The South West Region Threatened Flora Recovery Team is overseeing the implementation of this IRP and will include information on progress in an annual report to the Department's Corporate Executive and funding bodies.

**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 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.

**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            | 9. Continue weed control                          |
| 2. Maintain disease hygiene               | 10. Control grazing                               |
| 3. Continue <i>Phytophthora</i> control   | 11. Conduct further surveys                       |
| 4. Map critical habitat                   | 12. Collect seed and cutting material             |
| 5. Implement the fire management strategy | 13. Obtain biological and ecological information  |
| 6. Continue the translocation process     | 14. Stimulate the germination of soil-stored seed |
| 7. Liaise with land managers              | 15. Promote awareness                             |
| 8. Monitor populations                    | 16. Review the need for a full Recovery Plan      |

## 1. BACKGROUND

### History

G.J. Keighery<sup>1</sup> made the first collection of *Darwinia* sp. Williamson from the base of the Whicher Range in November 1991. N. Gibson<sup>2</sup> and other botanists undertook floristic and vegetation surveys of the Swan Coastal Plain in 1994 (Gibson *et al.* 1994) but located no additional populations of the species. A hot fire burnt through the population in 1993 and resulted in the death of almost all the mature individuals. Approximately 100 *D.* sp. Williamson seedlings were noted at that site during a survey in 1994, and some of these plants flowered in 1995.

Dieback disease caused by the plant pathogen *Phytophthora cinnamomi* is known to exist in the vicinity of *Darwinia* sp. Williamson. The taxon is presumed to be susceptible to this pathogen, as this is a characteristic of many Myrtaceous species. Susceptibility tests are being conducted but are incomplete at this stage. The site was first sprayed with phosphite in 1996, and this action is ongoing. The Department's Blackwood District staff assess the effectiveness of this treatment by monitoring local key dieback indicator species (personal communication, R. Smith<sup>3</sup>).

An Interim Recovery Plan was developed for the species in 1999 (Stack *et al.* 1999). Information accumulated since that plan was completed has been incorporated into this plan and this document now replaces Stack *et al.* (1999). This IRP will be implemented in conjunction with the IRP for the 'Shrublands on southern Swan Coastal Plain Ironstones' (English 1999) and with IRPs for other Critically Endangered taxa that occur at the same locality (*Brachysema papilio*, *Lambertia echinata* subsp. *occidentalis* and *Petrophile latericola*).

### Description

*Darwinia* sp. Williamson is an erect or sometimes spreading shrub, up to 70 cm tall by 40 cm wide, and often uses other shrubs for support. The green linear leaves, 3 to 5 mm long, are triangular in cross section, are crowded at the ends of branches, and bend backwards. This feature of the leaves distinguishes the species from the similar *Darwinia oederoides*. The inflorescence is nodding or (in young plants) rarely erect. The flowers are enclosed by red and green bracts that are arranged in several rows. The ribbed floral tube is brown, 3 mm long, with small triangular calyx lobes. The petals are about 1 mm long, and there is a red, curved style, 10 to 16 mm long (Brown *et al.* 1998).

### Distribution and habitat

*Darwinia* sp. Williamson is known from a single wild population (Population 1) at the base of the Whicher Range, in a winter-wet area of shrubland on shallow red clay over ironstone. The ecological community in which the species grows ('Shrublands on southern Swan Coastal Plain Ironstones') was ranked as Critically Endangered in 1995. These ironstone soils are highly restricted in distribution. There are a total of 13 occurrences of this species-rich plant community located on seasonal wetlands on ironstone and heavy clay soils on the Swan Coastal Plain near Busselton (English 1999). *D.* sp. Williamson has been translocated into two recently purchased areas that contain ironstone soils with vegetation in variable condition.

Much of the species diversity in the community comes from annuals and geophytes. Typical and common native species are the shrubs *Kunzea* aff. *micrantha*, *Pericalymma ellipticum*, *Hakea oldfieldii*, *Hemiandra pungens* and *Viminaria juncea*, and the herbs *Aphelia cyperoides* and *Centrolepis aristata* (Gibson *et al.* 1994). Other associated species include *Hakea varia*, *Loxocarya magna* and *Chamelaucium roycei*.

There are six additional Declared Rare Flora (DRF), three of which are also ranked Critically Endangered, that occur on the ironstone soils in the vicinity of *Darwinia* sp. Williamson. These are *Brachysema papilio* (CR),

<sup>1</sup> Greg Keighery, Principal Research Scientist (botany), the Department's Science Division, Wildlife Research Centre

<sup>2</sup> Neil Gibson, Senior Research Scientist (botany), the Department's Science Division, Wildlife Research Centre

<sup>3</sup> Russell Smith, Ecologist, Phosphite Program, The Department's Environmental Protection Branch, Bunbury

*Lambertia echinata* subsp. *occidentalis* (CR), *Petrophile latericola* (CR), *Dryandra nivea* subsp. *uliginosa* (Endangered), *Dryandra squarrosa* subsp. *argillacea* (Endangered) and *Chamelaucium roycei* ms (Vulnerable).

The IRPs for all of the Critically Endangered flora that occur near *Darwinia* sp. Williamson will be complementary to, and implemented in conjunction with, the IRP for the ‘Shrublands on southern Swan Coastal Plain Ironstones’ (English 1999).

### **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 *Darwinia* sp. Williamson 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 species.

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

Given that this species is listed as Critically Endangered it is considered that all known habitat is habitat critical. In addition all populations, including translocated populations, are considered important to the survival of the species. Recovery actions include survey for further populations that would lead to the identification of additional habitat critical.

### **Benefits to other species/ecological communities**

Population 1 is located within an occurrence of a Threatened Ecological Community (TEC) listed as Endangered under the EPBC Act, and Critically Endangered in Western Australia. Other listed flora also occur in the wider habitat of Population 1 of *Darwinia* sp. Williamson (*Gastrolobium papilio* (previously *Brachysema papilio*), *Lambertia echinata* subsp. *occidentalis*, and *Petrophile latericola*). All of these taxa are listed as Critically Endangered in Western Australia and Endangered under the EPBC Act. Recovery actions implemented to improve the quality or security of the habitat of *Darwinia* sp. Williamson Population 1 are likely to improve the status of the TEC in which this population is located, and also that of other listed flora that occur in the wider habitat.

### **Social and economic impacts**

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts. There are mineral leases over the area that contains population 1a of *Darwinia* sp. Williamson (refer Table 1), however, a mine proposed for immediately adjacent to the habitat of this species has been approved by all relevant authorities conditional upon specified environmental commitments made by the mining company. Recovery actions refer to continued liaison between stakeholders.

### **Evaluation of the Plan’s Performance**

The Department of Conservation and Land Management, in conjunction with the South West Region Threatened Flora Recovery Team will evaluate the performance of this recovery plan. In addition to annual reporting on progress against the criteria for success and failure, the plan is to be reviewed within five years of its implementation. Any changes to management / recovery actions made in response to monitoring results 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* (EPBC Act)).

The critical habitat for *Darwinia* sp. Williamson comprises:

- the area of occupancy of the known population;
- occurrences of ironstone habitat currently containing translocated plants of this species (populations 2T and 3T) which may in time become self-sustaining populations;
- areas of similar habitat within 200 metres of wild and translocated populations, i.e. winter-wet areas of shrubland on shallow red clay over ironstone (these provide potential habitat for natural range extension);
- corridors of remnant vegetation that link wild and translocated populations (these are necessary to allow pollinators to move between populations and are usually road and rail verges);
- the local catchment for the groundwater and surface water that feeds the wetland habitat in which the species occurs; and
- additional occurrences of similar habitat that do not currently contain the species but may have done so in the past (these represent possible translocation sites).

## Biology and ecology

Little is known about the biology and ecology of *Darwinia* sp. Williamson. The species appears to be killed by fire, although one adult plant was recorded as surviving the 1993 fire. *Darwinia* species are generally considered to be fire-sensitive with post-fire regeneration occurring mainly from seed. Approximately 100 seedlings germinated after the 1993 fire, and a few of these flowered in October 1995. The species is likely to be dieback susceptible as this is a characteristic of many Myrtaceous species.

A number of *Darwinia* species are cultivated for their ornamental bell-like flower heads. Propagation of *Darwinia* species is achieved through cuttings, as seed germination is often low even under generally favourable conditions (Turnbull and Doran 1987). Further investigation of germination techniques is necessary. The germination rate of this species has ranged from 60 to 86% initially, and was 31% after one year in storage (unpublished data A. Cochrane<sup>4</sup>). Like most Darwinias, this species propagates well from cuttings, with strike rates generally above 50% and often as much as 90% (personal communication A. Shade<sup>5</sup>).

## Threats

*Darwinia* sp. Williamson was declared as Rare Flora under the Western Australian *Wildlife Conservation Act* 1950 in October 1996 and was ranked as Critically Endangered (CR) in November 1998. It is also listed as Endangered under the EPBC Act. It currently meets IUCN Red List Category 'CR' under criteria A4ce; B1ab(iii)+2ab(iii); C2a(ii) (IUCN 2000), as it is only known from a single population comprised of approximately 100 mature individuals, with continued decline in the quality of the habitat. The main threats are disease, inappropriate fire regimes, mineral sand exploration and extraction, changes to hydrology, water-logging and salinity, weeds, rabbit grazing, and impacts such as high wind speeds that occur as a consequence of proximity to cleared land.

- **Disease** is a serious threat to Population 1. *Phytophthora* is known to occur in the vicinity of the species, and *Darwinia* sp. Williamson is suspected to be susceptible to this plant pathogen. As this is the only *in situ* population, protecting the habitat from dieback is imperative. There have also been deaths of the DRF species *Dryandra nivea* subsp. *uliginosa* at the locality, and these are likely to have been caused by canker

<sup>4</sup> Anne Cochrane, Manager, the Department's Threatened Flora Seed Centre

<sup>5</sup> Amanda Shade, Horticulturalist, Botanic Garden and Parks Authority

(probably *Armillaria luteobubalina*). The susceptibility of *Darwinia* sp. Williamson to this second pathogen is unknown.

- **Inappropriate fire regimes** would affect the viability of the population, as *Darwinia* sp. Williamson appears to be an obligate seeder that germinates following fire. If this is the case, 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, it is likely that occasional fires are needed for reproduction of the species.
- **Mineral sand extraction** has been approved within privately owned land adjacent to the area of State Forest which contains Population 1. Potential impacts include major modification of the hydrology of the area, and the proponent has installed an artificial recharge system to help maintain current hydrology and several piezometers for monitoring purposes.
- **Mineral sand exploration** and extraction leases exist over the area of State Forest in which *Darwinia* sp. Williamson occurs.
- **Water-logging and salinity** are becoming threats on the ironstone soil type on which *Darwinia* sp. Williamson occurs (Tille and Lantzke 1990). Extensive clearing for agriculture in the area is likely to have increased surface runoff and recharge of the groundwater. Neither waterlogging nor salinity are immediate threats, but require monitoring. Hirschberg (1989) measured levels of salinity in the groundwater in the area, and found the water near this population to be reasonably fresh.
- **Weeds** are an established problem at the translocation sites. These partially cleared areas were purchased by the Department in 1999, and are being rehabilitated. 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 grass weed species.
- **Rabbits** are a threat to the translocated populations through selectively grazing seedlings and young growth.
- **Environmental stress** including strong winds as a consequence of proximity to cleared land is a threat at Population 2T. Lack of native vegetation increases wind and heat exposure increasing susceptibility to desiccation and reducing plant vigour.

### Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1. Whicher Range	State Forest	1991 Common 1992 27 1993 1 1994 1 (ca100) 1997 5 (ca100) 2002 100+	Healthy	Disease, inappropriate fire regimes, mineral sands exploration and extraction, waterlogging and salinity
2T. Whicher Range (Oates Rd)	Nature Reserve	2001 (328)	49	Disease, inappropriate fire regimes, waterlogging and salinity, weeds, rabbits, strong wind, drought
3T. Whicher Range (Negus' Block)	Nature Reserve	2001 (68)	32	Disease, inappropriate fire regimes, waterlogging and salinity, weeds, rabbits, kangaroos

Numbers in brackets = number of juveniles. Pop.No.T = a translocated population.

### Guide for decision-makers

Section 1 provides details of current and possible future threats. Any on-ground works (clearing, mining firebreaks, roadworks etc) in the immediate vicinity of *Darwinia* sp. Williamson will require assessment. On-ground works should not be approved unless the proponents can demonstrate that they will not have an impact on the species, its habitat or potential habitat, or on the local surface or groundwater catchments such that hydrology of the wetland habitat of the species would be altered.

## 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.

**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

The Department of Minerals and Energy was formally notified of the presence of *Darwinia* sp. Williamson in October 1996. The adjacent private property owners were notified in February 1999. These notifications detailed the Declared Rare status of the species and associated legal obligations. The mining company with a tenement over this area was notified of the presence of two other Critically Endangered species (*Petrophile latericola* and *Brachysema papilio*) in October 1994, and of the occurrence of *Darwinia* sp. Williamson in June 1999.

Liaison with these stakeholders is ongoing. The area is still under a Mineral Lease. Approval to mine Location 4102 adjacent to the wild population was granted in 2002. Liaison between the proponent, the Department and relevant government bodies is ongoing. Potential impacts include major modification of the hydrology of the area, and the proponent has installed an artificial recharge system to maintain the water levels at the site, and several piezometers for monitoring purposes, together with programmes for monitoring vegetation health and some funds for general maintenance of the TEC and component threatened flora.

In addition to previous purchases of ironstone habitat, two areas of this habitat type on private property were purchased by the Department in 1999. Although degraded through previous clearing for agriculture, the new sites contain the ironstone soil type. Both parcels of land are being used for a suite of translocations of five critically endangered ironstone species, and are also being rehabilitated with common local provenance species. Population 2T is north of the wild population of *Darwinia* sp. Williamson, and has been protected with rabbit-proof fencing. Population 3T of *Darwinia* sp. Williamson is to the north east of Population 1, and has been fenced to exclude kangaroo and rabbit grazing. Both are now A Class Nature Reserves for the purpose of conservation of flora and fauna. The purchase of another area of private property adjoining one of the new Nature Reserves is also in progress, further extending the area of remnant vegetation to act as a buffer, and a potential site for future translocations.

A total of approximately 360 seeds (from 879 fruits) are currently stored in the Department's Threatened Flora Seed Centre (TFSC) at  $-18^{\circ}\text{C}$ . These were collected in December 1995 and December 1997. Staff of the TFSC test the viability of seed soon after collection and again after one year in storage. The initial germination rate of *Darwinia* sp. Williamson seed ranged from 60 to 86%. After one year in storage the germination rate was 31% (unpublished data A. Cochrane). Additional seed was collected in 2002, but this has not yet been processed.

The Botanic Garden and Parks Authority (BGPA) currently have eleven living plants of *Darwinia* sp. Williamson from three clones. Cuttings of this species do very well, with strike rates generally above 50% and often as much as 90% (personal communication A. Shade).

A Translocation Proposal as required under the Department's Policy Statement Number 29 was approved for this species in 2001. 422 plants were propagated by BGPA from seed and cuttings, and translocated into the two previously mentioned Nature Reserve sites in July 2001. 354 plants were introduced to an area of ironstone north of the wild population (Population 2T), and 68 more to a second area north east of the wild population (Population 3T). Different treatments being trialled include ripping and mounding, mounding, watering and shading. Control sites were also established. Survival of the 2001 plantings was poor, with only 14% still alive

six months after planting at Population 2T, and 47% at Population 3T. Problems with rabbits, weeds, strong winds and inundation, followed by a longer than average summer drought, have all contributed to plant deaths with initial survival overall being poor. Watering systems have been set up at both sites, weed and rabbit control is continuing and windbreaks were planned for planting in 2002 in a bid to reduce the number of plant deaths.

An additional 6 translocates were planted in Population 2T in 2002. Windbreaks were planted using plants grown from local provenance material and further plantings of associated species are planned for 2003. It is anticipated that further translocations of the species will occur in 2004.

Disease hygiene measures are implemented during all operations. This includes limiting vehicle access to tracks, and cleaning all tools used on one plant before using on another, such as secateurs when taking cuttings, and when using spades and other tools used during translocations. Bollards were installed across the main access track into the wild population in 1999, to prevent vehicle access at all times.

Samples were taken from the habitat of the wild population by the Department's Science Division in May 1997 to assess the presence or absence of *Phytophthora* spp. These positively identified *P. cinnamomi*. Dieback disease (caused by *Phytophthora cinnamomi*) is evident at the site with deaths of susceptible species, including *Lambertia echinata* subsp. *occidentalis*. Research conducted between 1992 and 1997 indicates that phosphite application is a very effective tool in controlling the impact of dieback disease (Murray 1997). Population 1, within a State Forest Block, has been sprayed up to three times per year since 1996. A phosphite monitoring program was established in 1998, and is ongoing. This involves the monitoring of floristic plots by checking plant health of a number of tagged plants and recording changes over time. Photographic records are also kept for comparison. Recent monitoring suggests that annual spraying of phosphite may be too frequent for some associated species, leading to phyto-toxicity ('burning' of foliage). Modifications may be required to the schedule of spraying as the program continues. The susceptibility of *Darwinia* sp. Williamson to the disease is currently under investigation.

*Phytophthora* spp. were also implicated in the deaths of translocates at Population 2T. *P. cinnamomi* was recorded from roots and soil, while *P. cryptogea* was also isolated from soil in early 2002. Both translocated populations were also treated with phosphite in 2002.

A coordinated fire response plan for the species has been developed and incorporated into the Fire Control Working Plan. This includes strategies for fire control at each location of the taxon, including translocation sites. The information will also be communicated to other fire response organisations.

In 2001, invasive weeds were controlled by hand around *Darwinia* sp. Williamson in Populations 2T and 3T by both volunteers and Department staff. The entire paddock section of Population 2T had herbicide applied via a blanket wiper mounted on a four-wheel motorbike to control Guilford grass (*Romulea* sp.), which was very effective. The remaining weed species are mostly annuals which will be controlled by application of herbicide and slashing as required. The aim is to eventually smother the weed species with native vegetation.

The fence surrounding Population 2T was observed to have rusted in some sections in 2001. Rabbit activity was also observed. Repairs have been effected and 1080 poisoned oats, gassing and shooting have all been used to reduce the number of rabbits. However, they continue to threaten the translocates and rabbit control methods will continue. A rabbit and kangaroo proof fence was erected at population 2T (Negus) in 2002.

Implementation of the recovery actions outlined in the IRP for the community 'Shrublands on southern Swan Coastal Plain Ironstones' (English 1999) has commenced, and recovery actions that benefit the TEC habitat will also benefit *Darwinia* sp. Williamson.

A double-sided information sheet has been produced, and includes a description of *Darwinia* sp. Williamson, its habitat, threats, recovery actions and photos. This will be distributed to community members through local libraries, wildflower shows and other events, and is available for download on the internet

A brochure about the values of Abba Plains vegetation has also been produced by local catchment group Geocatch with Departmental assistance, in support of landholders protecting their remnant vegetation. This includes details of the 'Shrublands on southern Swan Coastal Plain Ironstones' threatened ecological

community and photos of *Darwinia* sp. Williamson and other key species. It is hoped that these may result in the discovery of new populations. A threatened flora display was presented during a recent Busselton Wildflower Show.

Staff from the Department's Blackwood District have developed a map delineating the areas not available for commercial wildflower picking to help ensure that pickers do not enter the area in which *Darwinia* sp. Williamson occurs.

Staff from the Department's Blackwood District regularly monitor the wild and translocated populations of this taxon. Monitoring includes recording changes in weed levels, the impacts of *Phytophthora cinnamomi* and other plant diseases, grazing activity, fire, fencing and other types of disturbance.

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

### 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 SWRTFRT will continue to coordinate the implementation of recovery actions for *Darwinia* sp. Williamson and other Declared Rare flora in the 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 (Blackwood District) through the SWRTFRT  
**Cost:** \$6,200 per year

#### 2. Maintain disease hygiene

The ironstone habitat in which *Darwinia* sp. Williamson occurs is inundated over the winter months, and this favours the establishment and spread of *Phytophthora* species. Many plant species in the ironstone community are presumed to be susceptible to this disease, including *Darwinia* sp. Williamson. Dieback hygiene (outlined in Department of Conservation and Land Management 1992) will therefore be adhered to for activities such as installation and maintenance of firebreaks and walking into the population in wet soil conditions. Purpose built signs advising of the dieback risk and high conservation values of this site will be installed.

**Action:** Maintain disease hygiene  
**Responsibility:** The Department (Blackwood District) through the SWRTFRT  
**Cost:** \$600 per year

#### 3. Continue *Phytophthora* control

Aerial spraying of phosphite has occurred over the community that contains *Darwinia* sp. Williamson. This action helps to protect the TEC, and the other endangered flora that occur in that community (a number of which are also Critically Endangered) from dieback disease. This action will continue to be implemented as necessary.

The impact of the phosphite application on this taxon and its habitat will continue to be monitored, and this will also indicate the requirement for follow-up treatment.

**Action:** Continue *Phytophthora* control  
**Responsibility:** The Department (Blackwood District, Dieback Disease Coordinator) through SWRTFRT  
**Cost:** \$3,800 in the first, third and fifth years, plus \$500 per year for monitoring

#### 4. 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 (Blackwood District, WATSCU) through the SWRTFRT  
**Cost:** \$2000 in the first year

#### 5. Implement the fire management strategy

It is known that fire kills most adult plants of the species and regeneration is largely from seed. However, frequent fire may prevent the accumulation of sufficient soil-stored seed for recruitment to occur. 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 response plan has been developed for both the wild and translocated populations and incorporated into the Blackwood District's Fire Control Working Plan. Other fire fighting agencies will be informed of appropriate responses to fire threatening this site. Firebreaks will continue to be maintained.

**Action:** Implement the fire management strategy  
**Responsibility:** The Department (Blackwood District) through the SWRTFRT  
**Cost:** \$1000 per year

#### 6. Continue the translocation process

Translocation is essential for the conservation of this species, as the single small wild population is not secure from threats including disease, inappropriate fire regimes, mineral exploration or extraction, waterlogging and salinity. Information on the translocation of threatened plants and animals in the wild is provided in the Department's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. This recovery action will continue to be coordinated by the SWRTFRT.

A Translocation Proposal has been developed and was endorsed by the Department's Director of Nature Conservation. The translocation will involve two sites, introducing the species into two areas of suitable habitat recently acquired as Nature Reserves.

The propagation of plants for translocation has been undertaken and will continue as necessary. Plantings have occurred in 2001 and 2002. Additional plantings will occur as necessary in accordance with the approved Translocation Proposal. Monitoring of the translocation is essential, and will continue to be done according to the timetable developed for the Translocation Proposal.

**Action:** Continue the translocation process  
**Responsibility:** The Department (Blackwood District, Science Division, TFSC), BGPA through SWRTFRT  
**Cost:** \$10,500 per year (\$5,500 for monitoring, \$2,000 for propagation, \$3,000 for planting)

#### 7. Liaise with land managers

Staff from the Department's Blackwood District will continue to liaise with the mining tenement holder and adjacent land managers to ensure that neither wild nor translocated populations are accidentally damaged or destroyed. In particular, the results of monitoring of the impacts of the mine that will occur immediately adjacent to the species are to be promptly communicated to the Department, and appropriate responses made.

**Action:** Liaise with land managers  
**Responsibility:** The Department (Blackwood District) through the SWRTFRT  
**Cost:** \$500 per year

## 8. Monitor populations

Factors such as habitat degradation (including weed invasion, salinity and plant diseases such as *Phytophthora cinnamomi*), groundwater quality and levels, population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation will be monitored annually for both wild and translocated populations.

**Action:** Monitor populations  
**Responsibility:** The Department (Blackwood District) through the SWRTFRT  
**Cost:** \$500 per year

## 9. Continue weed control

Weed levels at the wild population is low; however, at the translocated sites the level of weed invasion is high and ongoing control is necessary. Remaining weeds are mostly annuals, and weed control will be by hand weeding or localised application of herbicide during the appropriate season to minimise the effect of herbicide on the species and any associated native vegetation. Because of the increasing difficulties in using chemicals and slashing within the translocation sites due to proximity to regenerating seedlings, trials will be undertaken to compare the effects of smothering weeds by mulch, jute matting and no treatment. 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 *Darwinia* sp. Williamson and associated native plant species.

**Action:** Continue weed control  
**Responsibility:** The Department (Blackwood District) through the SWRTFRT  
**Cost:** \$500 per year

## 10. Control grazing

As a consequence of some previous control, the current level of threat from rabbits is moderate at the translocated populations. Populations 2T and 3T have been fenced with rabbit-proof fencing to protect the translocates from grazing. However, rabbits continue to impact on populations through grazing and digging, and they will continue to be controlled using a variety of methods as appropriate, in consultation with relevant landholders. Fencing has also been undertaken to exclude kangaroo grazing at population 3T.

**Action:** Control grazing  
**Responsibility:** The Department (Blackwood District) through the SWRTFRT  
**Cost:** \$200 per year

## 11. Conduct further surveys

Although this community type has been extensively surveyed over the last decade, it is possible that additional populations of this or other ironstone species may be discovered. Surveys will particularly target remnant vegetation of this type on private lands as permission is obtained. It is likely, however, that these occurrences would be affected by agricultural clearing and grazing. Community volunteers will be encouraged to be involved in further surveys by Departmental staff to be conducted during the flowering period of the species (October).

**Action:** Conduct further surveys  
**Responsibility:** The Department (Blackwood District) through the SWRTFRT  
**Cost:** \$2,500 per year

## 12. 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. A small quantity of seed and cuttings has been collected

from Population 1 but further collections are required. In addition, collections from the translocated populations will be made when possible.

**Action:** Collect seed and cutting material  
**Responsibility:** The Department (TFSC, Blackwood District) and BGPA, through the SWRTFRT  
**Cost:** \$2,800 in the second and fourth years

### 13. Obtain biological and ecological information

Increased knowledge of the biology and ecology of *Darwinia* sp. Williamson will provide a better scientific basis for its management in the wild. 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 species.
3. The requirements of pollinators.
4. The reproductive strategies, phenology and seasonal growth of the species.
5. The population genetic structure, levels of genetic diversity and minimum viable population size.
6. The impact of dieback disease and control techniques on *Darwinia* sp. Williamson and its habitat.
7. The impact of changes in hydrology on *Darwinia* sp. Williamson and its habitat.

**Action:** Obtain biological and ecological information  
**Responsibility:** The Department (Science Division, Blackwood District) through the SWRTFRT  
**Cost:** \$17,200 per year in the second, third and fourth years

### 14. Stimulate the germination of soil-stored seed

Burning, smokewater and soil disturbance are likely to be effective in stimulating the germination of soil-stored seed. These trials will be conducted as appropriate at the base of dead mature plants.

**Action:** Stimulate the germination of soil-stored seed  
**Responsibility:** The Department (Blackwood District) through the SWRTFRT  
**Cost:** \$200 in second and fourth years

### 15. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of this species 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.

**Action:** Promote awareness  
**Responsibility:** The Department (Blackwood District) through the SWRTFRT  
**Cost:** \$600 per year

### 16. Review the need for a full Recovery Plan

At the end of the fourth year of its five-year term this Interim Recovery Plan will be reviewed and the need for further recovery actions will be assessed. If the species is still ranked as Critically Endangered at that time a full Recovery Plan may be required.

**Action:** Review the need for further recovery actions and/or a full Recovery Plan  
**Responsibility:** The Department (WATSCU, Blackwood District) through the SWRTFRT  
**Cost:** \$20,300 in the fifth year (if full Recovery Plan required)

#### 4. TERM OF PLAN

This Interim Recovery Plan will operate from March 2003 to February 2008 but will remain in force until withdrawn or replaced. If the taxon is still ranked Critically Endangered 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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Anne Cochrane	Manager, the Department's Threatened Flora Seed Centre
Colin Crane	Senior Technical Officer, the Department's Science Division
Leonie Monks	Research Scientist, the Department's Science Division
Amanda Shade	Horticulturalist, Botanic Garden and Parks Authority
Bryan Shearer	Principal Research Scientist, the Department's Science Division
Meredith Spencer	Conservation Officer, the Department's Blackwood District
Russell Smith	Ecologist, Phosphite Program, CALM Bunbury

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## 7. TAXONOMIC DESCRIPTION

Brown *et al.* (1998).

### ***Darwinia* sp. Williamson**

This erect or spreading shrub, up to 70 cm tall and 40 cm wide, often uses other shrubs for support. Green linear leaves, three to five mm long, are triangular in cross section. They are crowded at the ends of branches, and bend backwards. The inflorescence is nodding or (in young plants) rarely erect. Red and green bracts are arranged in several rows, enclosing the flowers. The brown floral tube, three mm long, is ribbed, with small triangular calyx lobes. Petals are about one mm long. There is a long, red curved style, 10 to 16 mm long.