Department of Parks and Wildlife

Interim Recovery Plan No. **348**

Late Hammer Orchid
Drakaea confluens

Interim Recovery Plan
2014–2019

Department of Parks and Wildlife, Western Australia

June 2014

List of Acronyms

The following acronyms are used in this plan:

ADTFCRT	Albany District Threatened Flora and Communities Recovery Team
BGPA	Botanic Gardens and Parks Authority
CALM	Department of Conservation and Land Management
CFF	Conservation of Flora and Fauna
CCWA	Conservation Commission of Western Australia
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DAA	Department of Aboriginal Affairs
DEC	Department of Environment and Conservation
DPaW	Department of Parks and Wildlife (Parks and Wildlife)
DRF	Declared Rare Flora
EPBC	Environment Protection and Biodiversity Conservation
IBRA	Interim Biogeographic Regionalisation for Australia
IMGs	Interim Management Guidelines
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
NP	National Park
NR	Nature Reserve
NRM	Natural Resource Management
PEC	Priority Ecological Community
SCB	Species and Communities Branch (Parks and Wildlife)
SCD	Science and Conservation Division
SWRTFRT	South West Region Threatened Flora Recovery Team
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
VU	Vulnerable
WA	Western Australia
WANOSCG	Western Australian Native Orchid Study and Conservation Group

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife Policy Statements Nos. 44 and 50 (CALM 1992; CALM 1994). Note: The Department of Conservation and Land Management (CALM) formally became the Department of Environment and Conservation (DEC) in July 2006 and the Department of Parks and Wildlife in July 2013. Plans 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.

Parks and Wildlife is committed to ensuring that Threatened taxa are conserved through the preparation and implementation of Recovery Plans (RPs) or Interim Recovery Plans (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 plan, which results from a review of, and replaces plan No. 80 Late Hammer Orchid (*Drakaea confluens* ms) (Phillimore and Brown 2001), will operate from June 2014 to May 2019 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked as CR in WA, this plan will be reviewed after five years and the need for further recovery actions assessed.

This plan was given regional approval on 6 June 2014 and was approved by the Director of Science and Conservation on 13 June 2014. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting Parks and Wildlife, as well as the need to address other priorities.

Information in this plan was accurate at June 2014.

Plan preparation: This plan was prepared by:

Robyn Luu	Project Officer, Parks and Wildlife Species and Communities Branch
Andrew Brown	Threatened Flora Coordinator, Parks and Wildlife Species and Communities Branch

Acknowledgments: The following people provided assistance and advice in the preparation of this plan:

Sarah Barrett	Flora Conservation Officer, Parks and Wildlife Albany District
Tiffany Fowler	Reserves Officer, Parks and Wildlife Wellington District
Simon Martin	Nature Conservation Coordinator, Parks and Wildlife Wellington District
Ryan Phillips	Research Scientist, Botanic Gardens and Parks Authority
Andrew Webb	Flora Conservation Officer, Parks and Wildlife South West Region

Thanks also to the staff of the Western Australian Herbarium for providing access to Herbarium databases and specimen information, and other departmental staff for comments and assistance in developing this plan.

Cover photograph by Ryan Phillips.

Citation: This plan should be cited as: Department of Parks and Wildlife (2014) Late Hammer Orchid, *Drakaea confluens* Interim Recovery Plan 2014–2019. Interim Recovery Plan No. 348. Department of Parks and Wildlife, Western Australia.

Summary

Scientific name:	***Drakaea confluens***	**Common name:**	Late Hammer Orchid
Family:	Orchidaceae	**Flowering period:**	September–November
DPaW regions:	South Coast, South West	**DPaW districts:**	Albany, Wellington
Shires:	Cranbrook, Plantagenet, Gnowangerup, West Arthur, Collie	**NRM regions:**	South Coast, South West
IBRA regions:	Jarrah Forest, Esperance Plains	**Recovery teams:**	ADTFCRT, SWRTFRT
IBRA subregions:	Southern Jarrah Forest JAF0, Fitzgerald ESP01		

Distribution and habitat: *Drakaea confluens* is endemic to Western Australia where it is found in three disjunct areas – near Boyup Brook, the Stirling Range-Gnowangerup area and near the Porongurup Range. The Boyup Brook populations grow in sandy sites associated with spearwood (*Kunzea glabrescens*), jarrah (*Eucalyptus marginata*), and slender banksia (*Banksia attenuata*). In the Stirling Range the dominant overstorey of jarrah and slender banksia is similar, but the understorey is a low shrubland of *Dasypogon* and *Stirlingia*. The Porongurup population occurs in similar woodland (Hopper and Brown 2007).

Habitat critical to the survival of the species, and important populations: *Drakaea confluens* is ranked as Critically Endangered (CR) in Western Australia and, as such, it is considered that all known habitat for wild populations is critical to the survival of the species and that the wild populations are important populations. Habitat critical to the survival of *D. confluens* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Conservation status: *Drakaea confluens* is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as CR in Western Australia under International Union for Conservation of Nature (IUCN) 1994 criteria C2a due to less than 250 mature individuals being known in the wild, their being a continuing decline in the number of mature individuals and severe fragmentation of populations. The species is listed as Endangered (EN) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The main threats to the species are track and firebreak maintenance, grazing, trampling, fire, recreational activities, poor recruitment, declining populations and disease.

Existing recovery actions: The following recovery actions have been or are currently being implemented and have been considered in the preparation of this plan:

1. Relevant land managers have been made aware of this species and its locations.
2. Declared Rare Flora (DRF) markers have been installed at populations 1, 9, 10 and 16.
3. Cages were placed over individual plants at Population 6 by Parks and Wildlife in 2006 to prevent grazing by herbivores such as kangaroos.
4. The dieback front at Population 11 has been pegged to monitor its spread. Banksias have been trunk injected with phosphite at the site.
5. The species has been extensively surveyed for by Parks and Wildlife's Albany and Wellington Districts and Western Australian Native Orchid Study and Conservation Group (WANOSCG) in areas of suitable habitat with a number of new populations being discovered.

6. Populations 4 and 5 located on private property have been fenced to exclude stock.
7. Rabbit baiting was carried out in Twin Creeks Nature Reserve (Population 11) in 2006 and 2007. Control of kangaroos to reduce grazing at Populations 4 and 5 has also been implemented by the landowner.
8. Population 7 originally occurred on unallocated Crown land which was identified under the Regional Forest Agreement as a proposed Conservation Park . Muja Conservation Park was formally established on 8/12/2004.
9. An experimental burn was undertaken at Population 4 in April 2000 by staff from Parks and Wildlife's South West Region and the private property owner.
10. Approximately 0.2mls of seed has been collected by the Botanic Gardens and Parks Authority (BGPA) and is to be used for PhD research in cross-specificity experiments. Seed was also collected for the Millenium Seed Bank project in 2001. Two isolates of the mycorrhizal endophyte associated with the species have also been cultured.
11. Fire management for conservation is included as a specific strategy (#23) in the Stirling Range and Porongurup National Park Management Plan (Herford *et al*. 1999). A fire management strategy for the SRNP was written in 2010 (Barrett *et al*. 2010).
12. Several articles about the species have appeared in newspapers including "Land Taken Back for the Future" in The Weekender newspaper on October 9, 2003; "Under threat" by Sarah Barrett in the Extra, October 6, 2001. Several presentations have also been conducted and information on the species has been included in the WATSNU Newsletter, Wildflowers of the Stirling Range Bushbook and The West Australian Newspaper.
13. An A4 sized poster, that provides a description of the species and information about threats and recovery actions, has been developed for *Drakaea confluens*.
14. A reply paid postal drop, illustrating *Drakaea confluens* and describing its distinctive features and habitat has been distributed by Parks and Wildlife's Albany District staff to local farmers and other residents in the areas where the orchid is found.

Plan objective: The objective of this plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term conservation of the species in the wild.

Recovery criteria

Criteria for recovery success:

- The number of extant populations has increased from 16 to 17 or more over the term of the plan and/or
- The number of mature individuals has increased by 20% or more over the term of the plan from 94 to 113 or more.

Criteria for recovery failure:

- The number of populations has decreased from 16 to 15 or less over the term of the plan and/or
- The number of mature individuals has decreased by 20% or more over the term of the plan from 94 to 75 or less.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Protect plants from herbivory
4. Fence Subpopulation 7f and others as required
5. Implement fire management strategies
6. Confirm the presence of dieback disease and maintain disease hygiene
7. Undertake and monitor translocations
8. Undertake surveys
9. Collect and store seed and mycorrhizal material
10. Obtain biological and ecological information
11. Ensure long-term protection of habitat
12. Liaise with land managers and Aboriginal communities
13. Promote awareness
14. Incorporate recovery actions into the IMGs for the Muja Conservation Park
15. Map habitat critical to survival
16. Review this plan

1. Background

A review of outputs and effectiveness of plan 80 (2001–2003) by R. Phillimore and A. Brown follows. This revised plan replaces plan No. 80.

The criteria for success in the previous plan (the number of individuals within populations and/or the number of populations have increased) has been partly met. At the time the previous plan was written in 2001, the taxon was known from 10 populations and three subpopulations comprising 212 mature plants. An additional six populations and four subpopulations have since been located. However the number of mature plants have decreased from 212 to 94 (56% decrease). This may be due to seasonal influences, such as rainfall, and the difficulty in locating the species in the field.

Most recovery actions included in the previous plan have now been fully or partially implemented while a few are yet to be started or are no longer required. The species' restricted extent of occurrence and occupancy and a continuing decline in quality of habitat and plant numbers requires further recovery actions being implemented.

Action 15 is redundant as Parks and Wildlife no longer produces full flora recovery plans. Interim Recovery Plans (IRP's) have been extended to a five year term after which they are reviewed and updated if required. The current status of recovery actions is listed in table 1.

Table 1: Status of recovery actions included in previous plan

Recovery action	Status	Result
Coordinate recovery actions	Ongoing	Recovery actions are conducted by the Albany and Wellington Districts Flora Conservation Officers. In the Albany area assistance is provided by the ADTFCRT. Although the SWRTFCRT was set up to assist in the coordination of recovery actions in the South West Region, which includes the Wellington District, it has not met for many years.
Develop and implement a fire management strategy	Strategy complete, implementation ongoing	Fire management for conservation is included as a specific strategy (#23) in the Stirling Range and Porongurup National Park Management Plan (Herford *et al.* 1999). A fire management strategy for the SRNP was written in 2010 (Barrett *et al.* 2010) and recommends appropriate fire regimes for each fire management 'cell' and provides improved strategic direction for the use of planned fire within the SRNP. Fire management is also included in the draft Twin Creeks Management Plan (2005). Wellington District fire response strategies exist for Muja CP, Haddleton NR and private property populations (4 and 5).
Collect seed and tissue culture material	Collections made, ongoing	BGPA have 0.2mls of seed to be used for PhD research in cross-specificity experiments. Two isolates of the mycorrhizal endophyte associated with the species have been cultured. Seed was collected for the Millennium Seed Bank Project in 2001.
Monitor and control vertebrate grazing	Control started, ongoing	Rabbit baiting was carried out in Twin Creeks NR (Population 11) in 2006 and 2007. The private land manager regularly culls kangaroos on his property (Populations 4 and 5).
Conduct further surveys	Surveys conducted, ongoing	The species has been surveyed by Parks and Wildlife and volunteers from WANOSCG.
Undertake weed control	Not started, currently not considered a threat	Weed control has not been undertaken as recent monitoring indicates that weeds were not a current threat.
Apply phosphite as	Started	The dieback front at Population 11 has been pegged to monitor its spread.

required		Banksias near the site have been trunk injected with phosphite. No phosphite spraying has occurred within any populations.
Monitor the impact of phosphite application	Not started	Monitoring of phosphite trunk injections has not yet commenced.
Notify and liaise with relevant land owners	Completed, ongoing	All stakeholders have been made aware of this species and its locations. Liaison with landowners is ongoing.
Monitor populations	Ongoing	Populations were monitored during the term of the plan. Information collected during monitoring is stored at Parks and Wildlife's district offices and SCB.
Protect populations on private land	Not started	No action has been taken to place a conservation covenant on or purchase land containing Populations 4 and 5 as these steps are not currently thought necessary to protect these plants. An excellent relationship exists between Parks and Wildlife and the land owner who is interested in retaining the bush for conservation and has fenced it.
Obtain biological and ecological information	Started, ongoing	A PhD candidate based at the BGPA is currently studying the role of pollinators and soil mycorrhiza in the distribution and speciation of *Drakaea*, including *D. confluens*. This information is currently being prepared for publication.
Promote awareness	Ongoing	Presentations have been conducted and information on the species has been included in the WATSNU Newsletter, Wildflowers of the Stirling Range book and The West Australian Newspaper. A poster and a "have you seen this flower" postcard have also been developed.
Incorporate recovery actions into the IMGs for a new conservation park	Guidelines not yet written	Muja CP (Population 7) was formally established on the 8/12/2004. IMGs for the park have not yet been written.
Write a full Recovery Plan	No longer a requirement	As Parks and Wildlife no longer produces full recovery plans for flora, this plan will be reviewed and a new plan written if required.

With the exceptions of *Action 6* (undertake weed control) and *Actions 7* and *8* (phosphite spraying to protect plants from *Phytophthora* infection) which are no longer considered necessary, ongoing recovery actions included in the previous plan are included in this revised plan.

New recovery actions included in this plan are to protect plants from herbivory, fence Subpopulation 7f, implement fire management strategies, confirm the presence of dieback disease and maintain disease hygiene, undertake and monitor translocation, map habitat critical to survival, and review this plan and assess the need for further recovery actions.

History

Drakaea confluens was first collected from Gnowangerup in September 1930 by Mrs P. Andrews but was not seen again until 1982 when farmer and orchid enthusiast Eric Chapman discovered the species near Boyup Brook. Further collections of the species were made east of Mondurup Peak in 1983, Haddleton Nature Reserve in 1990, near Lake Ngartiminny in 1992, Camel Lake Nature Reserve in 1999 and the Porongurup Range and Stirling Range National Park areas in 2000. Although widespread, most *Drakaea confluens* populations comprise very few mature plants.

Drakaea confluens was formally described by Stephen Hopper and Andrew Brown in 2007, its name derived from the Latin *confluens* (confluent, running together) referring to the labellum that has features of both *D. livida* (conspicuous spots) and of *D. elastica* (straight or slightly upturned labellum apex) (Hopper and Brown 2007).

Drakaea confluens is currently known from 16 populations comprising approximately 94 mature plants. Four populations and three subpopulations no longer appear to have any adult plants with some of these failing to regenerate after fire. The habitat of several populations is affected by dieback disease (*Phytophthora cinnamomi*), however there does not appear to be any direct impact on *D. confluens*.

Description

Drakaea confluens grows 15 to 30cm high and has a single greyish-green, heart-shaped leaf 1 to 2cm across, held flat to the ground. The leaf may either be smooth or covered with short hairs. The flower stem is up to 30cm long and supports a single, dull purple, green and yellow flower 2−4cm long by 3−5mm wide (Brown *et al*. 1998; Brown *et al*. 2008; Hoffman and Brown 1998).

Drakaea confluens is often sympatric with other hammer orchids such as *D. livida* and *D. glyptodon* but begins flowering when they are finishing. *Drakaea confluens* is distinguished from *D. livida* and *D. glyptodon* by its leaf which is often covered in short dense hairs and from *D. livida* by its flower which has a two coloured labellum with a relatively straight, rather than upturned, apex (Hoffman and Brown 1998). The species is distinguished from the related *D. isolata* by its larger flower size, later flowering period and different range of distribution (Brown *et al*. 2008).

Illustrations and/or further information

Brown, A.P., Dixon, K.W., French, C.J. and Brockman, G. (2013) *Field Guide to the Orchids of Western Australia*. Simon Nevill Publications, Western Australia; Brown, A., Dundas, P., Dixon, K. and Hopper, S. (2008) *Orchids of Western Australia*. University of Western Australia Press, Crawley, 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; Hoffman, N. and Brown, A. (1998) *Orchids of South-west Australia*. Revised 2nd edition with supplement. University of Western Australia Press, Nedlands; Hopper, S.D. and Brown, A.P. (2007) A revision of Australia's hammer orchids (*Drakaea*: Orchidaceae), with some field data on species-specific sexually deceived wasp pollinators. *Australian Systematic Botany* 20, 252−285; Western Australian Herbarium (1998−) *FloraBase-The Western Australian Flora*. Department of Parks and Wildlife. http://florabase.dec.wa.gov.au/.

Distribution and habitat

Drakaea confluens is endemic to Western Australia where it is found in three disjunct areas – near Boyup Brook, the Stirling Range-Gnowangerup area and near the Porongurup Range. The Boyup Brook populations grow in sandy sites associated with spearwood (*Kunzea glabrescens*), jarrah (*Eucalyptus marginata*), and slender banksia (*Banksia attenuata*). In the Stirling Range the dominant overstorey of jarrah and slender banksia is similar, but the understorey comprises a low shrubland of *Dasypogon bromeliifolius* and *Stirlingia latifolia*. The Porongurup population is in similar habitat to that of the Stirling Range (Hopper and Brown 2007).

Associated species (which vary according to geographic location) include *Melaleuca preissiana*, *M. scabra*, *M. striata*, *Leptospermum erubescens*, *Phlebocarya ciliata*, *Hibbertia subvaginata*, *Acacia extensa*, *Drakaea livida, D. glyptodon*, *Kunzea ericifolia*, *K. recurva*, *Jacksonia furcellata*, *Xanthorrhoea preissii*, *X. platyphylla*, *Calytrix flavescens*, *Petrophile linearis*, *Adenanthos obovatus*, *Lambertia inermis*, *Conospermum floribundum*, *Regelia inops*, *Paracaleana nigrita*, *Persoonia longifolia*, *Allocasuarina fraseriana* and *Gompholobium scabrum*.

Table 2. Summary of population land vesting, purpose and manager

Population number & location	Parks and Wildlife district	Shire	Vesting	Purpose	Manager
1. Stirling Range	Albany	Cranbrook	CCWA	NP	Parks and Wildlife
2. Stirling Range	Albany	Gnowangerup	CCWA	NP	Parks and Wildlife
4. SSW of Darkan	Wellington	West Arthur	Private property		Landowners
5. SSW of Darkan	Wellington	West Arthur	Private property		Landowners
6. SSW of Cordering	Wellington	West Arthur	CCWA	CFF	Parks and Wildlife
7a. N of Lake Ngartiminny	Wellington	West Arthur	CCWA	CP	Parks and Wildlife
7b. NW of Lake Ngartiminny	Wellington	West Arthur	CCWA	CP	Parks and Wildlife
7c. E of Lake Ngartiminny	Wellington	West Arthur	CCWA	CP	Parks and Wildlife
7d. E of Lake Ngartiminny	Wellington	West Arthur	CCWA	CP	Parks and Wildlife
7e. E of Lake Ngartiminny	Wellington	West Arthur	CCWA	CP	Parks and Wildlife
7f. NW of Lake Ngartiminny	Wellington	West Arthur	CCWA	CP	Parks and Wildlife
7g. NW of Lake Ngartiminny	Wellington	West Arthur	CCWA	CP	Parks and Wildlife
8. Stirling Range	Albany	Cranbrook	CCWA	NP	Parks and Wildlife
9. Camel Lake	Albany	Gnowangerup	CCWA	CFF	Parks and Wildlife
10. Stirling Range	Albany	Gnowangerup	CCWA	NP	Parks and Wildlife
11. Porongurup	Albany	Plantagenet	Private property		Landowners
12. Stirling Range	Albany	Gnowangerup	CCWA	NP	Parks and Wildlife
13. Stirling Range	Albany	Cranbrook	CCWA	NP	Parks and Wildlife
14. Stirling Range	Albany	Cranbrook	CCWA	NP	Parks and Wildlife
15. Stirling Range	Albany	Cranbrook	CCWA	NP	Parks and Wildlife
16. Stirling Range	Albany	Cranbrook	CCWA	NP	Parks and Wildlife
17. SE of Collie	Wellington	Collie	CCWA	State forest	Parks and Wildlife

Biology and ecology

Drakaea is a small genus of 10 geophytic orchid species, characterised by their small, spongy, ground-hugging, heart-shaped leaves, thin wiry stems and solitary flowers with hinged insect-like labella. They are commonly known as hammer orchids because of unusual hammer-like shape of the labellum. All species are endemic to the south-west of Western Australia.

Most *Drakaea* species are found in deep sandy soil and favour open areas, along old tracks and around the margins of sand pits.

The genus is well known for its morphological and chemical adaptations. The labellum approximates a female Thynnid wasp in scent and appearance and attracts male wasps. The male wasp attempts to fly

away holding the labellum but because it is hinged the wasp comes into contact with the column picking up or depositing pollen. Pollinator studies undertaken by the Botanic Gardens and Parks Authority (BGPA) showed the orchid uses the same pollinator in the disjunct Stirling Range and Boyup Brook areas. This pollinator is locally common within suitable habitat. Fruit set in *D. confluens* is generally high compared with other sexually deceptive orchids. This information is currently being prepared for publication (Phillips, R. unpublished data\). Preliminary observations of pollinator activity by BGPA suggest hand pollination is required to secure further seed and to improve natural recruitment.

Drakaea have a species-specific association with a mycorrhizal fungus that is purple-violet in colour and particularly slow growing (Brown *et al*. 2008; Hopper and Brown 2007; Stoutamire 1974).
Genetic techniques have shown that the mycorrhizal fungus associated with *Drakaea confluens* is the same as that associated with other more common co-occurring *Drakaea* species.

The flowering time of *Drakaea confluens* is September to early November in the Stirling Range-Gnowangerup and Porongurup Range areas and October to November near Boyup Brook (Hopper and Brown 2007).

Like other *Drakaea* species, *D. confluens* colonises disturbed areas, such as old firebreaks. Once the canopy cover becomes enclosed, the orchid gradually disappears. However, continued disturbance, such as annual grading of firebreaks, is known to kill plants of *Drakaea* species.

It is likely the orchid is killed by fire if burnt during its active growing period (late April to late November), but fires during its dormancy period (December to early April) should not cause any damage to plants. A three year post fire monitoring program was initiated at Subpopulations 7a and f in 2010 to determine if low intensity autumn burns would result in the decline in the population size. Between 2010 and 2012 the number of plants increased marginally from two to five plants in the burnt plots, while in the unburnt plots there was a large increase from 17 to 40. The result for the burnt plots was not significant and further replicates are required (Martin and Fowler 2012). An experimental burn was also undertaken at Population 4 in April 2000 by staff from Parks and Wildlife's South West Region and the private property owner. A 5 x 2m transect was burnt in an area which previously contained seven flowering *Drakaea confluens* plants. The burn aimed to assess the use of fire as a population management tool. Follow-up monitoring in October 2000 revealed the population had declined to only two flowering and three non-flowering plants.

Conservation status

Drakaea confluens is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Critically Endangered (CR) in Western Australia under International Union for Conservation of Nature (IUCN) 1994 criteria C2a due to less than 250 mature individuals being known in the wild, there being a continuing decline in the number of mature individuals and severe fragmentation of populations. The species is listed as EN under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Threats

- **Track and firebreak maintenance** is a threat to populations 1, 9 and 10 and subpopulations 7a–g. Populations that occur on tracks are directly threatened by grading which also encourages weed invasion.
- **Grazing and trampling** by kangaroos, rabbits (mainly Population 11) and feral pigs (Population 6) is a threat to the majority of populations. Grazing by kangaroos, whereby the flowers have been removed, has been evident at populations 4, 5, 6 and 7. Although grazing does not appear to directly kill the plants it reduces the reproductive output of the species. At Population 6, cages have been placed over the plants and seem to be effective in reducing grazing. Feral pig activity is also evident at Population 6. Pigs can damage plants and habitat by digging in search of food.
- **Altered fire regimes**. Fire during late autumn, winter and spring can adversely affect the viability of populations by killing flowering plants and preventing seed set. Fire during the summer when plants are dormant has no detrimental effect. Most orchid species emerge from the soil by mid-April and dehisce their seed by late November. The optimum time for fire is therefore between December and mid April. Fire appears to facilitate weed invasion and when it occurs should be followed up with appropriate weed control.
- **Recreational activities** including vehicle and horse access may impact on populations 6 and 7. Horses also exacerbate the deterioration of the bushland through the spread of weeds and disease, and the trampling of vegetation.
- **Poor recruitment and declining population size**. Since the previous plan was written in 2001 the number of mature plants has decreased from 212 to 94 (56% decrease), increasing the risk of distinction and reducing genetic resilience
- **Dieback disease** caused by *Phytophthora cinnamomi* is a potential threat to most populations. Although it is thought the species is not directly susceptible the habitat is highly susceptible and deaths of associated plants due to dieback may result in a change in the vegetation structure. Species that are resistant to dieback (i.e. sedges) may increase in number resulting in greater density. However, observations in the Stirling Range, suggest that that the pathogen reduces canopy cover in the upper and lower strata, thus providing suitable habitat for *Drakaea confluens*. Hammer orchids usually grow in open sandy patches between shrubs and cannot survive under a thick canopy. Within the SRNP, *Phytopthora* dieback is present at Populations 1 and 2 (linear infestations adjacent to road) while Population 15 is heavily infested. *Phytopthora* dieback is also present at Population 11 (Porongurup).

The intent of this plan is to provide actions that will mitigate immediate threats to *Drakaea confluens*. Although climate change and drought may have a long-term effect on the species, actions taken directly to prevent their impact are beyond the scope of this plan.

Table 3. Summary of population information and threats

Population number & location	Land status	Year/no. mature plants	Condition		Threats
			Plants	Habitat	
1. Stirling Range	NP	1983 2 2007 2 2012 0		Degraded	Firebreak maintenance, fire
2. Stirling Range	NP	1983 1 1999 0 2012 0		Good	Fire
4. SSW of Darkan	Private property	1983 100+ 1999 81 (15)	Healthy		Grazing, fire

		2000 2 (3) 2007 5			
5. SSW of Darkan	Private property	1998 34 2001 30 2007 6	Healthy		Grazing, fire
6. SSW of Cordering	NR	1998 11 2001 4 2006 5 [3 dead] 2007 11 (8) 2010 6 [4 dead] 2012 7	Healthy	Excellent	Disease, fire, grazing (kangaroos), feral pig activity
7a. N of Lake Ngartiminny	CP	1992 1 2007 3 2009 16 2010 5 (13) 2012 16 (53)	Healthy	Excellent	Disease, fire, grazing, recreational impacts (vehicles, horses), track maintenance
7b. NW of Lake Ngartiminny	CP	1999 53 2008 0 2012 0		Excellent	Fire, grazing, recreational impacts (vehicles, horses), track maintenance
7c. E of Lake Ngartiminny	CP	1999 2 2009 0 2012 0		Excellent	Fire, grazing, recreational impacts (vehicles, horses), track maintenance
7d. E of Lake Ngartiminny	CP	2007 5 2009 1 2012 3 (2)	Healthy	Excellent	Fire, grazing, recreational impacts (vehicles, horses), track maintenance
7e. E of Lake Ngartiminny	CP	2007 2 2009 0 2012 0		Excellent	Fire, grazing, recreational impacts (vehicles, horses), track maintenance
7f. NW of Lake Ngartiminny	CP	2007 33 (9) 2009 4 2012 3 (21)	Healthy	Excellent	Fire, grazing, recreational impacts (vehicles, horses), track maintenance
7g. NW of Lake Ngartiminny	CP	2009 2 2012 2	Healthy	Excellent	Fire, grazing
8. Stirling Range	NP	1983 2 2001 12 2007 15 2012 19 (9)	Healthy	Excellent	Fire
9. Camel Lake	NR	1999 1 2003 8 2007 1 2012 0		Very good	Firebreak maintenance, fire
10. Stirling Range	NP	2000 6 2007 8 (3) [1 dead] 2008 2009 12 (8) 2012 16 (1)	Healthy	Very good	Firebreak maintenance, grazing (kangaroos), fire
11. Porongurup	Private property	2000 1 2001 1 2012 0		Good	Inappropriate fire, grazing (rabbits, kangaroos)
12. Stirling Range	NP	2001 1 2007 1? 2012 1 (1)	Moderate	Good	Grazing, fire
13. Stirling Range	NP	2004 1	Healthy		Fire
14. Stirling Range	NP	2012 2		Excellent	Fire
15. Stirling Range	NP	2012 8	Healthy	Very good	Fire
16. Stirling Range	NP	2012 2	Healthy	Excellent	Fire
17. SE of Collie	State forest	2012 3 (3)	Healthy	Very good	Fire

Note: Populations in **bold text** are considered to be important populations; Numbers in brackets refers to vegetative plants; Population 3 has been confirmed as *Drakaea isolata*.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions for development and/or land clearing in the immediate vicinity of *Drakaea confluens* may require assessment.

Actions that result in any of the following may impact on the species:

- Damage or destruction of occupied or potential habitat;
- Changed fire regimes;
- Reduction of pollinator habitat;
- Alteration of the local surface hydrology; and
- A reduction in population size.

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

Drakaea confluens is ranked as CR in Western Australia and it is considered that all known habitat for wild populations is critical to the survival of the species and that wild populations are important populations. Habitat critical to the survival of *D. confluens* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Drakaea confluens* will also improve the status of associated native vegetation. Two Declared Rare Flora (DRF) and nine priority flora taxa occur within 500m of the species (see Table 4).

Table 4. Conservation-listed flora species occurring within 500m of *Drakaea confluens*

Species name	Conservation status (WA)	Conservation status (EPBC Act)
Tribonanthes purpurea	DRF (VU)	VU
Verticordia carinata	DRF (VU)	VU
Calothamnus microcarpus	Priority 2	
Melaleuca ordinifolia	Priority 2	
Verticordia brevifolia subsp. *stirlingensis*	Priority 2	
Xanthoparmelia louisii (lichen)	Priority 2	
Hakea lasiocarpha	Priority 3	
Laxmannia grandiflora subsp. *stirlingensis*	Priority 3	
Eucalyptus erectifolia	Priority 4	
Pleurophascum occidentale (moss)	Priority 4	
Tecticornia uniflora	Priority 4	

For a description of conservation codes for Western Australian flora see http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions_18092013.pdf

One threatened fauna species, Carnaby's Cockatoo (*Calyptorhynchus latirostris*) which is listed as EN also occurs within the range of populations, will benefit from management of *Drakaea confluens*.

Population 8 of *Drakaea confluens* occurs within the buffer of a Priority Ecological Community (PEC) 'Montane mallee thicket community of the Stirling Range' (Priority 1); and Population 11 within 500m of the buffer of the PEC 'Wet ironstone heath community (Albany District)' (Priority 1). For a description of PEC categories see DEC (2010).

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. The species is listed under Appendix II in the United Nations Environment Program World Conservation Monitoring Centre Convention on International Trade in Endangered Species, however this plan does not affect Australia's obligations under any other international agreements.

Aboriginal consultation

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Sites Register revealed two sites (#20434, Blackwood River; #18681, Lake Ngartiminny) of Aboriginal significance adjacent to populations 6 and 7 of *Drakaea confluens*. The species also occurs within the Stirling Range National Park which is known to be a culturally significant site. Aboriginal opportunity for future involvement in the implementation of the plan is included as an action in the plan. Indigenous involvement in management of land covered by an agreement under the *Conservation and Land Management Act 1984* is also provided for under the joint management arrangements in that Act, and will apply if an agreement is established over any reserved lands on which this species occurs.

Social and economic impacts

The implementation may potentially have some social and economic impact for private property owners (populations 4 and 5) due to the loss of land available for development and the cost of implementing recovery actions (maintaining fencing).

Affected interests

The implementation of this plan has some implications for private property owners.

Evaluation of the plan's performance

Parks and Wildlife, with assistance from the Albany District Threatened Flora and Communities Recovery Team (ADTFCRT) and South West Region Threatened Flora Recovery Team (SWRTFRT), will evaluate the performance of this plan. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

2. Recovery objective and criteria

Plan objective

The objective of this plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term conservation of the species in the wild.

Recovery criteria

Criteria for recovery success:
- The number of extant populations has increased from 16 to 17 or more over the term of the plan and/or
- The number of mature individuals has increased by 20% or more over the term of the plan from 94 to 113 or more.

Criteria for recovery failure:
- The number of populations has decreased from 16 to 15 or less over the term of the plan and/or
- The number of mature individuals has decreased by 20% or more over the term of the plan from 94 to 75 or less.

3. Recovery actions

Existing recovery actions

All relevant land managers have been made aware of this species and its locations. These notifications detail the current status of the species as Declared Rare Flora (DRF) and the associated legal obligations in regards to their protection.

DRF markers have been installed at Populations 1, 9, 10 and 16. These alert people working in the vicinity to the presence of DRF and the need to avoid work that may damage the species or its habitat. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed to relevant Shires and other organisations.

Cages were placed over plants at Population 6 by Parks and Wildlife in 2006 to prevent grazing by herbivores such as kangaroos.

The dieback front at Population 11 has been pegged to monitor its spread. Banksias along the front have been injected with phosphite. No populations have received aerial phosphite application.

The species has been extensively surveyed for by Parks and Wildlife's Albany and Wellington Districts and the Western Australian Native Orchid Study and Conservation Group (WANOSCG) in areas of suitable habitat with new populations being discovered. As the species is cryptic and flowers over a very short period and, as considerable areas of suitable habitat exist within the SRNP in particular, there is significant potential for further populations to be found.

Populations 4 and 5, which are on private property, have been fenced to exclude stock.

Rabbit baiting was carried out in Twin Creeks Nature Reserve (Population 11) in 2006 and 2007. Control of kangaroos to reduce grazing at Populations 4 and 5 has been implemented by the landowner.

Population 7 is in Muja Conservation Park which was formally established on 8/12/2004. IMGs for the park have not yet been written.

An experimental burn was undertaken at Population 4 in April 2000 by staff from Parks and Wildlife's South West Region and the private property owner. A 5 x 2m transect was burnt in an area which previously contained seven *Drakaea confluens* plants. A nearby equivalent area with four *D. confluens* plants was left unburnt as a control. The burn aimed to assess the use of fire as a population management tool. The site is being monitored to see if plants of *D. confluens* appear and to assess its effect on associated plant species. Follow-up monitoring in October 2000 revealed the population had declined to only two flowering and three non-flowering plants.

Approximately 0.2mls of seed collected by the Botanic Gardens and Parks Authority (BGPA) is to be used for PhD research in cross-specificity experiments. Seed was also collected for the Millenium Seed Bank project in 2001. Two isolates of the mycorrhizal endophyte associated with the species have also been cultured.

Fire management for conservation is included as a specific strategy (#23) in the Stirling Range and Porongurup National Park Management Plan (Herford *et al*. 1999). A fire management strategy for the Stirling Range National Park was written in 2010 (Barrett *et al*. 2010) and recommends appropriate fire regimes for each fire management 'cell' and provides improved strategic direction for the use of planned fire within the Stirling Range National Park. Fire management is also included in the draft Twin Creeks Management Plan (2005). Wellington District fire response strategies exist for Muja CP (Population 7), Haddleton Nature Reserve (Population 6) and private property Populations 4 and 5.

Several articles about the species have appeared in newspapers including "Land Taken Back for the Future" in The Weekender newspaper on October 9, 2003; "Under threat" by Sarah Barrett in the Extra, October 6, 2001. Several presentations have also been conducted and information on the species has been included in the WATSNU Newsletter, Wildflowers of the Stirling Range Bushbook and The West Australian Newspaper.

An A4 sized poster, that provides a description of the species and information about threats and recovery actions, has been developed for *Drakaea confluens*. It is hoped that the poster will result in the discovery of new populations.

A reply paid postal drop, illustrating *Drakaea confluens* and describing its distinctive features and habitat has been distributed by Parks and Wildlife's Albany District staff to local farmers and other residents in the areas where the orchid is found. Postal drops aim to provide information about threatened species and a contact name and number if new populations are found.

Future recovery actions

Parks and Wildlife is overseeing the implementation of this plan and, with the assistance of the ADTFCRT and SWRTFRT, will include information on progress in annual reports to Parks and Wildlife's Corporate Executive and funding bodies. Where recovery actions are implemented on lands other than those managed by Parks and Wildlife, permission has been or will be sought from the appropriate land managers prior to 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 recovery action if funding is available and other opportunities arise.

1. Coordinate recovery actions

Parks and Wildlife will coordinate recovery actions for *Drakaea confluens* and, with assistance from the ADTFCRT and SWRTFRT, will include information on progress in annual reports to Parks and Wildlife's Corporate Executive and funding bodies.

Action:	Coordinate recovery actions
Responsibility:	Parks and Wildlife (Albany and Wellington Districts), with assistance from the ADTFCRT and SWRTFRT
Cost:	$8,000 per year

2. Monitor populations

Monitoring of grazing, habitat degradation, disease impact (*Phytophthora* sp. and aerial canker), population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity will be undertaken.

Action:	Monitor populations
Responsibility:	Parks and Wildlife (Albany and Wellington Districts), with assistance from the ADTFCRT and SWRTFRT
Cost:	$8,000 per year

3. Protect plants from herbivory

When monitoring ascertains that the threat posed by kangaroos, rabbits and pigs is high, protective measures such as baiting, trapping and protective cages should be considered.

Action:	Protect plants from herbivory
Responsibility:	Parks and Wildlife (Albany and Wellington Districts)
Cost:	$15,000 in years 1, 3 and 5

4. Fence Subpopulation 7f

Subpopulation 7f will be fenced to protect *Drakaea confluens* from 4WD vehicles and horses.

Action:	Fence Subpopulation 7f
Responsibility:	Parks and Wildlife (Wellington District)
Cost:	$5,000 in the first year

5. Implement fire management strategies

Where possible, fire will be prevented from occurring in the habitat of the populations, except where it is being used experimentally as a recovery tool. Fire management strategies developed for the Wellington District including Muja Conservation Park, Haddleton Nature Reserve and private property populations (4 and 5); as well as the Stirling Range National Park Fire Management Strategy (2010), will be implemented and updated where required.

Action:	Implement fire management strategies
Responsibility:	Parks and Wildlife (Albany and Wellington Districts)
Cost:	$6,000 per year

6. Confirm the presence of dieback disease and maintain hygiene

The presence of dieback disease will be confirmed through mapping and collection and testing of suspected soil and plant samples.

Disease hygiene measures are required for all populations. Dieback hygiene (outlined in CALM 2003) will be followed during installation and maintenance of firebreaks and when walking into populations in wet soil conditions. Purpose built signs advising of the dieback risk and high conservation values of the sites will be installed if required.

Action:	Confirm the presence of dieback disease and maintain hygiene
Responsibility:	Parks and Wildlife (Albany and Wellington Districts)
Cost:	$10,000 in years 1, 3 and 5

7. Undertake and monitor translocations

Translocation may be deemed desirable for the conservation of this species. A translocation proposal will be developed and suitable translocation sites that are disease free will be selected. Information on the translocation of threatened plants and animals in the wild is provided in Parks and Wildlife's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM 1995), and the Australian Network for Plant Conservation translocation guidelines (Vallee *et al*. 2004). All translocation proposals require endorsement by Parks and Wildlife's Director of Nature Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action:	Undertake and monitor translocations
Responsibility:	Parks and Wildlife (Science and Conservation Division (SCD), Albany and Wellington Districts), BGPA
Cost:	$42,000 in years 1 and 2; and $26,500 in subsequent years as required

8. Undertake surveys

It is recommended that areas of potential suitable habitat be surveyed for the presence of *Drakaea confluens* during its flowering period. All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and reduce unnecessary duplicate surveys. Where possible, volunteers from the local community, landcare groups, Western Australian Native Orchid Study and Conservation Group (WANOSCG), wildflower societies and naturalists clubs will be encouraged to become involved.

Action:	Undertake surveys
Responsibility:	Parks and Wildlife (Albany and Wellington Districts), with assistance from the ADTFCRT, SWRTFRT and volunteers
Cost:	$10,000 per year

9. Collect and store seed and mycorrhizal material

Preservation of genetic material is essential to guard against extinction of the species if the wild populations are lost. It is recommended that seed of *Drakaea confluens* be collected and stored by the BGPA along with samples of the symbiotic fungus. Collections should aim to sample and preserve the maximum range of genetic diversity possible (which should be determined by an appropriate molecular technique such as genetic fingerprinting if feasible).

Action:	Collect and store seed and mycorrhizal material
Responsibility:	BGPA, Parks and Wildlife (Albany and Wellington Districts)
Cost:	$10,000 per year

10. Obtain biological and ecological information

Knowledge of the biology and ecology of the species will provide a scientific basis for management of *Drakaea confluens* in the wild. To obtain this knowledge research will be conducted on:

1. Seed viability;
2. Conditions necessary for germination;
3. The species response to disturbance such as fire;
4. Longevity of plants, and time taken to reach maturity; and
5. The impact of *Phytophthora* dieback on *Drakaea confluens* population demography.

Action:	Obtain biological and ecological information
Responsibility:	Parks and Wildlife (SCD, Albany and Wellington Districts), BGPA
Cost:	$50,000 in years 1–3

11. Ensure long-term protection of habitat

An excellent relationship currently exists between Parks and Wildlife and the owner of private property habitat containing Populations 4 and 5, who is interested in retaining the bush remnants for conservation of the threatened species and has fenced them. Circumstances could change however if the land changes ownership and, as a protective measure, a conservation covenant or land purchase should be considered.

Action:	Ensure long-term protection of habitat
Responsibility:	Parks and Wildlife (Albany District, SCB)
Cost:	$4,000 per year

12. Liaise with land managers and Aboriginal communities

Staff from Parks and Wildlife's Albany and Wellington Districts will liaise with appropriate land managers to ensure that populations of *Drakaea confluens* are not accidentaly damaged or destroyed, and the habitat is maintained in a suitable condition for the conservation of the species. Aboriginal consultation will take place to determine if there are any issues or interests in areas that are habitat for the species.

Action:	Liaise with land managers and Aboriginal communities
Responsibility:	Parks and Wildlife (Albany and Wellington Districts)
Cost:	$4,000 per year

13. Promote awareness

The importance of biodiversity conservation and the protection of *Drakaea confluens* will be promoted through an information campaign. An information sheet, which includes a description of the plant, its habitat type, threats, management actions and photos has been produced but may need updating. Formal links with local naturalist groups and interested individuals will be encouraged.

Action:	Promote awareness
Responsibility:	Parks and Wildlife (Albany and Wellington Districts, SCB, Public Information and Corporate Affairs (PICA)), with assistance from the ADTFCRT and SWRTFRT
Cost:	$7,000 in years 1–2; $5,000 in years 3–5

14. Incorporate recovery actions into the Interim Management Guidelines for the Muja Conservation Park

Recovery actions for *Drakaea confluens* will need to be addressed in the Interim Management Guidelines for the Muja Conservation Park (subpopulations 7a–g).

Action:	Incorporate recovery actions into the IMGs for the Muja CP
Responsibility:	Parks and Wildlife (South West Region)
Cost:	$4,000 in year 2

15. Map habitat critical to the survival of *Drakaea confluens*

Although habitat critical to the survival of the *Drakaea confluens* is alluded to in Section 1, it has not yet been mapped and will be addressed under this action. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action:	Map habitat critical to the survival of *Drakaea confluens*
Responsibility:	Parks and Wildlife (SCB, Albany and Wellington Districts)
Cost:	$6,000 in year 2

16. Review this plan and assess the need for further recovery actions

If *Drakaea confluens* is still ranked as CR at the end of the five-year term of this plan, the need for further recovery actions, or a review of this plan will be assessed and a revised plan prepared if necessary.

Action:	Review this plan and assess the need for further recovery actions
Responsibility:	Parks and Wildlife (SCB, Albany and Wellington Districts)
Cost:	$6,000 in year 5

Table 5. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	Parks and Wildlife (Albany and Wellington Districts), with assistance from the ADTFCRT and SWRTFRT	Ongoing
Monitor populations	High	Parks and Wildlife (Albany and Wellington Districts), with assistance from the ADTFCRT and SWRTFRT	Ongoing
Protect plants from herbivory	High	Parks and Wildlife (Albany and Wellington Districts)	Ongoing
Fence Subpopulation 7f	High	Parks and Wildlife (Wellington District)	2018
Implement fire management strategies	High	Parks and Wildlife (Albany and Wellington Districts)	Ongoing
Confirm the presence of dieback disease and maintain disease hygiene	High	Parks and Wildlife (Albany and Wellington Districts)	Ongoing
Undertake and monitor translocations	High	Parks and Wildlife (SCD, Albany and Wellington Districts), BGPA	2018
Undertake surveys	High	Parks and Wildlife (Albany and Wellington Districts), with assistance from the ADTFCRT, SWRTFRT and volunteers	Ongoing
Collect and store seed	High	Parks and Wildlife (Albany and Wellington Districts), BGPA	2018
Obtain biological and ecological information	High	Parks and Wildlife (SCD, Albany and Wellington Districts), BGPA	2016
Ensure long-term protection of habitat	High	Parks and Wildlife (Albany District, SCB)	2018
Liaise with land managers and Aboriginal communities	Medium	Parks and Wildlife (Albany and Wellington Districts)	Ongoing
Promote awareness	Medium	Parks and Wildlife (Albany and Wellington Districts, SCB, PICA), with assistance from the ADTFCRT and SWRTFRT	2018
Incorporate recovery actions into the IMGs for the Muja Conservation Park	Medium	Parks and Wildlife (South West Region)	2015
Map habitat critical to the survival of *Drakaea confluens*	Medium	Parks and Wildlife (SCB, Albany and Wellington Districts)	2015
Review this plan and assess the need for further recovery actions	Medium	Parks and Wildlife (SCB, Albany and Wellington Districts)	2018

4. Term of plan

This plan will operate from June 2014 to May 2019 but will remain in force until withdrawn or replaced. If the species is still ranked CR after five years, the need for further recovery actions will be determined.

5. References

Barrett, S., Comer, S., Freebury, G., Grant, M., Broomhall, G. and Hilder, V. (2010) Fire Management Strategy for the Stirling Range National Park. Department of Environment and Conservation, for the Stirling Range Fire Working Group.

Brown, A., Dundas, P., Dixon, K. and Hopper, S. (2008) *Orchids of Western Australia*. University of Western Australia Press, Crawley, Western Australia.

Brown, A., Thompson-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 (1992) Policy Statement No. 44 *Wildlife Management Programs*. 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 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 (1999) *Phytophthora cinnamomi* and disease caused by it Volume III – Phosphite Operations Guidelines. Perth, 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, Perth, Western Australia.

Department of Environment and Conservation (2010) *Definitions, categories and criteria for Threatened and Priority Ecological Communities*. Department of Environment and Conservation, Western Australia. http://www.dec.wa.gov.au/management-and-protection/threatened-species/wa-s-threatened-ecological-communities.html.

Fairs, A. (2008) Review of approved Western Australian Recovery Plans adopted as National Recovery Plans under the EPBC Act. NHT Project ID 61821.

Government of Australia (1999) Environment Protection and Biodiversity Conservation Act.

Herford, I., Gillen, K., Lloyd, M., Hine, C., McCaw, L., Keighery, G. J. and Allan, J. (1999) Stirling Range National Park and Porongurup National Park Management Plan, 1999-2009. Management Plan No. 42. Department of Conservation and Land Management, Western Australia.

Hoffman, N. and Brown, A. (1998) *Orchids of South-west Australia*. Revised 2nd edition with supplement. University of Western Australia Press, Nedlands.

Hopper, S.D. and Brown, A.P. (2007) A revision of Australia's hammer orchids (*Drakaea*: Orchidaceae), with some field data on species-specific sexually deceived wasp pollinators. *Australian Systematic Botany* 20, 252–285.

International Union for Conservation of Nature (2001) *IUCN Red List Categories: Version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

Martin, S. and Fowler, T. (2012) *Drakaea confluens* Prescribed Fire Response Monitoring. Department of Environment and Conservation, Collie.

Phillimore, R. and Brown, A. (2001) Late Hammer Orchid *Drakaea confluens* ms Interim Recovery Plan No 80, 2001–2003. Department of Conservation and Land Management, Perth.

Vallee, L., Hogbin T., Monks L., Makinson B., Matthes M. And Rossetto M. (2004) Guidelines for the Translocation of Threatened Australian Plants. Second Edition. *The Australian Network for Plant Conservation*. Canberra, Australia.

Western Australian Herbarium (1998–) *FloraBase–The Western Australian Flora*. Department of Parks

and Wildlife. http://florabase.dec.wa.gov.au/.

6. Taxonomic description

***Drakaea confluens* Hopper & A.P.Br.**

Hopper, S.D. and Brown, A.P. (2007) A revision of Australia's hammer orchids (*Drakaea*: Orchidaceae), with some field data on species-specific sexually deceived wasp pollinators. *Australian Systematic Botany* 20, 252–285.

Leaf fully developed at anthesis, minutely papillate; lamina dull, blue-grey with darker green longitudinal radiating lines and transverse veins above, to 20mm wide. Scape 15–30cm tall; pedicels 10–12mm long. Dorsal sepal 9–11mm long. Lateral sepals 9–11mm long. Petals 9–11mm long. Labellum claw distal section beyond hinge slightly descending below line with proximal section, without prominent dark spots; labellum lamina 10–11mm long, articulated at *c*. 90° to distal arm of claw; head-like apex one-third of lamina length, prominently hirsute for 0.9x its length, with paired lateral dark maroon callosities at base; main labellum body two-coloured, proximal half greenish-yellow with maroon spots and irregular markings, apex straight or slightly upturned, glabrous. Column 7–8mm long; wings 1mm wide. Anther terminating in a definite mucronate point.