

INTERIM RECOVERY PLAN NO. 316

CARBUNUP KING SPIDER ORCHID

(*CALADENIA PROCERA*)

RECOVERY PLAN



September 2011
Department of Environment and Conservation
Kensington



Australian Government



**GOVERNMENT OF
WESTERN AUSTRALIA**



**Department of
Environment and
Conservation**

Our environment, our future

FOREWORD

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

These 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.

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

This plan results from a review of and replaces IRP No.175 Carburnup King Spider Orchid (*Caladenia procera*), 2004-2009, prepared by Gillian Stack and Val English.

This plan will operate from September 2011 to August 2016 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked as Critically Endangered (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 22 August 2011 and was approved by the Director of Nature Conservation on 15 September 2011. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

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

Information in this plan was accurate at September 2011.

PLAN PREPARATION

This revised plan was prepared by Nick Casson¹.

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ACKNOWLEDGMENTS

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

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Ben Lullfitz	Conservation Officer (Flora), DEC Busselton
Andrew Webb	Botanist, DEC Bunbury
Aminya Ennis	Regional Planning Officer, DEC Bunbury

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information.

Cover photograph by Andrew Brown.

CITATION

This plan should be cited as: Department of Environment and Conservation (2011) *Caladenia procera* Interim Recovery Plan 2011-2016. Interim Recovery Plan No. 316. Department of Environment and Conservation, Western Australia.

SUMMARY

Scientific Name:	<i>Caladenia procera</i>	Common Name:	Carbunup King Spider Orchid
Family:	Orchidaceae	Flowering Period:	September – October
DEC Regions:	South West	DEC District:	Blackwood
Shires:	Busselton	NRM Region:	Southwest
Recovery Teams:	South West Region Threatened Flora Recovery Team	IBRA Region:	Swan Coastal Plain

Analysis of outputs and effectiveness of Interim Recovery Plan (IRP) 175 Carbunup King Spider Orchid (*Caladenia procera*) 2004-2009, prepared by Gillian Stack and Val English

The criteria for success in the previous plan have been met (the number of individuals has increased and/or the number of populations have increased).

The number of known mature individuals increased from 220 in 2003 to approximately 535 in 2010 and the number of known natural populations increased from 4 to 6 during the same period. An informal translocation established a 7th population of 17 plants. Higher plant numbers are mainly due to more intensive surveys undertaken at Populations 2 and 4.

All actions included in the previous plan are ongoing and are included in this revised plan. Notable achievements include:

- Action 2: Partial reservation of habitat has occurred at Population 4 protecting extant plants and providing an area for a salvage translocation.
- Action 3: Two new populations were located during surveys, together containing 10 mature plants.
- Action 5: An unofficial translocation of 35 plants was undertaken into Ambergate Reserve (17 were still extant 4 years later).

New recovery actions included in this plan are:

- Action 2: Define & map habitat critical to the survival of *Caladenia procera*.
- Action 6: Deter access.
- Action 7: Undertake grazing control.
- Action 13: Undertake germination field trials.
- Action 14: Install DRF markers.
- Action 18: Re-evaluate and update ranking criteria

Illustrations and/or further information: Hopper, S.D. and Brown, A.P. (2001) Contributions to Western Australian Orchidology: 2. New taxa and circumscriptions in *Caladenia* (Spider, Fairy and Dragon orchids of Western Australia). *Nuytsia* 14(1/2), 27-308.

Current status: *Caladenia procera* was declared to be Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in April 2002 and is currently ranked as Critically Endangered (CR) in WA under International Union for Conservation of Nature (IUCN 2001) Red List criteria B1ab(iii)+2ab(iii); C1 as the extent of occurrence is estimated to be less than 100 km² and the area of occupancy less than 10 km², with populations severely fragmented, a continuing decline in area of occupancy, extent and quality of habitat, a population size of less than 250 mature individuals and an estimated continuing decline of at least 25% in one generation. Criterion C1 may have to be reviewed as there are now about 535 mature plants known. The species is listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as Critically Endangered. The main threats are: clearing for development, road, firebreak and power utility maintenance, weed invasion, inappropriate fire regimes and grazing.

Description: *Caladenia procera* is a perennial herb that dies back to a dormant tuber over the dry summer months. It occurs as solitary plants or in small clumps, grows to 70 cm tall, and has a single pale green leaf that is 10-30 cm long and 6-10 mm wide. The flowers are c. 5-9 cm across and appear in groups of 1-4 on a scape 35-70 cm tall. The stiffly-held petals and sepals of the flowers are greenish lemon yellow with lines and spots of dull maroon to pink. The labellum is also greenish yellow with pale pink to fawn radiating stripes, ending in a dark maroon recurved tip (Hopper and Brown 2001).

Habitat requirements and Distribution: *Caladenia procera* is currently known from a linear range of less than 15 km to the south-west of Busselton, where it grows in Jarrah, Marri and Peppermint woodland on alluvial sandy-clay loam flats with *Anigozanthos manglesii* (Hopper and Brown 2001), and also from a disjunct occurrence some 70 km north near Kemerton.

Habitat critical to the survival of the species and important populations: *Caladenia procera* is ranked as Critically Endangered in WA and, as such, it is considered that all known habitat that holds wild populations is critical to the survival of the species and that all populations, including those based on translocation, are important populations.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of the habitat of the species will be of benefit to several other threatened species and a threatened ecological community.

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 plan does not affect Australia's obligations under any other international agreements.

Indigenous Consultation: A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register did not reveal any sites of Aboriginal significance within or adjacent to populations of *Caladenia procera*. However, input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs to determine if there are any issues or interests. Indigenous opportunity for future involvement in the implementation of the recovery plan is included as an action in this plan.

Social and economic impact: The implementation of this plan may cause some economic impact. There are development proposals for private land that contains populations of *Caladenia procera*. Other populations occur on Shire managed reserves. Recovery actions refer to continued negotiations between stakeholders with regard to these areas.

Affected interests: The protection of the species will have implications for private landholders and Shire operations.

Evaluation of the Plan's Performance: The DEC in conjunction with the South West Region Threatened Flora Recovery Team 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 within five years of implementation.

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. All relevant land managers have been made aware of the existence of this species and its locations.
2. Declared Rare Flora (DRF) markers have been installed.
3. Plants found in a proposed subdivision have been moved into a reserved area.
4. Negotiations are underway to reserve an area containing Population 2.
5. Botanic Gardens and Parks Authority (BGPA) staff collected seed from one population and have isolated endophytic material (the soil fungus associated with the orchid). Seed and fungus are stored at the BGPA.
6. Monitoring has been carried out opportunistically during the orchid's flowering season, and plant numbers and current threats recorded. Global Positioning System (GPS) locations of all populations have been recorded in Blackwood District's Geographic Information System database.
7. Populations 5 & 6 were discovered during surveys.
8. Reserve management plans that incorporate fire impact have been developed in liaison with the shire.
9. The South West Region Threatened Flora Recovery Team (SWRTFRT) is overseeing the implementation of this plan and will include information on progress in its annual report to DEC's Corporate Executive and funding bodies.

Plan Objective: The objective of this 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 populations has increased and/or the number of mature individuals has increased by ten percent or more over the five year term of the plan.

Criteria for failure: The number of populations has decreased and/or the number of mature individuals has decreased by ten percent or more over the five year term of the plan.

Recovery actions

- | | |
|--|---|
| 1. Coordinate recovery actions | 11. Rehabilitate habitat |
| 2. Define and map habitat critical to the survival of <i>Caladenia procera</i> | 12. Develop and implement a translocation proposal |
| 3. Undertake surveys | 13. Install DRF markers |
| 4. Obtain biological and ecological information | 14. Undertake weed control |
| 5. Ensure long-term protection of habitat | 15. Develop and implement a fire management strategy |
| 6. Deter access | 16. Notify the land manager of the location of this species |

7. Control grazing
8. Collect seed and fungal material
9. Monitor populations
10. Undertake liaison with land managers
17. Promote awareness
18. Re-assess and update ranking criteria
19. Review this plan and prepare a revised plan if necessary

1. BACKGROUND

Analysis of outputs and effectiveness of Interim Recovery Plan (IRP) 175 (2004-2009) prepared by Gillian Stack & Val English

The criteria for success in the previous plan were met (the number of individuals has increased and/or the number of populations have increased).

The number of known mature individuals increased from 220 in 2003 to 535 in 2010 and the number of known natural populations increased from 4 to 6 during the same period. An unofficial translocation has established a 7th population of 17 plants.

All actions included in the previous plan are ongoing and are included in this revised plan. Notable achievements against ongoing actions include:

- Action 2: Partial reservation of habitat has occurred at Population 4 protecting extant plants and providing an area for a salvage translocation.
- Action 3: Two new natural populations were located during surveys, together containing 10 mature plants.
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New recovery actions included in this plan are:

- Action 2: Define & map habitat critical to the survival of *Caladenia procera*.
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History

Edith Coleman made the first collection of *Caladenia procera* from the Busselton area in 1929. For many years it was considered to be a form of *Caladenia pectinata* but was formally described as a species in 2001 (Hopper and Brown 2001). It is mostly found near Busselton in an area that has been extensively cleared for agriculture. A significant proportion of its remaining habitat is now threatened by development.

Six natural populations are currently known and comprise a total of 535 mature plants.

About 32 *Caladenia procera* plants dug up from Population 4 prior to clearing for development were delivered to BGPA in late spring 2004. Between 2005 and 2008 the plants were cross pollinated and produced about 80 capsules containing numerous seeds which were harvested and placed in storage. Many seedlings also appeared in the pots as seed capsules dehisced. The seedlings established well and by February 2007 there were 94 plants in 33 pots (N. Swarts pers. comm.).

Description

Caladenia procera is a perennial herb that dies back to a dormant tuber over the dry summer months. It occurs as solitary plants or in small clumps, grows to 70 cm tall, and has a single pale green leaf that is 10-30 cm long and 6-10 mm wide. The flowers are c. 5-9 cm across and appear in groups of 1-4 on a scape 35-70 cm tall. The stiffly-held petals and sepals of the flowers are greenish lemon yellow with lines and spots of dull maroon to pink. The labellum is also greenish yellow with pale pink to fawn radiating stripes, ending in a dark maroon recurved tip (Hopper and Brown 2001).

Caladenia procera is closely related to *C. pectinata* and *C. decora*, differing from both in its consistently greenish yellow sepals, petals and basal labellum lamina, and its somewhat taller scapes. *C. procera* also differs from *C. decora* in its consistently ascending petals lacking an osmophore (a scent producing gland), and its

broader more acute column wings. It has a taller broader column and somewhat longer labellum than *C. pectinata*. *C. procera* occasionally hybridizes with *C. attingens* (Hopper and Brown 2001).

Distribution and habitat

Caladenia procera is known mainly from a linear range of less than 15 km to the south-west of Busselton, where it grows in Jarrah, Marri and Peppermint woodland on alluvial sandy-clay loam flats with *Anigozanthos manglesii* (Hopper and Brown 2001). It also has a disjunct occurrence some 70 km north near Kemerton, where a single plant has been found.

Table 1. Summary of population land vesting, purpose and manager

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1a. Carbunup	Blackwood	Busselton	MRD	Road reserve	MRD
1b. Carbunup	Blackwood	Busselton	Shire	Parkland	Shire
1c. Carbunup	Blackwood	Busselton	Shire	Road reserve	Shire
1d. Carbunup	Blackwood	Busselton	SPC	UCL	SPC
1e. Carbunup	Blackwood	Busselton	SPC	UCL	SPC
2a. Busselton	Blackwood	Busselton	Freehold	Golf Course	Landholder
2b. Busselton	Blackwood	Busselton	Shire	Road reserve	Shire
2c. Busselton	Blackwood	Busselton	Shire	Recreation	Shire
3a. Busselton	Blackwood	Busselton	Shire	Road reserve	Shire
3b. Busselton	Blackwood	Busselton	Freehold		Landholder
4. Busselton	Blackwood	Busselton	Freehold		Landholder
5. Kemerton	Wellington	Harvey	Freehold		Landholder
6. Busselton	Blackwood	Busselton	Freehold	Private School	Landholder
7. Ambergate Reserve (Unauth. Translocation)	Blackwood	Busselton	Shire	Parkland	Shire

Populations in **bold text** are considered to be important populations; MRD – Main Roads Department; UCL – Unallocated Crown Land; SPC – State Planning Commission.

Biology and ecology

Caladenia procera actively grows between late April and October after which it dies back to a dormant tuber. Early in the growing season a new shoot arises from the tuber and, later, a single leaf appears above ground. As the species has no roots, the infection point for an associated mycorrhizal fungus is in the collar area just below the leaf. During winter the replacement tuber, which is essential for the plant's long-term survival, is formed and continues to develop until late in the growing season. Not all plants in the population will produce flowers in any one year. Generally, for every flowering plant many more vegetative plants will be present. The proportion of flowering to non-flowering individuals is influenced by environmental conditions including the presence or absence of summer fire and the amount of rainfall received during winter and spring (A. Brown pers. comm.; Dixon & Hopper 2009).

Caladenia procera is pollinated by male Thynnid wasps, however, observations suggest that only a small fraction of plants are pollinated in any one year (DSE 2009). These wasps require largely intact natural habitat as they use a range of plant species for food (A. Brown pers. comm.). Thynnid wasps are believed to be particularly sensitive to environmental change (Tscharntke & Brandl, 2004), resulting in the wasps and the orchids they pollinate being at risk in the longer term if habitat is fragmented and in poor condition.

Mature plants produce a bud early in the growing season which continues to develop until flowering in the spring. Plants flower for approximately two weeks or until pollination occurs, after which flowers collapse and, if pollination was successful, a seed capsule develops. The capsule swells as seed matures, and can take from six to eight weeks to develop depending on climatic conditions. If temperatures are higher than average seeds may mature faster. Prior to seeds being released the capsule turns yellow and then brown. Small slits develop in the capsule from which the seed is dispersed.

Seeds will remain dormant in the soil over summer until the break of the season the following year. Seed is short-lived and does not survive a second summer. Once wet, the seeds imbibe water and the seed coat splits. At this point infection by a suitable fungus is required for germination to occur. Once they germinate, plants that fail to produce a tuber will not survive the following summer (Batty et. al. 2000).

Orchid seedlings are very small for the first growing season and are difficult to locate. Leaves are typically less than 20 mm long and only a few mm wide. It appears that leaf and tuber size increase over the next 4 to 5 years until they develop into adult plants capable of flowering. This means a generation length is about 6 years; while data on the closely related *C. huegelii* indicates plants can live up to 19 years or more (A. Brown pers. comm.).

Threats

Caladenia procera was declared to be Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in April 2002. and is currently ranked as Critically Endangered (CR) in WA under International Union for Conservation of Nature (IUCN 2001) Red List criteria B1ab(iii)+2ab(iii); C1 as the extent of occurrence is estimated to be less than 100 km² and the area of occupancy less than 10 km², with populations severely fragmented, a continuing decline in area of occupancy, extent and quality of habitat, a population size of less than 250 mature individuals and an estimated continuing decline of at least 25% in one generation. Criterion C1 may no longer apply as there are now about 535 mature plants known. The species is listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as Critically Endangered. The main threats are: clearing for development, road, firebreak and power utility maintenance, weed invasion, inappropriate fire regimes and grazing.

Land clearing for development has or is likely to affect Populations 2, 4 and 5, and Subpopulation 3b. Population 2 and Subpopulation 3b are subject to urban development applications (A. Ennis & J. Carter pers. comm.). Population 4, which at one time held nearly half the known plants, has been most impacted by development. At this site only one third of the original habitat remains within an excised reserve.

Habitat fragmentation: The habitat in which the species occurs has been subject to extensive clearing for agriculture and, more recently, residential sub-division. In plants, the effects of fragmentation can depend on various factors relating to the demography and reproductive biology of a species (breeding system, degree of pollination specialisation, pollinator abundance, seed dispersal and germination and seedling establishment and survival (Hobbs and Yates 2003)). Studies of the effects of fragmentation on *Caladenia rigida* in South Australia found that the smallest populations (<100 plants) failed to reproduce during stressful environmental conditions, and indicated that reduced population size may also have contributed to poor seed quality in some populations (Faast 2009; Faast et al 2011). Given the potential longevity of some orchids, consequent declines in such populations are likely to remain undetected for some time; this places the emphasis on protecting species, and their habitats, long before signs of degradation and decline become obvious.

Road and firebreak, and utility maintenance threatens all road reserve populations and most populations on private property. General threats include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Populations 1 and 5 also have power utilities passing through them. Population 2 is adjacent to a pipeline. A water main is proposed for an area adjacent to Population 3. Population 4 is affected by drainage, pipelines, fences and firebreaks. Several of these actions also encourage weed invasion.

Weed invasion is a minor threat at most populations. Weeds suppress early plant growth by competing with the orchids and their associated vegetation 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. Weeds appear to be the most pressing threat at Population 6, Subpopulations 2a, 2b, and then Subpopulations 3a & 3b.

Inappropriate fire regimes may affect the viability of populations. Fire that occurs when the orchid has above-ground growth will prevent seed set, and possibly kill the plant if it happens before a new tuber is formed. Most south-west orchid species emerge from the soil by mid April and dehisce their seed by late October-November. The optimum time for fire in orchid populations is therefore from December to March when the orchids are dormant and climatic conditions are typically hot and dry. In addition to the detrimental effects of inappropriate fire on the species, a proliferation of weeds often follows burning due to a temporary increase in the availability of nutrients (Panetta and Hopkins 1991). The effects of fire on associated mycorrhiza and pollinator populations also need to be considered.

Grazing by rabbits, kangaroos or stock has impacted on all *Caladenia procera* populations. The high level of palatable weeds in and near the populations and adjacent farming properties attract herbivorous animals, which are often non-selective in their grazing. The translocates at Population 7 are heavily grazed.

Recreational impacts are a threat to Subpopulations 1a, 1b, 2a, 2b and Population 4. The habitat of the plants is subject to recreational impacts including trampling by walkers, pets, and BMX riders, and pet faeces may also have a cumulative impact on vegetation.

Unauthorised translocation. Population 7 may be unstable because the number of plants translocated was small and it was not established that this area was suitable habitat for the species.

The intent of this plan is to provide actions that will deal with immediate threats to *Caladenia procera*. Although climate change may have a long-term effect on the species, actions taken directly to prevent the impact of climate change are beyond the scope of this plan.

Table 2. Summary of population information and threats

Pop. No. & Location	Land Status	Year / No. of plants	Current Condition	Current and potential threats
1a. Carbunup	Main Roads Reserve	1986 4 2001 43 2002 61 2003 burnt 2006 39 2008 1	Healthy	Road maintenance, fire, fire break maintenance, recreation , weed invasion, herbicide spraying
1b. Carbunup	Shire Reserve	1999 13 2000 4 2001 43 2002 61 2003 2003 9 2008 186	Healthy	Fire, fire break maintenance, recreation , herbicide spraying
1c. Carbunup	UCL	See 1b		
1d. Carbunup	UCL	See 1b		
1e. Carbunup	UCL	See 1b		
2a. Busselton	Private	2000 6 2000 13 2001 48 2002 79 2006 192 2006 21 2007 125	Healthy	Weed invasion, grazing, recreation, proposed development, firebreak maintenance, fire.
2b. Busselton	Shire Road Reserve	2010 2		Weed invasion, road maintenance.
2c. Busselton.	Shire Recreation Reserve	See 2b		
3a. Busselton	Shire Road Reserve	2000 2 2001 22 2002 25 2003 2007 11	Healthy	Road maintenance, proposed pipeline construction, weed invasion, fire.
3b. Busselton	Freehold	2001 3 2007 2	Healthy	Road maintenance, firebreak maintenance, grazing, proposed development, weed invasion, fire
4. Busselton	Reserve for recreation, drainage & conserva-tion.	2001 100 2002 133 2002 107 2005 2006 253 2006 250 2007 198	Healthy	Weed invasion, recreational impacts, fire.
5. Kemerton	Freehold	2005 1	Healthy	Pipeline and powerline maintenance. clearing for development
6. Busselton	Freehold	2007 9	Healthy	Weed invasion.
7T. Busselton	Shire Reserve	2010 17		Grazing.
Most recent total		535		

T –translocates.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Any on-ground works (i.e. clearing, firebreaks, roadworks) in the immediate vicinity of *Caladenia procera* may have impacts on the species, its habitat or potential habitat and may require assessment.

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

- damage to or destruction of occupied or potential habitat.
- alteration of the surface hydrology.
- a reduction in population size due to poor recruitment, threatening processes and other factors.
- a decrease in the number of pollinators.

This species is protected under the *Environment Protection and Biodiversity Conservation Act 1999* and by the *Western Australian Wildlife Conservation Act 1950*. The above potential impacts will be taken into account when assessing any actions that may take this species or threaten its habitat when assessed under these Acts. Environmental impact assessment under either Part IV or Part V of the *Environmental Protection Act 1986* will also address these impacts as part of the broader assessment provisions available under this Act.

Management practices

DEC will continue to liaise with land managers to ensure that the above actions will not impact upon the species. Where direct action is required, specific management actions will be implemented to address threats.

In addition to the recovery actions outlined in this plan the species is included in the broader Regional Plan “Western Australian Wildlife Management Program 33 - Declared Rare and Poorly Known Flora in the Central Forest Region”.

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

As *Caladenia procera* is listed as Critically Endangered in WA and also listed under the EPBC Act it is considered that all known remaining habitat that held or holds wild populations is habitat critical to the survival of the species, and that all populations, including those based on translocation, are important populations. Habitat that is critical to the survival of *Caladenia procera* comprises:

- the area of occupancy of known populations.
- areas of similar habitat surrounding known populations (these provide potential habitat for population expansion and provide habitat and a food source for pollinators).
- corridors of remnant vegetation that link populations.
- 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).
- the local catchment for the surface and/or groundwater that maintains the habitat of the species.

The orchid’s habitat requirements are likely to exceed the area of known occupancy. Monitoring of Population 4 revealed the orchid was more widely dispersed through the locality than initial survey had shown. This demonstrates the variability of occupation and flowering of plants in any section of suitable habitat over time. The pollinator (a wasp) requires both a nectar source and habitat for its insect-host. The adult wasps and the beetles that host their larvae both require habitat with a range of suitable plants.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of the species, such as weed control and rehabilitation, will be of benefit to other threatened species and a threatened ecological community.

The critically endangered *Caladenia busselliana* and *C. viridescens* occur in the habitat of Population 1.

The habitat at Subpopulation 1b is associated with the Threatened Ecological Community ‘*Eucalyptus calophylla* woodlands on heavy soils of the southern Swan Coastal Plain’. This community is described in Gibson et. al. (1994) and is listed as Vulnerable in Western Australia. The orchid is also associated with a Priority 1 PEC (*Eucalyptus rudis*, *Corymbia calophylla* and *Agonis flexuosa* Closed Low Forest; Webb et.al 2009) at Populations 2, 4 and 6.

Table 3. Conservation-listed flora species or communities occurring within 500m of population 1 of *Caladenia procera*.

Species or community name	Conservation Status – WA	Conservation Status (EPBC Act)
<i>Caladenia busselliana</i>	Declared Rare Flora (CR)	Endangered
<i>Caladenia viridescens</i>	Declared Rare Flora (CR)	Endangered
<i>Eucalyptus calophylla</i> woodlands on heavy soils of the southern Swan Coastal Plain	VU	
<i>Eucalyptus rudis</i> , <i>Corymbia calophylla</i> and <i>Agonis flexuosa</i> Closed Low Forest	Priority 1	

For a description of Priority categories for flora see Smith (2010) and for TECs see English and Blyth (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. The plan does not affect Australia’s obligations under any other international agreements.

Indigenous Consultation

A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register did not reveal any sites of Aboriginal significance within or adjacent to populations of *Caladenia procera*. However, input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs to determine if there are any issues or interests. Indigenous opportunity for future involvement in the implementation of the Recovery plan is included as an action in this plan.

Social and economic impacts

Implementation of this plan may impact development proposals for private land that contains populations of *Caladenia procera*. It may also impact on Shire Road maintenance and other activities in the vicinity of populations situated on Shire managed reserves. Costs associated with managing the populations may include deterring access, weed control and fencing. Recovery actions refer to continued negotiations between stakeholders with regard to these areas.

Affected interests

These include private landholder, developer and Shire operations.

Evaluation of the Plan’s Performance

The DEC in conjunction with the 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 within five years of implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

Objective

The objective of this 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 populations has increased and/or the number of mature individuals has increased by ten percent or more over the five year term of the plan.

Criteria for failure: The number of populations has decreased and/or the number of mature individuals has decreased by ten percent or more over the five year term of the plan.

3. RECOVERY ACTIONS

Existing recovery actions

Most land managers have been notified of the location and threatened status of the species. The notification has details of the Declared Rare status of *Caladenia procera* and the legal responsibility to protect it under the *Wildlife Conservation Act 1950*.

Declared Rare Flora (DRF) markers have been installed at Subpopulations 1a and 1b, and on internal firebreaks within the habitat of Population 2. These markers alert maintenance workers to the presence of the population and help to ensure that the habitat is not accidentally damaged.

Part of the remnant bushland in which Population 4 is found has been fenced and reserved for the conservation of *Caladenia procera*.

Negotiations are being undertaken between DEC and developers to create a reserve capsuling Subpopulation 2a.

An unofficial translocation has taken place in Ambergate Reserve.

Botanic Gardens and Parks Authority (BGPA) staff collected seed from 32 potted plants originating from Population 4.

Some 94 plants grown at the BGPA have been returned to Population 4. The soil fungus associated with the orchid was isolated; and plant tissue culture proved effective. Seed and fungus are stored at the BGPA facility.

Monitoring is carried out opportunistically during the flowering season with plant numbers and current threats recorded. Global Positioning System (GPS) locations of all populations have been recorded in Blackwood District's Geographic Information System database.

Populations 5 & 6 were discovered by consultants and DEC staff following the implementation of the first recovery plan in 2004. Both populations are on private land.

Reserve management plans that incorporate fire management have been developed in liaison with the Shire of Busselton. A coordinated fire response plan has also been developed for the DEC South West Region and incorporated into the Fire Control Working Plan. It includes strategies for fire control at each location of *C. procera*. The information is also being communicated to other fire response organisations.

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

Future recovery actions

Where recovery actions occur on lands other than those managed by DEC, permission has been or will be sought prior to activities being undertaken. The following recovery actions are generally in order of descending priority, influenced by their timing over the life of the plan. However this should not constrain addressing any of the actions if funding is available and other opportunities arise.

1. Coordinate recovery actions

The SWRTFRT will oversee the implementation of the recovery actions for *Caladenia procera* and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action: Coordinate recovery actions

Responsibility: DEC (Blackwood District) through the SWRTFRT
Cost: \$1,000 per year

2. Define and map habitat critical to the survival of *Caladenia procera*

In order to adequately protect this species, habitat critical to its survival needs to be defined and mapped. Such information can provide a guide as to whether the area of existing populations needs to be augmented in some way.

Action: Define and map habitat critical to the survival of *Caladenia procera*
Responsibility: DEC (SCB, Blackwood District) through the SWRTFRT
Cost: \$6,000 in year 2

3. Undertake surveys

It is recommended that areas of potential habitat be surveyed for the presence of *Caladenia procera* during its flowering period between September and October, with specific focus on secure land tenures. It is thought that remnants near Population 3 and in the hinterland of Population 5 may be suitable for further survey.

Action: Undertake surveys
Responsibility: DEC (Wellington District & Blackwood District) through the SWRTFRT
Cost: \$4,000 per year

4. Obtain biological and ecological information

Knowledge of the biology and ecology of the species will provide a scientific basis for management of *Caladenia procera* and its habitat in the wild. Investigations will ideally include:

1. Ecological requirements of *C. procera*, its pollinating Thynnid wasp and symbiont fungus.
2. Effects of fire, competition, rainfall and grazing in recruitment and survival of the orchid and associated fungus.
3. The population genetic structure, levels of genetic diversity and minimum viable population size.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Blackwood District) through the SWRTFRT
Cost: \$30,000 per year in the first two years

5. Ensure long-term protection of habitat

Liaison with land managers and landowners will continue to prevent accidental damage or destruction of populations. Negotiations will continue regarding the future management of the habitat of the two populations currently on private land. Ways of improving the security of populations and their habitat will also be investigated. The conservation status of land that supports Population 5, and Subpopulations 2a, 3a and 3b will be reviewed and the possibility of purchase, a change of land tenure and/or establishment of nature conservation covenants investigated.

Action: Ensure long-term protection of habitat
Responsibility: DEC (Wellington District for population 5, and Blackwood District for the rest, Land Unit, Species and Communities Branch); Department of Planning (DoP); Department of Mines and Petroleum (DMP), through the SWRTFRT
Cost: \$4,000 per year

6. Deter access

Fencing is required at several populations. The existing fencing at Population 4 will require checking and maintenance over the long-term. Subpopulation 1b, and Populations 2 and 4 will likely require public access barriers. Signs indicating the significance of the area may also be required.

Action: Deter access
Responsibility: DEC (Blackwood District), Shire of Busselton, through the SWRTFRT
Cost: \$10,000 in years 1 and 2

7. Control grazing

Population 2, and Subpopulation 3b and the translocated plants at Ambergate Reserve are affected by grazing; at the latter it is mainly by kangaroos. Exclusion fences or cages may be required rather than the measures in the Reserve plan (Shire of Busselton 2004; B. Lullfitz pers. comm.; A. Webb pers. comm.).

Action: Control grazing
Responsibility: DEC (Blackwood District) through the SWRTFRT; relevant land managers
Cost: \$7,000 in years 1, 3 and 5

8. Collect seed and fungal 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. Some seed and endophytic fungal material has been collected from one population but further collections are required so that there is a store of genetic material from all populations. Collections of material are also necessary to enable DNA studies of fungal and orchid diversity in each population of this species.

Action: Collect seed and fungal material
Responsibility: DEC (Blackwood District, TFSC), BGPA through the SWRTFRT
Cost: \$9,000 per year

9. Monitor populations

Annual monitoring of weed invasion, plant diseases, population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation is essential. Where possible, the position of each individual will be mapped using a differential GPS system when in flower. Regular return visits and good record keeping will be important to determine the effect of prescribed and other fire.

Action: Monitor populations
Responsibility: DEC (Blackwood District) through the SWRTFRT
Cost: \$5,000 per year

10. Undertake liaison with land managers

Staff from DEC's Blackwood District will liaise with appropriate land managers to ensure that populations of *Caladenia procera* are not accidentally damaged or destroyed. This is particularly important for Population 2, Subpopulation 1b and for potential habitat in areas adjacent to Population 5 and Subpopulations 3a and 3b. Indigenous consultation will take place to determine if there are any issues or interests in areas that are habitat for *C. procera*.

Action: Undertake liaison with land managers and indigenous communities
Responsibility: DEC (Blackwood District) through the SWRTFRT
Cost: \$4,000 per year

11. Rehabilitate habitat

Where necessary, habitat restoration will be undertaken in populations of this species. This may include the re-introduction of local provenance plants to disturbed areas of habitat.

Action: Rehabilitate habitat
Responsibility: DEC (Blackwood District) through the SWRTFRT

Cost: \$4,000 per year

12. Develop and implement a translocation proposal

As populations of *Caladenia procera* are not secure from threats, a translocation proposal may be required and suitable translocation sites found. Information on the translocation of threatened plants and animals in the wild is provided in DEC's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM 1995). Translocations should meet the standards set in the Australian Network for Plant Conservation translocation guidelines (Vallee et al 2004). All translocation proposals require endorsement by DEC's Director of Nature Conservation.

Action: Develop and implement a translocation proposal
Responsibility: DEC (Blackwood District) through the SWRTFRT
Cost: \$8,000 per year (dependant on verified former habitat becoming available)

13. Install DRF markers

DRF markers are required near Population 5.

Action: Install DRF markers
Responsibility: DEC (Wellington District & Blackwood District) through the SWRTFRT
Cost: \$3,500 in year 1 and \$2,000 in year 2

14. Undertake weed control

The current level of threat at most populations from weeds is low to moderate. However, if weed numbers increase they could impact on *Caladenia procera* by competing for resources, degrading habitat, exacerbating grazing pressure, and increasing the risk and severity of fire. If monitoring indicates that the threat from weeds has increased, weed control will be undertaken in consultation with the land managers. It will be necessary to monitor the success of the treatment on weeds and any adverse effects on *Caladenia procera* and associated native plant species.

Weeds appear to be the greatest threat at Population 6 and to a lesser degree Subpopulations 2b, 3a and 3b.

Action: Undertake weed control
Responsibility: DEC (Blackwood District) through the SWRTFRT
Cost: \$2,000 per year, as required

15. Develop and implement a fire management strategy

It may be necessary to develop specific fire management plans for this species. It is thought that late autumn--spring fire kills terrestrial orchids but that summer fire is unlikely to affect plants during their dormant phase. Little is known about the effects of fire on orchid fungi. Fire may also encourage weed invasion. Fire should be prevented from occurring in the area of populations, except where it is being used experimentally as a recovery tool.

Action: Develop and implement a fire management strategy
Responsibility: DEC (Blackwood District) through the SWRTFRT
Cost: \$7,000 in first year and \$5,000 in subsequent years

16. Notify the land manager of the location of this species

Notify Busselton Shire to the presence of Subpopulation 2b. Notify additional land managers if further populations are located.

Action: Notify the land manager of the location of this species
Responsibility: DEC (SCB, Blackwood District) through the SWRTFRT

Responsibility: \$100 in year 1

17. Promote awareness

The importance of biodiversity conservation and the long-term protection of wild populations of *Caladenia procera* will be promoted to the public. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action: Promote awareness

Responsibility: DEC (Blackwood District, SCB, Strategic Development and Corporate Affairs Division) through the SWRTFRT

Cost: \$3,000 in year 1 and \$2,000 in subsequent years

18. Re-assess and update ranking criteria

Caladenia procera is ranked as Critically Endangered (CR) under the World Conservation Union (IUCN 2001) Red List Criteria B1ab(iii)+2ab(iii); C1. However, as additional plants have now been found (535 plants known), it no longer meets criterion C1. The ranking of the species will be re-assessed and the criteria updated.

Action: Re-assess and update ranking criteria

Responsibility: DEC (SCB)

Cost: \$1,000 in year 1

19. Review this plan and prepare a revised plan if necessary

If *Caladenia procera* is still ranked as Critically Endangered 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 prepare a revised plan if necessary

Responsibility: DEC (SCB, Blackwood District) through the SWRTFRT

Cost: \$6,000 in year 5 (or \$30,000 if a full recovery plan is required)

Table 4. Summary of Recovery Actions

Recovery Action	Priority	Responsibility	Completion Date
Coordinate recovery actions	High	DEC (Blackwood District) via the SWRTFRT	Ongoing
Define and map habitat critical to the survival of <i>Caladenia procera</i>	High	DEC (SCB, Blackwood District) via the SWRTFRT	2016
Undertake surveys	High	DEC (Wellington District & Blackwood District) via the SWRTFRT	2013
Obtain biological and ecological information	High	DEC (Science Division, Blackwood District) via the SWRTFRT	2015
Ensure long-term protection of habitat	High	DEC (Wellington District & Blackwood District, Land Unit); Department of Planning (DoP); Department of Mines and Petroleum (DMP), through the SWRTFRT	2013
Deter access	High	DEC (Blackwood District), Shire of Busselton, through the SWRTFRT	Ongoing
Control grazing	High	DEC (Blackwood District) through the SWRTFRT; relevant land managers	Ongoing
Collect seed and fungal material	High	DEC (Blackwood District, TFSC), BGPA through the SWRTFRT	2013
Monitor populations	High	DEC (Blackwood District) via the SWRTFRT	Ongoing
Undertake liaison with land managers	Moderate	DEC (Blackwood District) via the SWRTFRT	Ongoing
Rehabilitate habitat	Mod/high	DEC (Blackwood District) via the SWRTFRT	As required
Develop and implement a translocation proposal	Mod	DEC (Blackwood District) via the SWRTFRT	
Install DRF markers	Mod/high	DEC (Wellington District & Blackwood District) via the SWRTFRT	2011
Undertake weed control	Moderate	DEC (Blackwood District) via the SWRTFRT	As required

Develop and implement a fire management strategy	Moderate	DEC (Blackwood District) via the SWRTFRT	Ongoing
Notify Landmanagers of the location of this species	Moderate	DEC (Blackwood District) via the SWRTFRT	2011
Promote awareness	Moderate	DEC (Blackwood District, SCB, Strategic Development and Corporate Affairs Division) through the SWRTFRT	Ongoing
Re-assess and update ranking criteria	Moderate	DEC (SCB)	2011
Review this plan and prepare a revised plan if necessary	Moderate	DEC (Blackwood District) via the SWRTFRT	2017

Completion dates are dependent on sufficient budget to undertake recovery actions.

4. TERM OF PLAN

Western Australia

This plan will operate from September 2011 to August 2016 but will remain in force until withdrawn or replaced. It is intended that, if the species is still ranked Critically Endangered after five years, the need for further recovery actions will be assessed.

Commonwealth

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

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

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6. TAXONOMIC DESCRIPTION

Hopper, S.D. and Brown, A.P. (2001) Contributions to Western Australian Orchidology: 2. New taxa and circumscriptions in *Caladenia* (Spider, Fairy and Dragon orchids of Western Australia). *Nuytsia* 14(1/2), 27-308.

Plant solitary or in small clumps. *Leaf* erect, linear, 10-30 cm x 6-10 mm, pale green, basal third usually irregularly blotched with red-purple. *Scape* 35-70 cm tall. *Flowers* 1-4, c. 5-9 cm across, predominantly greenish lemon yellow with variable suffusions, lines and spots of dull maroon to pink; floral odour absent. *Sepals and petals* stiffly held, linear-lanceolate in basal quarter (sepals) or third (petals), then abruptly narrowing (sepals) or tapering (petals) to a long-acuminate apex; osmophore prominently tumescent, 15-25 mm long in sepals, absent from petals, yellow-brown, consisting of minute densely packed globular sessile glandular cells. *Dorsal sepal* erect and slightly incurved, 5-7 cm x 4-5 mm. *Lateral sepals* spreading and downcurved, 5.5-6.5 cm x 6-8 mm. *Petals* obliquely ascending, 3.5-4.5 cm x 4.5-5 mm. *Labellum* obscurely 3-lobed, prominently 2-coloured, greenish lemon yellow with pale pink to fawn radiating stripes, terminating in a uniformly dark maroon recurved apex, stiffly articulate on a claw c. 2.5 mm wide; lamina narrowly-cordate to cordate in outline when flattened, 22-30 x 15-20 mm, basal third curving from erect to oblique, middle third curving to horizontal, apical third sharply recurved, margins at widest point moderately curved upwards and terminated by obliquely ascending margins and calli; lateral lobes erect with entire margins near the claw,

becoming fimbriate with slender acuminate linear greenish lemon yellow calli to 10 mm long which are abruptly decrescent near midlobe; midlobe margins with short broad slightly forward-facing obtuse hooked dull maroon calli decrescent towards the apex. *Lamina calli* in 4 rows extending at least $\frac{3}{4}$ - $\frac{4}{5}$ the length of the labellum, dull maroon, sometimes white at base, golf stick-shaped, the longest c. 3 mm tall, decrescent towards apex and becoming sessile. *Column* 22-25 x 13-15 mm, broadly winged, greenish lemon yellow with pale pink to fawn blotches. *Anther* c. 4 x 4 mm, pink. *Pollinia* c. 4 mm long, yellow. *Stigma* c. 4 mm wide, dark yellow-green. *Capsule* not seen.

Notes. A locally common but highly restricted species closely related to *Caladenia pectinata* and *C. decora*, differing from both in its consistently greenish yellow sepals, petals and basal labellum lamina, and its somewhat taller scapes. *C. procera* also differs from *C. decora* in its consistently ascending petals lacking an osmophore, and its broader more acute column wings. It has a taller broader column and somewhat longer labellum than *C. pectinata*. *C. procera* hybridizes with *C. attingens*.

