



Department of
Parks and Wildlife



Interim Recovery Plan No. **382**

Collie Spider Orchid *(Caladenia leucochila)*

Interim Recovery Plan
2017–2022



Department of Parks and Wildlife, Western Australia

May 2017

List of Acronyms

The following acronyms are used in this plan:

AOO	Area of occupancy
BGPA	Botanic Gardens and Parks Authority
CALM	Department of Conservation and Land Management
CFF	Conservation of Flora and Fauna
CITES	Convention on International Trade in Endangered Species
CPC	Conservation and Parks Commission
CR	Critically Endangered
DEC	Department of Environment and Conservation
DAA	Department of Aboriginal Affairs
DPaW	Department of Parks and Wildlife (also shown as Parks and Wildlife)
DRF	Declared Rare Flora (also shown as Threatened)
EOO	Extent of occurrence
EPBC	Environment Protection and Biodiversity Conservation
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
LGA	Local Government Authority
NRM	Natural Resource Management
PEC	Priority Ecological Community
PER	Public Environmental Review
PICA	Public Information and Corporate Affairs
RDL	Department of Regional Development and Lands
RP	Recovery Plan
SCB	Species and Communities Branch
SWALSC	South West Aboriginal Land and Sea Council
SWRTFCRT	South West Region Threatened Flora and Communities Recovery Team
TEC	Threatened Ecological Community
TFSC	Parks and Wildlife Threatened Flora Seed Centre
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
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 Corporate Policy Statement No. 35 (DPaW 2015a) and Department of Parks and Wildlife Corporate Guideline No. 35 (DPaW 2015b). 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 flora 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) flora, always within one year of endorsement of that rank by the Minister.

This plan will operate from May 2017 to April 2022 but will remain in force until withdrawn or replaced. It is intended that, if the species is still listed as threatened in Western Australia following five years of implementation, this plan will be reviewed, the need for further recovery actions assessed and a revised plan prepared if necessary.

This plan was given regional approval on 15 May 2017 and was approved by the Director of Science and Conservation on 22 May 2017. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting the Department of Parks and Wildlife, as well as the need to address other priorities.

Information in this plan was accurate at May 2017.

Plan preparation. This plan was prepared by:

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

Simon Martin	District Nature Conservation Leader, Parks and Wildlife Wellington District.
Belinda Newman	Research Scientist, Botanic Gardens and Parks Authority.
Ryan Phillips	Research Scientist, Botanic Gardens and Parks Authority and the Australian National University.
Andrew Webb	Regional Flora Conservation Officer, Parks and Wildlife South West Region.

Thanks also to the staff of the Western Australia Herbarium for providing access to Herbarium databases and specimen information, and other Parks and Wildlife Species and Communities staff for assistance in developing this plan.

Cover photograph by Andrew Brown.

Citation. This plan should be cited as: Department of Parks and Wildlife (2017) Collie Spider Orchid (*Caladenia leucochila*) Interim Recovery Plan 2017–2022. Interim Recovery Plan No. 382. Department of Parks and Wildlife, Western Australia.

Summary

Name:	<i>Caladenia leucochila</i>	Shires:	Collie, West Arthur
Family:	Orchidaceae	IBRA region:	Jarrah Forest
Common name:	Collie Spider Orchid	IBRA subregion:	Southern Jarrah Forest JAF02
Flowering period:	mid-September–October	NRM region:	South West Catchment Council
DPaW region:	South West	Recovery team:	SWRTFCRT
DPaW district:	Wellington		

Distribution and habitat: *Caladenia leucochila* is found over a small geographic range south-east of Collie, primarily growing in grey sandy soil downslope from laterite (sometimes extending into laterite). Populations occur in open *Eucalyptus marginata*, *Corymbia calophylla* and *Allocasuarina fraseriana* forest over *Xanthorrhoea preissii* and dwarf scrub of *Bossiaea ornata*, *Banksia nivea*, *Lechenaultia biloba* and open, low sedges. The largest populations occur on well-drained sandy slopes near the valley floor (Brown *et al.* 2015). The extent of occurrence (EOO) has been calculated to be 52km² and area of occupancy (AOO) calculated as 28km².

Habitat critical to the survival of the species, and important populations: It is considered that all known habitat for wild populations is critical to the survival of the species, and all wild populations are important populations. Habitat critical to the survival of *C. leucochila* includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators). It may also include 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: *Caladenia leucochila* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 17th September 2013 under the phrase name *Caladenia* sp. Collie (E. Bennett s.n. PERTH 08396051). It is ranked as Endangered (EN) in Western Australia under International Union for Conservation of Nature (IUCN 2001) criteria A3cd; B1ab(i,ii,iii,iv,v)+B2ab(i,ii,iii,iv,v) due to a projected reduction of mature individuals (plants are threatened by proposed mining expansion), a further decline in habitat quality (much of its habitat is highly disturbed from prior timber extraction, soil ripping, prescribed fire and mining), future timber harvesting, changed hydrology and altered fire regimes. The species is not listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The major threats to the species are mining, hydrological changes, altered fire regimes, grazing, road maintenance, logging, weeds, lack of biological and ecological information, small population size and drought.

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. Seed collected from *Caladenia leucochila* in 2008 and between 2010 and 2012 by the Botanic Gardens and Parks Authority (BGPA) is currently stored in their orchid seed bank.
2. Seed was successfully germinated in 2012 and 550 seedlings were potted out in the orchid glasshouse at BGPA.
3. Collar slivers were collected between 2010 and 2012 with associated fungi isolated, cleaned of contaminants and stored at the BGPA fungal library.
4. A draft proposal for a trial translocation of 50 *Caladenia leucochila* seedlings was developed by BGPA in June 2013.
5. Small portions of leaf material collected from mature *Caladenia leucochila* plants by BGPA is stored in dry silica gel for future genetic analysis.
6. Preliminary studies of the pollination biology of *Caladenia leucochila* have been undertaken by BGPA along with surveys recording the distribution of the pollinator.
7. Surveys have been undertaken for *Caladenia leucochila* using GPS to record accurate locations of individuals.

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

Recovery criteria

Recovery will be considered successful if one or more of the following take place over the term of the plan.

- There is no reduction in the extent of occurrence and the number of mature plants within known populations has remained within a 10% range or has increased by >10% from 827 to 910 or more; or
- New populations have been found, increasing the number of known populations from 18 to 19 or more with no net loss of mature plants; or
- The area of occupancy has increased by >10% with no net loss of mature plants.

Recovery will be considered unsuccessful if one or more of the following take place over the term of the plan.

- Populations have been lost which result in a reduction in the extent of occurrence; or
- The number of mature plants has decreased by >10% from 827 to 744 or less; or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Install DRF markers
4. Protect plants from herbivory
5. Develop and implement a fire management strategy
6. Collect and store seed and fungal material
7. Monitor hydrology
8. Undertake surveys
9. Undertake weed control
10. Ensure long-term protection of habitat

11. Obtain biological and ecological information
12. Develop and implement translocations
13. Liaise with land managers and Aboriginal communities
14. Promote awareness
15. Map habitat critical to the survival of *Caladenia leucochila*
16. Review this plan and assess the need for further recovery actions

1. Background

History

The first specimens of *Caladenia leucochila* were collected in State forest south-east of Collie in September 2008. While initially believed to represent a range extension of the related *Caladenia lodgeana*, taxonomic studies revealed the Collie taxon was a distinct new species and it was assigned the informal name *Caladenia* sp. Collie (E. Bennett s.n. PERTH 08396051). The species was listed as threatened flora under this name on 17 September 2013. It was formally named *C. leucochila* in 2015 (Brown *et al.* 2015), and was listed as threatened flora under its formal name on 3 November 2015. The 2008 specimen has been lodged at the Western Australian Herbarium.

Caladenia leucochila is currently known from 19 populations comprising approximately 827 mature (flowering) plants. Plant counts were recorded during surveys undertaken by Parks and Wildlife staff, Botanic Gardens and Parks Authority staff and Onshore Environmental on behalf of Griffin Coal (Onshore Environmental 2015). The majority of plants occur within State forest which is leased for coal mining.

Description

Caladenia leucochila is a medium sized spider orchid 120–400mm high with a single, erect, hairy leaf 120–200mm long by 4–11mm wide. Plants have up to three cream, pale yellow or greenish-yellow, red-marked flowers 40–60mm across with spreading or more rarely pendulous, apically pointed or scarcely clubbed petals, an erect, apically clubbed dorsal sepal and spreading or, more rarely, pendulous, prominently-clubbed lateral sepals. The labellum is creamy-white to pale yellow with narrow fringe segments and four or more rows or cream to yellow or red calli (Brown *et al.* 2015). The labellum lacks the red apical apex found in the majority of species in the *C. huegelii* complex. There is no obvious floral odour (Brown *et al.* 2015).

The species is a member of the *Caladenia huegelii* complex and, like other members of that complex, has sepals with prominent terminal osmophores (clubs) and shortened petals. However, it differs from the majority of these species in lacking a red labellum apex and in sometimes having lax lateral sepals, these features placing it with *C. lodgeana*, *C. busselliana* and *C. interjacens*. Unlike most members of the *C. huegelii* complex, *C. leucochila* sometimes has petals with thickened osmophores (Brown *et al.* 2015).

The species is distinguished from the related *Caladenia lodgeana*, with which it was previously included, by its more colourful flowers and more prominently-clubbed sepals. It also has an earlier flowering period and more northerly range of distribution (Brown *et al.* 2015).

The species often hybridises with *Caladenia longicauda* and *C. ferruginea* and in some populations these hybrids outnumber *C. leucochila*. Hybrids with *C. longicauda* are variable in colour and morphology but are usually paler and have longer tepals that either lack or, where present, have longer, narrower osmophores. Hybrids with *C. ferruginea* are more colourful and have maroon-suffused tepals and a red or maroon suffused labellum apex. The hairs on the osmophores also often have a redder appearance.

Illustrations and/or further information

Brown, A., Dixon, K., French, C. and Brockman, G. (2013) Field Guide to the Orchids of Western Australia: the definitive guide to the native orchids of Western Australia. Simon Nevill Publications, Floreat, WA; Brown, A.P. and Brockman, G. (2015) New taxa of *Caladenia* (Orchidaceae) from south-west Western Australia; Western Australian Herbarium (1998–) *FloraBase– the Western Australian Flora*. Department of Parks and Wildlife. <http://florabase.dpaw.wa.gov.au/>.

Distribution and habitat

Caladenia leucochila is found over a small geographic range south-east of Collie, primarily growing in grey sandy soil downslope from laterite (sometimes extending into laterite). Populations occur in open *Eucalyptus marginata*, *Corymbia calophylla* and *Allocasuarina fraseriana* forest over *Xanthorrhoea preissii* and dwarf scrub of *Bossiaea ornata*, *Banksia nivea*, *Lechenaultia biloba* and open, low sedges. The largest populations occur on well-drained sandy slopes near the valley floor (Brown *et al.* 2015). The extent of occurrence (EOO) has been calculated to be 52km² and area of occupancy (AOO) calculated as 28km².

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

TPFL population number & location	DPaW district	Shire	Vesting	Purpose	Manager
1. SW of Bowelling	Wellington	West Arthur	CPC	Conservation park	Parks and Wildlife
2. SW of Bowelling	Wellington	West Arthur	RDL	Water reserve	Water Corporation
3. S of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
4. S of Muja	Wellington	Collie	LGA	Road reserve	Shire of Collie
5abc. South of Muja (note: now combined with Population 3)	Wellington	Collie	CPC	State forest	Parks and Wildlife
6. S of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
7. S of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
8ab. SE of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
9. SW of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
10. SE of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
Recently discovered populations (not yet numbered)					
SW of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
S of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
S of Muja	Wellington	Collie	LGA	Road reserve	Shire of Collie
S of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
SW of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
SW of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
SW of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
SW of Muja	Wellington	Collie	CPC	State forest	Parks and Wildlife
SE of Muja	Wellington	West Arthur	CPC	State forest	Parks and Wildlife

Biology and ecology

The flowers of *Caladenia leucochila* have apical sepaline osmophores which emit chemical attractants known as pheromones. These attract thynnine wasps which attempt copulation with the labellum of the flower and by brushing against the column inadvertently deposit or remove pollen in the process. Research on *Caladenia* pollination (Phillips *et al.* 2009; Stoutamire 1983) and broad-scale surveys for the *C. leucochila* wasp (B. Newman, unpublished data), suggest that this is likely to involve a single species of wasp. Studies have confirmed that pollination is mainly by sexual deception with occasional visits by nectar foraging bees.

Fruit set in *Caladenia leucochila* is during October. Based on an estimate for the similarly sized *C. arenicola*, fruiting capsules contain approximately 30,000 seeds which are wind dispersed (Batty 2001). *Caladenia* species require the establishment and maintenance of a relationship with a specific mycorrhizal fungus for germination, growth and development (Ramsay *et al.* 1986; Swarts *et al.* 2010). There are no estimates of seed viability available for *C. leucochila* but in other *Caladenia* species seed viability is approximately 60 to 90% (Swarts 2007).

It is expected that *Caladenia leucochila* will reach reproductive maturity about three years following germination, as evident in studies of *C. huegelii* (Swarts 2007). Estimates for other *Caladenia* species have shown that they can live in excess of 30 years (K. Dixon, unpublished observation). Estimates of reproductive success indicate that capsule set is to be approximately 30%, as averaged across all populations for two successive years. Natural mortality of seed capsules through herbivory is also estimated at 30%, as averaged across all populations for two successive years.

Caladenia species are unaffected by summer fire which is known to enhance flowering of some species in the following growing season. However, winter and early spring fires, when the leaf is present and the new tuber is being formed, can be detrimental and may kill the plant. Neither fire nor disturbance is required for the flowering of *C. leucochila*.

Conservation status

Caladenia leucochila was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 17th September 2013 under the phrase name *Caladenia* sp. Collie (E. Bennett s.n. PERTH 08396051). It is ranked as Endangered (EN) in Western Australia under International Union for Conservation of Nature (IUCN 2001) criteria A3cd; B1ab(i,ii,iii,iv,v+B2ab(i,ii,iii,iv,v) due to a projected reduction of mature individuals (plants are threatened by proposed mining expansion), a further decline in habitat quality (much of its habitat is highly disturbed from prior timber extraction, soil ripping, prescribed fire and mining), future timber harvesting, changed hydrology and altered fire regimes. The species is not listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Future mining operations.** Populations 3, 4, 5, 8 and several recently discovered unnumbered populations are within the Muja South Public Environmental Review (PER) footprint (as shown in Onshore Environmental 2015) and are subject to possible future mining. Clearing of vegetation for

access tracks, power lines and other linear infrastructure corridors is also a threat. A drilling program covering 32.67 hectares has also been proposed.

- **Hydrological changes.** Changed hydrology has the potential to adversely alter the habitat of the orchid.
- **Altered fire regimes.** Fires that occur during winter and spring, when the leaf is present and the new tuber is being formed, may kill plants.
- **Grazing.** Although grazing does not appear to kill plants it reduces the reproductive output of the species if flowers or fruiting capsules are eaten.
- **Road maintenance.** Threats to road verge populations (Populations 4 and a recently discovered unnumbered population) include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation.
- **Timber extraction.** This is a potential threat to *Caladenia leucochila* as it would significantly alter vegetation structure, opening the forest canopy and changing the moisture level of the soil surface.
- **Weeds.** Weeds suppress early plant growth by competing for soil moisture, nutrients and light, and also increase the potential fire hazard due to higher fuel loads.
- **Lack of biological and ecological information.** Although some information on the biology and ecology of *Caladenia leucochila* has now been obtained, additional information crucial to the species conservation is required.
- **Small population size.** As *Caladenia leucochila* is known from mostly small populations, the likelihood of the species being impacted by chance demographic or environmental events such as bushfire is high.
- **Drought** is a threat to all populations of this species.

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

Table 2. Summary of population information and threats

TPFL pop no	Onshore pop no.	Land status	Year	No. of plants	Current condition	Threats
1. SW of Bowelling	3	Conservation park	2008 2009 2012	3 14 102*	Moderate	Fire, small population size, hydrological change, grazing, weeds
2. SW of Bowelling	-	Water reserve	2008 2009	1	Extinct?	Fire, small population size, weeds
3. S of Muja	1	State forest	2008 2009 2012	6 97 374*	Healthy	Mining, hydrological change, small population size, fire, weeds, grazing, timber extraction
4. S of Muja	6	Road reserve	2008 2009 2015	93 19 14*	Healthy	Mining, road maintenance, small population size, weeds
5abc. South of Muja (now combined with population 3)	1	State forest				
6. S of Muja	-	State forest	2008	1?	Extinct?	Fire, small population size
7. S of Muja	-	State forest	2008	1?	Extinct?	Fire, small population size
8ab. SE of Muja	2	State forest	2012	63?	Healthy	Mining, fire, small population size
9. SW of Muja	4	State forest	2013 2015	25 98***	Healthy	Fire, small population size, grazing

10. SE of Muja	-	State forest	2013	22	Healthy	Fire, small population size, grazing
Recently discovered populations (not yet numbered)	Onshore pop no.	Land status	Year	No. of plants	Current condition	Threats
S of Muja	5	State forest	2015	78*	Unknown	Fire, small population size
S of Muja	7	State forest	2013	18**	Unknown	Mining, fire, small population size
S of Muja	8	Road reserve	2013	10**	Unknown	Mining, fire, small population size
SW of Muja	9	State forest	2015	17*	Unknown	Mining, fire, small population size
SW of Muja	10	State forest	2014	12*	Unknown	Fire, small population size
SW of Muja	11	State forest	2014	9*	Unknown	Fire, small population size
SW of Muja	12	State forest	2012	5*	Unknown	Fire, small population size
South-east of Collie	13	State forest	2012	2*	Unknown	Fire, small population size
SE of Muja	14	State forest	2012	1*	Unknown	Fire, small population size

Note: all populations over 20 plants in size (in bold) are considered to be important populations; Only flowering individuals are included in plant counts as non-flowering plants (leaves) are generally not discernible from related orchid species that occur in the same area; TPFL Populations 3 and 5abc are now thought to be a single large population; * population survey from Onshore Environmental (2015); ** population survey by BGPA; *** population survey from both Onshore Environmental and BGPA.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions that result in any of the following may potentially have a significant 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 or drainage.
- Reduction in population size.
- A major increase in disturbance in the vicinity of a population.

Habitat critical to the survival of *Caladenia leucochila* and important populations

Caladenia leucochila is listed as Threatened in Western Australia and it is considered that all known habitat for wild populations is critical to the survival of the species, and all wild populations are important populations. Habitat critical to the survival of the species includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators). It may also include 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 *Caladenia leucochila* will also improve the status of associated native plant species including the three Priority plant taxa listed in the table below:

Table 3. Conservation-listed flora species occurring within 500m of *Caladenia leucochila*

Species name	Conservation status (WA)	Conservation status (EPBC Act)
<i>Acacia semitrullata</i>	Priority 4	-
<i>Pultenaea skinneri</i>	Priority 4	-
<i>Synaphea petiolaris</i> subsp. <i>simplex</i>	Priority 2	-

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

Caladenia leucochila is not known to be associated with any Threatened Ecological Communities (TECs), Priority Ecological Communities (PECs).

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 not listed under Appendix II in the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES), and this plan does not affect Australia's obligations under any other international agreements.

Aboriginal consultation

A search of the Aboriginal Affairs (DAA) Aboriginal Heritage Sites Register revealed no registered sites of Aboriginal significance, but did reveal a Heritage Place adjacent to populations of *Caladenia leucochila* (see table 4). Input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and DAA to determine if there are any issues or interests with respect to the management of this species. Opportunity for future Aboriginal involvement in the implementation of the plan is included as an action in the plan. Aboriginal 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.

Table 4. Aboriginal Heritage Place adjacent to *Caladenia leucochila*

Site identification	Access	Restriction	Site name	Site type
16713	open	none	Collie River Waugal	mythological, natural feature, water source

Social and economic impacts

Populations 3, 4, 5, 8 and several of the recently discovered unnumbered populations occur in areas covered by mining leases and there may be economic impact should mining operations be affected. For populations occurring on land under the management of Parks and Wildlife (Populations 1, 6–10 and all recently discovered populations), the Shire of Collie (Population 4) or Water Corporation (Population 2), some social and economic impacts may occur through the implementation of recovery actions (controlling weeds) and restrictions imposed on the management of the land, including timber extraction and maintenance of road infrastructure.

Affected interests

The implementation of this plan has implications for Parks and Wildlife, Shire of Collie, Water Corporation and mining tenement holders Lanco Infratech Limited (Griffin Coal), where populations occur on lands not specifically managed for conservation.

Evaluation of the plan's performance

Parks and Wildlife, with assistance from the South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT), 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 extant populations to ensure the long-term conservation of the species in the wild.

Recovery criteria

Recovery will be considered successful if one or more of the following take place over the term of the plan.

- There is no reduction in the extent of occurrence and the number of mature plants within known populations has remained within a 10% range or has increased by >10% from 827 to 910 or more; or
- New populations have been found, increasing the number of known populations from 18 to 19 or more with no net loss of mature plants; or
- The area of occupancy has increased by >10% with no net loss of mature plants.

Recovery will be considered unsuccessful if one or more of the following take place over the term of the plan.

- Populations have been lost which result in a reduction in the extent of occurrence; or
- The number of mature plants has decreased by >10% from 827 to 744 or less; or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

3. Recovery actions

Existing recovery actions

Parks and Wildlife, with assistance from the SWRTFCRT is overseeing the implementation of recovery actions for *Caladenia leucochila*.

Land managers have been notified of the location and threatened status of *Caladenia leucochila*. Notifications detail the current DRF status of the species, the associated legal obligations in regards to its protection, and contact details for management assistance.

Seed collected from *Caladenia leucochila* by BGPA in 2008 and between 2010 and 2012 is stored in their orchid seed bank. Seed was successfully germinated in 2012 and 550 seedlings have been potted out in the orchid glasshouse at BGPA. Collar slivers were collected between 2010 and 2012 and associated fungi were isolated, cleaned of contaminants, and stored at the BGPA fungal library.

A draft proposal for a trial translocation of 50 *Caladenia leucochila* seedlings was developed by BGPA in June 2013. The trial will be used to establish the best life history stage at which to translocate terrestrial orchids by comparing seedlings planted at the beginning of their growth phase, and dormant tubers planted during summer. Plants are to be watered during the growing season and caged to exclude macropod herbivory.

Small portions of leaf material collected from mature *Caladenia leucochila* plants by BGPA is stored in dry silica gel for future genetic analysis.

Preliminary studies of the pollination biology of *Caladenia leucochila* have been undertaken by BGPA along with studies on the distribution of the pollinator. Research has confirmed pollination by *Thynnid* wasps by sexual deception and occasional visits by nectar foraging bees.

Surveys have been undertaken for *Caladenia leucochila* with obtained GPS coordinates used to map accurate locations of individuals. Groups involved in conducting surveys include:

- Bennett Environmental Consulting.
- Bushland Native Seeds.
- Keith Smith of "Formosa Flora".
- Nigel Swarts (BGPA).
- Ryan Phillips (BGPA).
- Belinda Newman (BGPA). These surveys involved walking gridded transects 5m apart and searching the extent of the habitat in which plants were previously recorded.
- Onshore Environmental.
- The Western Australian Native Orchid Study and Conservation Group (WANOSCG).
- Parks and Wildlife.

Future recovery actions

The following recovery actions are listed in approximate 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. Where these 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.

1. Coordinate recovery actions

Parks and Wildlife with assistance from the SWRTFCRT will coordinate the implementation of recovery actions for *Caladenia leucoxyla* and will include information on progress in annual reports.

Action:	Coordinate recovery actions
Responsibility:	Parks and Wildlife (South West Region, Species and Communities Branch (SCB)), with assistance from the SWRTFCRT
Cost:	\$8,000 per year

2. Monitor populations

Ongoing monitoring populations and their habitat should be undertaken to identify trends or potential management requirements. Population monitoring should record the health and expansion or decline in the population, and other observations such as pollinator activity or seed production. Site monitoring should include observations of grazing, habitat degradation including weed invasion, and hydrological status (inundation and drought). Specific monitoring of hydrology and activities relating to research into the biology and ecology of *Caladenia leucoxyla* are included in other recovery actions detailed below.

Action:	Monitor populations
Responsibility:	Parks and Wildlife (Wellington District), with assistance from the SWRTFCRT
Cost:	\$10,000 per year

3. Install DRF markers

DRF markers are required at Population 4 and a new population to reduce the risk of accidental damage during road maintenance activities.

Action:	Install DRF markers
Responsibility:	Parks and Wildlife (Wellington District)
Cost:	\$4,000 in year 1

4. Protect plants from herbivory

When monitoring ascertains that the threat of grazing posed by kangaroos is high, protective cages and/or fencing may be considered.

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

5. Develop and implement a fire management strategy

Caladenia leucochila is thought to be killed by fire that occurs when the plant is in active growth and a fire management strategy will be developed that recommends fire frequency, intensity, seasonality, precautions to prevent bushfire and strategies for reacting to bushfire, and the need, method of construction and maintenance of firebreaks, and associated weed control measures, including actions to minimise the risk of unplanned fire. Permanent quadrats will be established to monitor the response of *C. leucochila* post-fire to either prescribed or unplanned fires. All data relating to fire response of the species will be entered into the Threatened Priority Flora (TPFL) fire response data base. A fire management strategy developed for Muja Conservation Park will be updated.

Action:	Develop and implement a fire management strategy
Responsibility:	Parks and Wildlife (Wellington District)
Cost:	\$10,000 in year 1, and \$6,000 in years 2–5

6. Collect and store seed and fungal material

To guard against the extinction of natural populations it is recommended that seed along with samples of the orchid's symbiotic fungus be collected and stored at the BGPA. Collections should aim to sample and preserve the maximum range of genetic diversity possible by collecting from the widest range of reproductive plants.

Action:	Collect and store seed and fungal material
Responsibility:	Coordinated by Parks and Wildlife (Wellington District), implemented by BGPA
Cost:	\$10,000 per year

7. Monitor hydrology

Understanding the effects of changes in the water table on vegetation associated with the orchid is essential and will include monthly monitoring of groundwater and surface water. This information will help in the formulation of future recommendations for management of the habitat of *Caladenia leucochila*.

Action:	Monitor hydrology
Responsibility:	Parks and Wildlife (Wellington District)
Cost:	\$10,000 per year

8. Undertake surveys

It is recommended that areas of potential habitat be surveyed for the presence of *Caladenia leucochila* during its September, October flowering period. All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and prevent duplication of effort.

Action:	Undertake surveys
Responsibility:	Parks and Wildlife (Wellington District), with assistance from the SWRTFCRT
Cost:	\$10,000 per year

9. Undertake weed control

Weeds are a minor threat to all populations and, when deemed necessary, the following actions will be implemented:

1. Determine which weeds are present.
2. Select appropriate technique; herbicide, mowing or hand weeding.
3. Control invasive weeds by hand removal and/or spot spraying around *Caladenia leucochila* plants when weeds first emerge.
4. Monitor the success of the treatment on weed death, *Caladenia leucochila* and associated native plant species.
5. Report on the method and success or otherwise of the treatment.

Action:	Undertake weed control
Responsibility:	Parks and Wildlife (Wellington District), Water Corporation, Shire of Collie
Cost:	\$10,000 per year, as required

10. Ensure long-term protection of habitat

Ways and means of improving the security of populations and their habitat will be investigated.

Action:	Achieve long-term protection of habitat
Responsibility:	Parks and Wildlife (South West Region, SCB)
Cost:	\$4,000 per year

11. Obtain biological and ecological information

It is recommended that research on the biology and ecology of *Caladenia leucochila* include:

1. Identification of pollinators and their habitat requirements.
2. Seed viability.
3. Identification of the fungal symbiont associated with *Caladenia leucochila* and its distribution in the wild.
4. Conditions necessary for natural germination.
5. Response to disturbance, competition, drought, inundation and grazing.
6. Longevity of plants, time taken to reach maturity, and minimum viable population size.
7. The impact of changes in hydrology.

Action:	Obtain biological and ecological information
Responsibility:	Parks and Wildlife (Science and Conservation Division, Wellington District), BGPA
Cost:	\$50,000 in years 1–3

12. Develop and implement translocations

Translocations may be required for the long term conservation of *Caladenia leucochila* if natural populations decline, with the first priority being augmentation of populations. A proposal for an experimental translocation has been developed but a full translocation proposal may be required in the future and suitable translocation sites selected.

Information on the translocation of threatened plants and animals in the wild is provided in Parks and Wildlife Corporate Policy Statement No. 35 (DPaW 2015a), Parks and Wildlife Corporate Guideline No. 36 (DPaW 2015c) and the Australian Network for Plant Conservation translocation guidelines (Vallee *et al.* 2004). The 2004 guidelines state that a translocation may be needed when a species is represented by few populations and the creation of additional self-sustaining, secure populations may decrease its susceptibility to catastrophic events and environmental stochasticity. For small populations which may be declining in size or subject to high levels of inbreeding, successful population enhancement may increase population stability and hence long-term viability.

Depending on the characteristics of the species, Vallee *et al.* (2004) suggest a minimum viable population size estimated between 50 and 2,500 individuals will be required. Suitable translocation sites may include where the taxon occurs, where it was known to have occurred historically and other areas that have similar habitat (soil, associated vegetation type and structure, aspect etc.), within the known range of the taxon (Vallee *et al.* 2004). The potential for a seed orchard on private land where granite will not be a defining factor may also need to be investigated.

All translocation proposals require endorsement by the department's Director of Science and Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action:	Develop and implement translocations
Responsibility:	Parks and Wildlife (Science and Conservation Division, Wellington District), BGPA
Cost:	\$42,000 in years 1 and 2; and \$26,500 in years 3–5 as required

13. Liaise with land managers and Aboriginal communities

Staff from Parks and Wildlife's Wellington District will liaise with Lanco Infratech Limited (formerly Griffin Coal) to ensure that populations of *Caladenia leucochila* are not accidentally 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 and opportunities will be provided for Aboriginal people to be involved in implementing this plan.

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

14. Promote awareness

The importance of biodiversity conservation and the protection of *Caladenia leucochila* will be promoted to the public. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action:	Promote awareness
Responsibility:	Parks and Wildlife (South West Region, SCB and Public Information and Corporate Affairs (PICA)), with assistance from the SWRTFCRT
Cost:	\$7,000 in years 1 and 2; \$5,000 in years 3–5

15. Map habitat critical to the survival of *Caladenia leucochila*

Although spatial data relating to habitat critical to the survival of *Caladenia leucochila* has been identified in Section 1, it has not been mapped. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action:	Map habitat critical to the survival of <i>Caladenia leucochila</i>
Responsibility:	Parks and Wildlife (SCB, South West Region)
Cost:	\$6,000 in year 2

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

If *Caladenia leucochila* is still listed as threatened in Western Australia following five years of implementation, this plan will be reviewed, the need for further recovery actions 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, South West Region)
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 (South West Region), with assistance from the SWRTFCRT	Ongoing
Monitor populations	High	Parks and Wildlife (Wellington District), with assistance from the SWRTFCRT	Ongoing
Install DRF markers	High	Parks and Wildlife (Wellington District)	2017
Protect plants from herbivory	High	Parks and Wildlife (Wellington District)	Ongoing
Develop and implement a fire management strategy	High	Parks and Wildlife (Wellington District)	Developed by 2017, implementation ongoing
Collect and store seed and fungal material	High	Coordinated by Parks and Wildlife (Wellington District), implemented by BGPA	Ongoing
Monitor hydrology	High	Parks and Wildlife (Wellington District)	Ongoing
Undertake surveys	High	Parks and Wildlife (Wellington District), with assistance from the SWRTFCRT	Ongoing
Undertake weed control	High	Parks and Wildlife (Wellington District), Water Corporation, Shire of Collie	Ongoing
Ensure long-term protection of habitat	High	Parks and Wildlife (South West Region, SCB Nature Conservation Covenant Program and Land Unit)	Ongoing
Obtain biological and ecological information	High	Parks and Wildlife (Science and Conservation Division, Wellington District), BGPA	2019
Develop and implement translocations	High	Parks and Wildlife (Science and Conservation Division, Wellington District), BGPA	2021
Liaise with land managers and aboriginal communities	Medium	Parks and Wildlife (Wellington District)	Ongoing
Promote awareness	Medium	Parks and Wildlife (South West Region, SCB and PICA), with assistance from the SWRTFCRT	Ongoing
Map habitat critical to the survival of <i>Caladenia leucochila</i>	Medium	Parks and Wildlife (SCB, South West Region)	2018
Review this plan and assess the need for further recovery actions	Medium	Parks and Wildlife (SCB, South West Region)	2021

4. Term of plan

This plan will operate from May 2017 to April 2022 but will remain in force until withdrawn or replaced.

5. References

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6. Taxonomic description

Description of *Caladenia leucochila* by Brown et. al. (2015).

Plants solitary. *Leaf* 12–20 cm long, 4–11 mm wide, linear, erect, incurved to flattened erect, pale green, the basal 1/3 irregularly blotched with red-purple. *Scape* 12–40 cm tall. *Flowers* 1(2), 4–6 cm across, pale yellow to greenish cream and white with faint to prominent dull red stripes; floral odour unknown. *Sepals and petals* linear-lanceolate in the basal 1/3 to 1/2 then abruptly narrowing before terminating in a yellowish brown apex. *Dorsal sepal* 2.5–3.5 cm long, 1.5–2 mm wide, erect and slightly incurved, terminating in a swollen osmophore which is 10–12 mm long and covered in short glandular hairs to 0.1 mm long. *Lateral sepals* 3.5–4 cm long, 2.5–3 mm wide, horizontal to down-curved, sometimes pendulous towards the apex, each terminating in a swollen osmophore which is 10–12 mm long and covered in short glandular hairs to 0.1 mm long. *Petals* 2.5–3 cm long, 1.5–2 mm wide, usually spreading horizontally or down-curved towards the apex, more rarely up-curved, usually lacking a swollen osmophore, or, when present 5–7 mm long. *Labellum* obscurely 3-lobed, white, stiffly articulated on a claw c. 2 mm wide; lamina 10–15 mm long, 7–9 mm wide, narrowly triangular in outline, erect with entire margins in the basal 1/3, nearly horizontal in middle 1/3 and apical 1/3 with a prominently recurved apex; lateral lobes with elongate, forward-facing, white to deep red, sometimes yellow-tipped marginal calli which are decrescent towards the midlobe; lamina calli cream to yellow or red, hockey-stick-shaped, the longest c. 1.5 mm tall, in 4–6 longitudinal rows extending about 2/3–3/4 the length of the labellum, decrescent towards the apex. *Column* 10–12 mm long, 3–4 mm wide, narrowly winged, opaque cream to pale yellow with pale red markings, sparsely hirsute with short glandular hairs on outer surface. *Anther* 2.5 mm long, 2.5 mm wide, greenish yellow to red. *Pollinia* 2.5 mm long, kidney-shaped, flat, yellow, mealy. *Stigma* 2.5 mm long, 2.5 mm wide. *Capsule* not seen.

