Department of Parks and Wildlife

Interim Recovery Plan No. **372**

Androcalva bivillosa

Interim Recovery Plan
2016–2021

Department of Parks and Wildlife, Western Australia

December 2016

List of Acronyms

The following acronyms are used in this plan:

BGPA	Botanic Gardens and Parks Authority
CALM	Department of Conservation and Land Management
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DEC	Department of Environment and Conservation
DAA	Department of Aboriginal Affairs
DPaW	Department of Parks and Wildlife
DRF	Declared Rare Flora
EN	Endangered
EPBC	Environment Protection and Biodiversity Conservation
GDTFCRT	Geraldton District Threatened Flora and Communities Recovery Team
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
LGA	Local Government Authority
MRWA	Main Roads Western Australia
NRM	Natural Resource Management
PICA	Public Information and Corporate Affairs
SCB	Species and Communities Branch
SWALSC	South West Aboriginal Land and Sea Council
TFSC	Parks and Wildlife Threatened Flora Seed Centre
TPFL	Threatened and Priority Flora System
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
WA	Western Australia

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife Corporate Policy Statement No. 35 (DPaW 2015*a*) and Department of Parks and Wildlife Corporate Guideline No. 35 (DPaW 2015*b*). 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This plan will operate from December 2016 to November 2021 but will remain in force until withdrawn or replaced. It is intended that if *Androcalva bivillosa* is still listed as Threatened in Western Australia following 5 years of implementation this plan will be reviewed and the need for further recovery actions assessed.

This plan was given regional approval on 22 November 2016 and was approved by the Director of Science and Conservation on 15 December 2016. 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 December 2016.

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:

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Janet Newell	Flora Conservation Officer, Parks and Wildlife Geraldton District
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Thanks also to the staff of the Western Australian Herbarium for providing access to Herbarium databases and specimen information and Wildlife Species and Communities Branch staff for assistance.

Cover photograph by Alanna Chant.

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Summary

Scientific name:	*Androcalva bivillosa*	**Shire:**	Northampton
Family:	Malvaceae	**NRM region:**	Northern Agricultural
Common name:	Straggling Androcalva	**IBRA region:**	Geraldton Sandplain
Flowering period:	July–October	**IBRA subregion:**	Geraldton Hills GES01
DPaW region:	Midwest	**Recovery team:**	Geraldton District Threatened Flora and Communities Recovery Team
DPaW district:	Geraldton		

Distribution and habitat: *Androcalva bivillosa* has a restricted distribution between Binnu, Kalbarri and Eurardy Station, growing in reddish-brown or yellow sand and gravel on flats and slopes and also in orange brown clayey-sand on recently disturbed road verges. Associated species include *Acacia* and *Allocasuarina* spp., *Callitris arenarius, Grevillea candelabroides, G. eriostachya, Jacksonia* sp. and *Melaleuca cordata* (Wilkins and Whitlock 2011).

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 *Androcalva bivillosa* and that all wild populations are important populations. Habitat critical to the survival of *A. bivillosa* 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: *Androcalva bivillosa* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 2 December 2014. It is ranked as Critically Endangered (CR) in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B2ab(iii,v); C2(a)(i) due to its area of occupancy estimated to be less than 10km^2; its populations being severely fragmented, a continuing decline in quality of habitat and number of mature individuals, there being <250 mature individuals and with no subpopulation having >50 mature individuals. The species is not currently listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The main threats to the species are road and track maintenance, poor recruitment, clearing, fire, weeds, habitat fragmentation, small population size, recreational activities and rabbits.

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. Land managers have been notified of the location and threatened status of *Androcalva bivillosa*. Notifications detail the current Threatened status of the species, the associated legal obligations in regards to its protection and contact details for management assistance.
2. Declared Rare Flora (DRF) markers have been installed at Populations 1, 3, 6 and 7 and Subpopulations 2a and 2b.
3. The gravel pit containing Population 8 was rehabilitated by Main Roads Western Australia (MRWA) in 2014. This included translocation of topsoil and plant material cleared from populations 1 and 2 by MRWA and resulted in some recruitment.
4. *Androcalva bivillosa* has been extensively surveyed for on private properties and nature reserves.
5. Cutting material taken from Population 1 and 2 has been propagated by the Botanic Gardens and Parks Authority (BGPA) who currently have 80 plants representing 13 clones.
6. Seed collected from four populations is stored at –20°C at the Threatened Flora Seed Centre (TFSC).
7. Monitoring has been carried out opportunistically with plant numbers and threats recorded.
8. A Translocation Proposal has been prepared and is currently in the approval process.

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

Criteria for recovery success: The plan will be deemed a success at the completion of its five year term 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 the known populations has remained within a 15% range or has increased by >15% from 87 to 100 or more or
- New populations have been found, increasing the number of known populations from eight to nine 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.

Criteria for recovery failure: The plan will be deemed a failure at the completion of its five year term 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 >15% from 87 to 74 or less or
- The area of occupancy has decreased by >10%.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Develop and implement a translocation proposal
4. Restrict access
5. Install DRF markers
6. Undertake weed control
7. Undertake regeneration trials
8. Obtain biological and ecological information
9. Develop and implement a fire management strategy
10. Undertake surveys
11. Collect and store seed
12. Ensure long-term protection of habitat
13. Liaise with land managers and Aboriginal communities
14. Map habitat critical to the survival of *Androcalva bivillosa*
15. Promote awareness
16. Review this plan and assess the need for further recovery actions

1. Background

History

Androcalva bivillosa was first collected from near Binnu by M.E. Phillips in September 1962 and was not seen again until 1990 when a collection was made from the Old Ajana Road by Don and Barbara Bellairs. Populations have since been located near Kalbarri and Eurardy Station.

The species had the manuscript name *Commersonia bivillosa* ms until placed in the new genus *Androcalva* during a taxonomic revision of *Rulingia* and *Commersonia* by Wilkins and Whitlock in 2011.

Androcalva bivillosa is currently known from eight populations comprising 56 plants. Most populations are small with 10 or less plants and the majority are located in disturbed areas within roadside vegetation.

Description

Androcalva bivillosa is a low growing shrub 10 to 50cm high by 40cm to 2.5m wide. The leaves are ovate, elliptic or oblong with the upper surface dark green, glossy over paler green. The petioles are 2 to 6mm long; the blade flat or crisped. The inflorescence is 12.2 to 16mm long, 3 to 9 flowered, flowers with a dark pink base and white or pink apex. The calyx is white with a tinge of pink or red at the base. The anthers are dark red, with paler red connective, 0.4 to 0.5 by 0.7 to 0.8mm (Wilkins and Whitlock 2011).

Wilkins and Whitlock (2011) describe *Androcalva bivillosa* as appearing most similar to *A. crispa* and *A. pulchella*. *Androcalva bivillosa* is distinguished from *A. crispa* by its flat rather than hooded lateral lobe margins and from *A. pulchella* by its calyx lobes which have an acute, rather than rounded apex. The petals and calyx of *A. bivillosa* are white throughout, or with a yellow or pink-tinged base, compared to white with a conspicuously dark red base in *A. crispa* (Wilkins and Whitlock 2011).

Androcalva bivillosa is named from the Latin *bi* (two) and *villosus* (hairy), in reference to the stellate and glandular hairs that are present on the stem, pedicels and outer surface of the calyx (Wilkins and Whitlock 2011).

Illustrations and/or further information

Western Australian Herbarium (1998–) *FloraBase- the Western Australian Flora*. Department of Parks and Wildlife. http://florabase.dpaw.wa.gov.au/; Wilkins, C.F. and Whitlock, B.A. (2011) A new Australian genus, *Androcalva*, separated from *Commersonia* (Malvaceae *s.l.* or Byttneriaceae). *Australian Systematic Botany* 24: 284–349.

Distribution and habitat

Androcalva bivillosa has a relatively restricted distribution between Binnu, Kalbarri and Eurardy Station, growing on flats and slopes in reddish-brown or yellow sand and gravel or in orange brown clayey-sand on recently disturbed road verges. Associated species include *Acacia* and *Allocasuarina* spp., *Callitris arenarius, Grevillea candelabroides, G. eriostachya, Jacksonia* sp. and *Melaleuca cordata* (Wilkins and Whitlock 2011). The area of occupancy is 0.0035km^2 and the extent of occurrence 1,125km^2.

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

TPFL population number & location	DPaW district	Shire	Vesting	Purpose	Manager
1. N of Binnu	Geraldton	Northampton	MRWA	Road reserve	MRWA
2a. N of Binnu	Geraldton	Northampton	MRWA	Road reserve	MRWA
2b. N of Binnu	Geraldton	Northampton	MRWA	Road reserve	MRWA
3. S of Binnu	Geraldton	Northampton	MRWA	Road reserve	MRWA
6. E of Binnu	Geraldton	Northampton	LGA	Road reserve	Shire of Northampton
7. E of Binnu	Geraldton	Northampton	LGA	Road reserve	Shire of Northampton
8. NW of Binnu	Geraldton	Northampton	LGA	Water	Shire of Northampton
9. NE of Kalbarri	Geraldton	Northampton	LGA	Airport	Shire of Northampton
10. NE of Kalbarri	Geraldton	Northampton	Crown land (leasehold)	Pastoral lease (Wildlife Sanctuary)	Bush Heritage Australia

Populations 2 and 4 were found to be the same population (Population 2). The coordinates for the herbarium specimen for Population 5 were incorrect and the location is now considered to be that of Population 2.

Biology and ecology

Androcalva bivillosa is thought to recruit mostly from seed following soil disturbance but may also resprout from rootstock. The species appears to be relatively short lived. Flowering begins within the first year following germination.

Conservation status

Androcalva bivillosa was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 2 December 2014. It is ranked as Critically Endangered (CR) in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B2ab(iii,v); C2(a)(i) due to its area of occupancy estimated to be less than 10km^2; its populations being severely fragmented, a continuing decline in quality of habitat and number of mature individuals, there being <250 mature individuals and with no subpopulation having >50 mature individuals. The species is not currently listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Road and track maintenance.** Threats to roadside and trackside populations include grading, chemical spraying, construction of drainage channels and slashing of vegetation (promoting weeds). The species has responded positively to physical disturbance on some road reserves, however continued widening of Main Roads Western Australia (MRWA) roads at populations 1, 2 and 3 is likely to result in habitat degradation and a future population reduction. Herbicide application at populations 6 and 7 has resulted in the loss of plants.
- **Poor recruitment and altered disturbance regimes.** The species appears to require disturbance to recruit. However, if disturbance is too frequent, occurs at the wrong time of the year or too much topsoil is removed, populations are unlikely to persist. Conversely a lack of appropriate fire or soil disturbance may in the long term threaten the viability of populations
- **Clearing.** MRWA cleared 12 plants at populations 1 and 2 during widening of the North West Coastal Highway, resulting in population decline and habitat degradation.
- **Weed invasion.** Grading, stock movement, slashing and spraying greatly promote weeds. Populations 6 and 7 have a high weed composition with 50% of these sites now weedy. Weeds suppress early plant growth by competing with the species for soil moisture, nutrients and light. Weeds also exacerbate grazing pressure and increase the fire hazard due to high fuel loads.
- **Habitat fragmentation.** The Shire of Northampton has less than 5% of pre-European natural vegetation remaining and most populations of *Androcalva bivillosa* are subject to the effects of fragmentation. These can be summarised as: 1. the creation of small patches of remnant vegetation, 2. the alteration of landscape processes, 3. the isolation of patches in a more or less altered matrix and 4. the reduction of population sizes (Hobbs and Yates 2003).
- **Small population size.** Small population size is likely to result in low genetic diversity and may limit the long term viability of the species.
- **Recreational activities.** Population 8 is threatened by recreational vehicles. Population 9 is in an airport carpark and is threatened by accidental damage from visitors.
- **Rabbits** (*Oryctolagus cuniculus*). Although direct grazing of plants has not been observed, soil disturbance during warren construction and increased nutrient levels and the introduction of weeds from droppings may impact on populations.

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

Table 2. Summary of population information and threats

TPFL population number & location	Land status	Year/no. mature plants	Condition		Threats
			Plants	Habitat	
1. N of Binnu	MRWA road reserve	2004 5 2013 15 2015 10 2016 0	Healthy	Degraded	Clearing, road maintenance, poor recruitment, fragmentation effects, fire
2a and 2b. N of Binnu	MRWA road reserve	2004 6 2011 7 (1) 2012 10 2015 8 2016 5	Moderate	Degraded	Road maintenance, poor recruitment, fragmentation effects, fire
3. S of Binnu	MRWA road reserve	2004 1 2014 1 2016 1		Degraded	Road maintenance, poor recruitment, fragmentation effects, fire
6. E of Binnu	Shire road reserve	2011 2 2013 4 2016 4	Moderate	Good	Road maintenance, weeds, poor recruitment, fragmentation effects, fire
7. E of Binnu	Shire road reserve	2011 2 2013 2 2016 0	Healthy	Good	Road maintenance, weeds, poor recruitment, fragmentation effects, fire
8. NW of Binnu	Shire reserve (water)	2014 51 2015 38 2016 31		Excellent	Poor recruitment, fire, recreational activities, rabbits, weeds
9. NE of Kalbarri	Airport	2013 5 2014 6 2016 10	Healthy	Excellent	Accidental damage, poor recruitment, fire
10. NE of Kalbarri	Wildlife Sanctuary	2014 9 (1) 2016 5	Moderate	Excellent	Track/firebreak maintenance, poor recruitment, fire, small population size

Note: () = number of juveniles/seedlings. Populations 2 and 4 were found to be the same population (Population 2). The coordinates for the herbarium specimen for Population 5 were incorrect and the location is now considered to be that of Population 2. All populations are considered to be important populations.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions for development and/or land clearing in the immediate vicinity of *Androcalva bivillosa* may require assessment. Actions that could result in any of the following may potentially result in a significant impact on the species:

- Damage or destruction of occupied or potential 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 the species, and important populations

Androcalva bivillosa is listed as Threatened Flora in Western Australia and it is considered that all known habitat for wild populations is critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *A. bivillosa* 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 *Androcalva bivillosa* will also benefit the two Declared Rare Flora (DRF) species and three Priority flora taxa listed in the table below.

Table 3. Conservation-listed flora species occurring within 500m of *Androcalva bivillosa*

Species name	Conservation status (WA)	Conservation status (EPBC Act 1999)
Eucalyptus cuprea	Threatened (CR)	EN
Caladenia barbarella	Threatened (EN)	EN
Scholtzia sp. Folly Hill (M.E. Trudgen 12097)	Priority 2	-
Arnocrinum drummondii	Priority 3	-
Gnephosis cassiniana	Priority 3	-

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

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 Department of Aboriginal Affairs (DAA) Aboriginal Heritage Sites Register revealed no sites of Aboriginal significance adjacent to populations of *Androcalva bivillosa*. However, input and involvement has been sought through the DAA to determine if there are any issues or interests with respect to management for this species in the vicinity of these sites. Indigenous opportunity for future 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.

Social and economic impacts

Management practices on land containing populations of *Androcalva bivillosa* may need to be modified to include weed control and protection from road maintenance activities. Recovery actions refer to continued negotiations between stakeholders with regard to these areas.

Affected interests

The implementation of this plan has implications for private land managers, the Shire of Northampton and MRWA, particularly as most populations occur on lands not specifically managed for conservation.

Evaluation of the plan's performance

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

2. Recovery objective and criteria

Plan objective

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

Recovery criteria

Criteria for recovery success: The plan will be deemed a success at the completion of its five year term 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 the known populations has remained within a 15% range or has increased by >15% from 87 to 100 or more or
- New populations have been found, increasing the number of known populations from eight to nine 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.

Criteria for recovery failure: The plan will be deemed a failure at the completion of its five year term 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 >15% from 87 to 74 or less or
- The area of occupancy has decreased by >10%.

3. Recovery actions

Existing recovery actions

Landholders have been notified of the location and threatened status of the species, their legal obligations in regards to its protection, and contact details for management assistance.

Declared Rare Flora (DRF) markers have been installed at Populations 1, 3, 6 and 7 and Subpopulations 2a and 2b. These alert people to the presence of threatened flora and the need to avoid work that may damage the species or its habitat. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed to relevant Shires and other organisations.

The gravel pit containing Population 8 was rehabilitated by MRWA in 2014 using topsoil taken from the road reserve at Populations 1 and 2. Rehabilitation was undertaken as per MRWA's 'Ajana Back Road Material Source Rehabilitation Plan' (Sutherland 2014) and translocation proposal (Chant *et al*. 2014). The aim is to improve the long term persistence of *A. bivillosa* by minimising the loss of individuals resulting from road widening. Photopoint monitoring of any recruitment is being undertaken. Additionally, cuttings taken from *Androcalva bivillosa* will be planted into the rehabilitated site or an alternative site.

Androcalva bivillosa has been extensively and opportunistically surveyed for in areas of suitable habitat. Surveys include:

- Inspection of known sites on MRWA road reserves by Parks and Wildlife Conservation Flora Officer Alanna Chant between 2004 and 2013.
- Surveying all known sites by Parks and Wildlife staff Kiera Foster and Catherine Page between 2008 and 2012.
- An extensive flora and vegetation survey within Kalbarri National Park in 2012 by Kiera Foster. This included 13 old disturbed resource pits along an access track to the north of the Airport (Foster 2013).
- A spring survey of roadsides and gravel pits over four consecutive years by Robin Simkin (recovery team member and Kalbarri local property owner). Two new subpopulations (six plants) were found during this survey work.
- Survey of road reserves, gravel pits and areas of recent machine activity within the vicinity of known locations by Alanna Chant, Robin Simkin and Janet Newell in spring 2013. Two new populations (10 plants) were found during the survey.
- Surveys of a known site and Eurardy Station by Alanna Chant, Robin Simkin and Vanessa Westcott (Bush Heritage Ecologist) in January 2014. Two plants were found at the recorded collection site.
- A MRWA commissioned survey of a gravel pit on Eurardy Station in July 2009. *Androcalva bivillosa* was not found during this survey (GHD 2009). MRWA also commissioned a consultant to survey areas of the North West Coastal Highway in 2013 (GHD 2014). No new plants were located.
- The Wildflower Society of Western Australia completed a Flora Survey and Field Herbarium Project over two weekends during spring 2003 (late August and early October).
- Don and Barbara Bellairs (former Geraldton District threatened flora recovery team members) recorded the species on a road reserve near Ajana in 1990. Despite spending over 20 years collecting

plant specimens and surveying known areas where the species occurs they have not found it at any other location.

The Botanic Gardens and Parks Authority (BGPA) have seventeen plants propagated from cutting material collected by Parks and Wildlife staff in February 2014 and 20 plants propagated from cutting material collected by Parks and Wildlife staff in December 2014.

Seed collected from cultivated plants and four natural populations is stored at –20°C at the Parks and Wildlife Threatened Flora Seed Centre (TFSC) (see table 4).

Table 4. TFSC seed collection details for *Androcalva bivillosa*

Accession number	Date collected	TPFL population number	Type	Seed in storage
04320	9/12/2013	6	I/2	Not yet processed
04321	9/12/2013	2	B/2	Not yet processed
04458	9/12/2014	1	I/2, I/2, I/2	Not yet processed
04470	9/12/2014	2	I/1, I/2	Not yet processed
04471	9/12/2014	7	I/5	Not yet processed
04501	23/12/2014	Cultivated at Kings Park	I/3	Not yet processed

Monitoring has been carried out opportunistically with plant numbers and current threats recorded. Global Positioning System (GPS) locations of all populations have been recorded in Geographic Information System databases at Geraldton District and at Species and Communities Branch (SCB).

Future recovery actions

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

1. Coordinate recovery actions

Parks and Wildlife with assistance from the GDTFCRT will oversee the implementation of recovery actions for *Androcalva bivillosa* and will include information on progress in annual reports.

Action:	Coordinate recovery actions
Responsibility:	Parks and Wildlife (Geraldton District), with assistance from the GDTFCRT
Cost:	$8,000 per year

2. Monitor populations

Monitoring of *Androcalva bivillosa* populations and habitat should be undertaken to identify trends or potential management requirements. Population monitoring should record the health and expansion or decline in populations, 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 (drought). Specific monitoring of hydrology and activities relating to research into the biology and ecology of *Androcalva bivillosa* are included in other recovery actions detailed below.

Action:	Monitor populations
Responsibility:	Parks and Wildlife (Geraldton District), with assistance from the GDTFCRT
Cost:	$8,000 per year

3. Develop and implement a translocation proposal

Translocations may be required for the long term conservation of *Androcalva bivillosa* as natural populations are in decline. With the exception of population 8 and possibly population 10 most natural populations are in disturbed, insecure habitat and augmentation is of limited value. New sites for translocation must therefore be located.

Information on the translocation of threatened plants and animals in the wild is provided in Parks and Wildlife Corporate Policy Statement No. 35 (DPaW 2015*a*), Parks and Wildlife Corporate Guideline No. 36 (DPaW 2015*c*) 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. Translocation is not an alternative to *in situ* conservation and is not a suitable ameliorative, compensatory, or mitigating measure for development and should be considered as a last resort when all other options are deemed inappropriate or have failed (Vallee *et al*. 2004). Note, however, a translocation proposal has been prepared and is required as an offset to a MRWA road widening project which has impacted populations 1 and 2.

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).

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 a translocation proposal
Responsibility:	Parks and Wildlife (Science and Conservation Division, Geraldton District), BGPA
Cost:	$42,000 in years 1 and 2; and $26,500 in subsequent years as required

4. Restrict access

Access into Populations 8 and 9 will be restricted through the installation of barriers such as bollards or fencing. At population 8 this will be in accordance with the Habitat Restoration Proposal (Chant *et al*. 2014). At population 9 installation of barriers will be carried out in liaison with the Shire of Northampton.

Action:	Restrict access
Responsibility:	Parks and Wildlife (Geraldton District), Shire of Northampton, MRWA (at Population 8)
Cost:	$30,000 (for fencing) in years 1 and 2

5. Install DRF markers

DRF markers are required at Populations 9 and 10.

Action:	Install DRF markers
Responsibility:	Parks and Wildlife (Geraldton District), Shire of Northampton, landowners
Cost:	$4,000 in year 1

6. Undertake weed control

Weeds are a threat to several populations and the following actions should be implemented:

1. Determine which weeds are present, map them, and prioritise control sites.
2. Select appropriate control technique; herbicide, mowing or hand weeding.
3. Control invasive weeds by hand removal and/or spot spraying when weeds first emerge.
4. Monitor the success of the treatment on weed death, and the tolerance of *Androcalva bivillosa* and associated native plant species to the weed control treatment.
5. Report on the method and success of the treatment, and effect on *Androcalva bivillosa* and associated species.
6. Revegetate with site-specific native species to maintain low weed levels.

Action:	Undertake weed control
Responsibility:	Parks and Wildlife (Geraldton District)
Cost:	$10,000 per year, as required

7. Undertake regeneration trials

Habitat disturbance (physical or fire) is thought to promote recruitment in *Androcalva bivillosa* and it is recommended that disturbance trials be undertaken.

Action:	Undertake regeneration trials
Responsibility:	Parks and Wildlife (Science and Conservation Division, Geraldton District)
Cost:	$10,000 in years 1 and 3, $4,000 in years 2, 4 and 5

8. Obtain biological and ecological information

It is recommended that research on the biology and ecology of *Androcalva bivillosa* include:

1. Identification of pollinators and their habitat requirements.
2. Soil seed bank dynamics.
3. Seed viability.
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, Geraldton District)
Cost:	$50,000 in years 1–3

9. Develop and implement a fire management strategy

A fire management strategy will be developed in consultation with land owners/managers, that recommends fire frequency, intensity and seasonality, precautions to prevent bushfire and strategies for reacting to bushfire, and the need, method of construction and maintenance of firebreaks. The risk of fire occurring in the habitat of populations should be minimised, except where it is being used to assist recovery. All data relating to fire response of the species will be entered into the Threatened Priority Flora (TPFL) fire response data base.

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

10. Undertake surveys

It is recommended that areas of potential suitable habitat be surveyed for the presence of *Androcalva bivillosa*. All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and reduce unnecessary duplicate surveys. Where possible, volunteers from the local community, landcare groups, Wildflower Society of WA and naturalists' clubs will be encouraged to become involved.

Action:	Undertake surveys
Responsibility:	Parks and Wildlife (Geraldton District), with assistance from the GDTFCRT and volunteers
Cost:	$10,000 per year

11. Collect and store seed

To guard against the extinction of natural populations of *Androcalva bivillosa* it is recommended that seed be collected and stored at the Parks and Wildlife TFSC. Collections should aim to sample and preserve the maximum range of genetic diversity possible by collecting from the widest range of reproductive plants. Seed has been collected from Populations 1, 2, 6 and 7 but further collections are required.

Action:	Collect and store seed
Responsibility:	Parks and Wildlife (Geraldton District, TFSC)
Cost:	$10,000 per year

12. Ensure long-term protection of habitat

Ways and means of achieving protection of existing populations are limited. Possible methods of achieving future conservation management include developing a Management Plan in consultation with land managers, covenanting and purchasing land.

Action:	Ensure long-term protection of habitat
Responsibility:	Parks and Wildlife (Geraldton District, Species and Communities Branch (SCB)), land managers
Cost:	$4,000 per year

13. Liaise with land managers and Aboriginal communities

Staff from Parks and Wildlife Geraldton District will liaise with appropriate land managers to ensure that populations of *Androcalva bivillosa* are not accidentaly damaged or destroyed and the habitat is maintained in a suitable condition for the conservation of the species. Aboriginal consultation will take place to determine if there are any issues or interests in areas that are habitat for the species and opportunities will be provided for Aboriginal people to be involved in implimenting this plan.

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

14. Map habitat critical to the survival of *Androcalva bivillosa*

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

Action:	Map habitat critical to the survival of *Androcalva bivillosa*
Responsibility:	Parks and Wildlife (SCB, Geraldton District)
Cost:	$6,000 in year 2

15. Promote awareness

The importance of biodiversity conservation and the protection of *Androcalva bivillosa* will be promoted to the public through poster displays and the development of an information sheet which includes a description of the plant, its habitat type, threats, management actions and photos. Formal links with local naturalist groups and interested individuals will also be encouraged.

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

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

If *Androcalva bivillosa* is still listed as Threatened Flora at the end of the five-year term of this plan, the need for further recovery actions and/or a review of this plan will be assessed and a revised plan prepared if necessary.

Action:	Review this plan and assess the need for further recovery actions
Responsibility:	Parks and Wildlife (SCB, Geraldton District)
Cost:	$6,000 at the end of year 5

Table 5. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	Parks and Wildlife (Geraldton District), with assistance from the GDTFCRT	Ongoing
Monitor populations	High	Parks and Wildlife (Geraldton District), with assistance from the GDTFCRT	Ongoing
Develop and implement a translocation proposal	High	Parks and Wildlife (Science and Conservation Division, Geraldton District), BGPA	2020
Restrict access	High	Parks and Wildlife (Geraldton District), Shire of Northampton	2017
Install DRF markers	High	Parks and Wildlife (Geraldton District), Shire of Northampton, landowners	2016
Undertake weed control	Medium	Parks and Wildlife (Geraldton District)	Ongoing
Undertake regeneration trials	High	Parks and Wildlife (Science and Conservation Division, Geraldton District)	2020
Obtain biological and ecological information	High	Parks and Wildlife (Science and Conservation Division, Geraldton District)	2018
Develop and implement a fire management strategy	High	Parks and Wildlife (Geraldton District)	Developed by 2016, implementation ongoing
Undertake surveys	High	Parks and Wildlife (Geraldton District), with assistance from the GDTFCRT and volunteers	Ongoing
Collect and store seed	High	Parks and Wildlife (Geraldton District, TFSC)	2020
Ensure long-term protection of habitat	Low	Parks and Wildlife (Geraldton District, SCB)	2020
Liaise with land managers and Aboriginal communities	High	Parks and Wildlife (Geraldton District)	Ongoing
Map habitat critical to the survival of *Androcalva bivillosa*	Medium	Parks and Wildlife (SCB, Geraldton District)	2017
Promote awareness	Medium	Parks and Wildlife (Geraldton District, SCB, PICA), with assistance from the GDTFCRT	2020
Review this plan and assess the need for further recovery actions	Medium	Parks and Wildlife (SCB, Geraldton District)	2021

4. Term of plan

This plan will operate from December 2016 to November 2021 but will remain in force until withdrawn or replaced. If *Androcalva bivillosa* is still listed as Threatened at the end of the five year term of this plan, a review of this plan will be completed, the need for further recovery actions determined and a revised plan prepared if necessary.

5. References

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6. Taxonomic description

Androcalva bivillosa

Wilkins, C.F. and Whitlock, B.A. (2011) A new Australian genus, *Androcalva*, separated from *Commersonia* (Malvaceae *s.l.* or Byttneriaceae). *Australian Systematic Botany* 24: 284–349.

Shrub decumbent or prostrate, 0.1–0.5 × 0.4–2.5 m, suckering not observed. *Young stems* with dense, sessile, white, pale brown or white, stellate hairs with 6–10 erect arms up to 1.1 mm long, over smaller stellate hairs, and with or without occasional, intermixed, white, clavate glandular trichomes up to 0.1 mm long. *Stipules* narrowly ovate or ovate, 1.7–5.5 × 0.45–1.3 mm; apex acute or acuminate, entire. *Mature leaves* petioles 2.1–6 mm long; blade flat or crisped, margins moderately recurved, base unequal, obtuse or attenuate, margin irregularly serrulate, apex obtuse; ovate, elliptic or oblong, 5.5–23 × 3–16.1 mm (*juvenile leaves* ~33 × 15 mm); discolorous dark green, glossy over paler green; abaxial surface tomentose, blade and ribs with sessile, white, stellate hairs with 6–12 erect arms up to 0.5 mm long, over smaller, stellate hairs, ribs with or without scattered, brown, stellate hairs, glandular trichomes absent; adaxial surface with scattered, to medium-density, sessile, white, stellate hairs with 1–6 erect arms up to 0.7 mm long, glandular trichomes absent. *Inflorescence* 12.2–16 mm long, 3–9-flowered. *Bud* base dark pink, apex white or pink; calyx lobes valvate; apex rounded. *Peduncle* 1–3.7 mm long. *Pedicel* non-articulated, 3.5–6.8 mm long. Peduncle and pedicel with dense, sessile, white, stellate hairs with ~6 erect arms up to 0.35 mm long, and intermixed medium-density, red-tipped, clavate, glandular trichomes up to 0.4 mm long. *Bract* narrowly ovate, to linear-lanceolate, 2.8–4.5 × 0.3–0.8 mm. *Calyx* white with tinge of pink or red at base; total calyx length 3–4.6 mm long; tube 0.8–1.4 mm long; lobes ovate, 2.1–3.3 × 1.1–2.1 mm, 70–73% of total, apex acute; abaxial surface with dense, white, stellate hairs with ~6 erect arms up to 0.7 mm long, and intermixed, medium-density, red-tipped, clavate, glandular trichomes up to 0.7 mm long; adaxial surface base glabrous, central lobe with scattered, white, simple, appressed hairs up to 0.2 mm long, glandular trichomes absent towards margin with medium-density, simple hairs up to 0.1 mm long. *Petals* white throughout or with base tinged with yellow or pink; 2.5–3 × 2.1–2.4 mm; glabrous; base when lateral lobes flattened obovate to obcordate, margin flat; apical ligule subsessile, obovate to broadly obovate, 1.7–1.9 × 1–1.1 mm. *Staminal tube* 0.45–0.8 mm long. *Staminodes* 3 between each stamen; central staminode ovate-lanceolate, white, 1.4–2.2 × 0.55–0.6 mm; 2 lateral staminodes linear, white, papillose, adnate to central staminode, 0.8–1.3 × 0.1–0.15 mm. *Filaments* 0.15–0.8 × 0.1–0.2 mm. *Anthers* dark red, with paler red connective, 0.4–0.5 × 0.7–0.8 mm. *Ovary* 5-loculate, ovoid, 0.7–1.1 × 0.7–1.1 mm; outer surface with pre-setae outgrowths. *Ovules* 5–9 per locule. *Styles* 0.6–0.8 mm long. *Fruit* ellipsoid; wings absent; thin woody wall 0.2 mm wide; 9–11 × 9–12 mm; outer surface with white, stellate hairs beneath dense setae throughout, 3.5–4.3 mm long; setae shaft straight, with medium-density, mainly simple but with occasional sessile or short-stalked, stellate hairs with 2–4 arms up to 0.3 mm long, glandular trichomes absent; apical hair with ~6 white arms; central-axis hairs up to 0.2 mm long. *Seed* obovate, exotesta black or dark brown, prominently aculeate or verrucate, 1.8–2.2 × 1.2–1.5 mm. *Aril* a white, translucent cap, ~1.2 × 1.5 mm.