Department of Parks and Wildlife

Interim Recovery Plan No. 353

Native Wild Rose (*Diplolaena andrewsii*)

Interim Recovery Plan

2015–2020

Department of Parks and Wildlife, Western Australia

July 2015

List of Acronyms

The following acronyms are used in this plan:

BGPA	Botanic Gardens and Parks Authority
CALM	Department of Conservation and Land Management
CCWA	Conservation Commission of Western Australia
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DEC	Department of Environment and Conservation
DAA	Department of Aboriginal Affairs
DGPS	Differential Global Positioning System
DMP	Department of Mines and Petroleum
DOL	Department of Lands
DPaW	Department of Parks and Wildlife (Parks and Wildlife)
DRF	Declared Rare Flora
EPBC	Environment Protection and Biodiversity Conservation
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
LGA	Local Government Authority
NP	National Park
NRM	Natural Resource Management
PEC	Priority Ecological Community
PICA	Public Information and Corporate Affairs
RP	Recovery Plan
SCB	Species and Communities Branch (Parks and Wildlife)
SPRAT	Species Profile and Threats
SRTFCRT	Swan Region Threatened Flora and Communities Recovery Team
SWALSC	South West Aboriginal Land and Sea Council
TEC	Threatened Ecological Community
TFSC	Threatened Flora Seed Centre
TPFL	Threatened and Priority Flora Database
TSSC	Threatened Species Scientific Committee
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
VU	Vulnerable
WA	Western Australia

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife Policy Statement No. 35 and Corporate Guideline No. 36 (DPaW 2015). Plans outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

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

This plan will operate from July 2015 to June 2020 but will remain in force until withdrawn or replaced. It is intended that, if *Diplolaena andrewsii* is still ranked as Vulnerable (VU) in Western Australia, this plan will be reviewed after five years and the need for further recovery actions assessed.

This plan was given regional approval on 10 July 2015 and was approved by the Director of Science and Conservation on 27 July 2015. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting Parks and Wildlife, as well as the need to address other priorities.

Information in this plan was accurate at July 2015.

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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Catherine Bourke	Flora Conservation Officer, Parks and Wildlife Perth Hills District
Kate Brown	Ecologist, Parks and Wildlife Swan Region
Vanessa Clarke	Former Senior Environmental Officer, Parks and Wildlife Native Vegetation Conservation Branch
Andrew Crawford	Principal Technical Officer, Threatened Flora Seed Centre, Parks and Wildlife Science and Conservation Division
Fred and Jean Hort	Parks and Wildlife volunteers
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Mia Podesta	Ecologist – TEC database, Parks and Wildlife Species and Communities Branch
Amanda Shade	Assistant Curator (Nursery), Botanic Gardens and Parks Authority
Niall Sheehy	Conservation Officer, Parks and Wildlife Perth Hills District

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

Cover photograph by Jean Hort.

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Summary

Scientific name:	*Diplolaena andrewsii*	**Common name:**	Native Wild Rose
Family:	Rutaceae	**Flowering period:**	July–October
DPaW region:	Swan	**DPaW district:**	Perth Hills
Shires:	Swan, Mundaring	**NRM regions:**	Swan, Avon
IBRA regions:	Jarrah Forest, Swan Coastal Plain	**Recovery team:**	SRTFCRT
IBRA subregions:	Northern Jarrah Forest, Perth		

Distribution and habitat: *Diplolaena andrewsii* is known from two areas 17km apart, one north-west of Gidgegannup and the other in John Forrest National Park, north-east of Swan View. Both locations are in the Darling Range. The species grows in brown, clay loam among granite outcrops and hillsides in marri (*Corymbia calophylla*) and wandoo (*Eucalyptus wandoo*) woodlands.

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 *Diplolaena andrewsii* and that the wild populations are important populations. Habitat critical to the survival of *D. andrewsii* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Conservation status: *Diplolaena andrewsii* is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Vulnerable (VU) in Western Australia under International Union for Conservation of Nature (IUCN) 2001 Red List criteria D1+2 due to less than 1,000 mature individuals being known in the wild and a very restricted area of occupancy and number of locations. The extent of occurrence is approximately 17km^2; and the area of occupancy is 0.026km^2. The species is not listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The main threats to the species are weed invasion, road, track and firebreak maintenance, altered fire regimes, recreational activities, powerline maintenance, poor recruitment, feral pig activity and future mining operations.

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 made aware of the existence of this species and its locations.
2. Parks and Wildlife research associate Fred Hort conducted over 87 hours of opportunistic survey for *Diplolaena andrewsii* between August 2005 and January 2006, during which no new populations were located.
3. A weed management plan for *Diplolaena andrewsii* was prepared by Parks and Wildlife Swan Region in 2011 using funds obtained through Western Australia's Natural Resource Management (NRM) program.
4. Some 435 *Diplolaena andrewsii* seeds collected from Population 2 in November 2008 are stored in the Parks and Wildlife Threatened Flora Seed Centre (TFSC) at −18°C.
5. Active weed spraying programs have been undertaken by the City of Swan and landowners at Subpopulations 1a, 1b, 1e and 1f.
6. A weed control trial was undertaken at Populations 2f and g from 2011 to 2014.
7. The Botanic Gardens and Parks Authority (BGPA) have six *Diplolaena andrewsii* plants in their conservation garden that are approximately three years old.

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 considered a success if one or more of the following take place.

- No important populations have been lost and the number of mature plants within those populations has remained within a 5% range or has increased by >5% over the term of the plan from 471 to 495 or more or
- New populations have been found, increasing the number of known populations from three to four or more over the term of the plan with no net loss of mature plants or
- The area of occupancy has increased by >10% over the term of the plan with no net loss of mature plants.

Criteria for recovery failure: The plan will be considered a failure if one or more of the following take place.

- Important populations have been lost or
- The number of mature plants has decreased by <5% from 471 to 447 or less or
- The area of occupancy has decreased by >10% over the term of the plan with a loss of mature plants.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Undertake regeneration trials
4. Implement actions listed in weed management plan
5. Install Declared Rare Flora markers
6. Manage recreational impacts
7. Develop and implement a fire management strategy
8. Collect and store seed
9. Undertake surveys
10. Ensure long-term protection of habitat
11. Obtain biological and ecological information
12. Liaise with land managers and Aboriginal communities
13. Map habitat critical to survival
14. Promote awareness
15. Review this plan and assess the need for further recovery actions

1. Background

History

The first collection of *Diplolaena andrewsii* was made from Swan View, east of Perth in 1901 by C. Anderson. The species was described by Carl Ostenfield in 1921.

There are three known populations of *Diplolaena andrewsii* comprising 471 mature plants.

Description

Diplolaena andrewsii is an erect shrub 0.5 to 1 metre high. It has branchlets with ferruginous stellate hairs which are often stipitate. The leaves are paper-like, flat and broadly ovate, 13 to 30mm by 10 to 20mm, and are sparsely stellate to hairy on the upper surface and densely stellate to hairy on the lower surface. The flower heads are small and 10 to 20mm across. The outer involucral bracts are thin, broadly ovate, 5 to 10mm by 5 to 7mm, sparsely stellate to hairy on the outside, and hairy with white, woolly, stellate hairs on the inside. The inner bracts are reddish brown with white membranous margins, oblong, 10 to 12mm long and smooth outside. The petals are narrowly oblong, approximately 5mm long, white–ciliate at the apex. The stamens are exserted, pale red, and 10 to 15mm long. The species differs from other members of the genus by having narrowly oblong petals in comparison to longer, more linear petals (Marchant *et al*. 1987).

Illustrations and/or further information

Marchant, N.G., Wheeler, J.R., Rye, B.L., Bennett, E.M., Lander, N.S. and Macfarlane, T.D. (1987) Flora of the Perth Region, Part One. Western Australian Herbarium, Department of Agriculture, Western Australia; Western Australian Herbarium (1998–) FloraBase – The Western Australian Flora. Department of Parks and Wildlife. http://florabase.dec.wa.gov.au/.

Distribution and habitat

Diplolaena andrewsii is known from two areas 17km apart, one north-west of Gidgegannup and the other in John Forrest National Park, north-east of Swan View. Both are on the Darling Scarp. The species grows with *Acacia pulchella*, *A. saligna*, *Banksia sessilis*, *Borya sphaerocephala*, *Calothamnus quadrifidus*, *Chamaescilla corymbosa*, *Dioscorea hastifolia*, *Hakea amplexicaulis*, *H. undulata*, *H. trifurcata*, *Hovea pungens*, *Orthrosanthus laxus*, *Phyllanthus calycinus*, *Pimelea ciliata*, *Stypandra glauca*, *Trymalium ledifolium* and *Xanthorrhoea preissii* in brown, clay-loam among granite outcrops and hillsides in marri (*Corymbia calophylla*) and wandoo (*Eucalyptus wandoo*) woodlands.

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

TPFL population number & location	DPaW district	Shire	Vesting	Purpose	Manager
1a. NW of Gidgegannup	Perth Hills	Swan	LGA	Recreation	City of Swan
1b. NW of Gidgegannup	Perth Hills	Swan	Private property	Freehold	Landowners
1c. NW of Gidgegannup	Perth Hills	Swan	Private property	Freehold	Landowners
1d. NW of Gidgegannup	Perth Hills	Swan	LGA	Road verge	City of Swan
1f. NW of Gidgegannup	Perth Hills	Swan	LGA	Road verge	City of Swan
2a. NE of Swan View	Perth Hills	Mundaring	CCWA	NP	Parks and Wildlife
2c. NE of Swan View	Perth Hills	Mundaring	CCWA	NP	Parks and Wildlife
2d. NE of Swan View	Perth Hills	Mundaring	CCWA	NP	Parks and Wildlife
2e. NE of Swan View	Perth Hills	Mundaring	CCWA	NP	Parks and Wildlife
2f. NE of Swan View	Perth Hills	Mundaring	CCWA	NP	Parks and Wildlife
2g. NE of Swan View	Perth Hills	Mundaring	CCWA	NP	Parks and Wildlife
2h. NE of Swan View	Perth Hills	Mundaring	CCWA	NP	Parks and Wildlife
2i. NE of Swan View	Perth Hills	Mundaring	CCWA	NP	Parks and Wildlife
3. NE of Swan View	Perth Hills	Mundaring	CCWA	NP	Parks and Wildlife

Biology and ecology

Diplolaena andrewsii is killed by fire and regenerates from soil-stored seed. In the summer of 1996/97 wildfire killed 50% of plants at Subpopulation 2a. A further wildfire occurred in the summer of 2003/04 killing plants in Subpopulations 2a–2i (excluding 2d). In 2006, monitoring revealed that the species had regenerated well. However, in a recent visit to Subpopulations 2a–2c and 2e, the population size had decreased significantly.

Frequent fire facilitates invasion by weeds and the many fire events within John Forrest National Park (Population 2), would have played a significant role in the expansion of Watsonia into native plant communities. A weed control trial implemented at Subpopulations 2f and 2g in 2011 found that herbicide was very effective in controlling Watsonia in the first year of treatment. However, over the following three years there was a dramatic decline in the number of live adult *Diplolaena andrewsii* plants. As the decline occurred in both the control (decrease of 97.5%) and treatment plots (decrease by 96.8%), it did not appear to be related to herbicide application and was potentially a result of the time since last burnt (see figure from Brown and Bourke 2014 below).

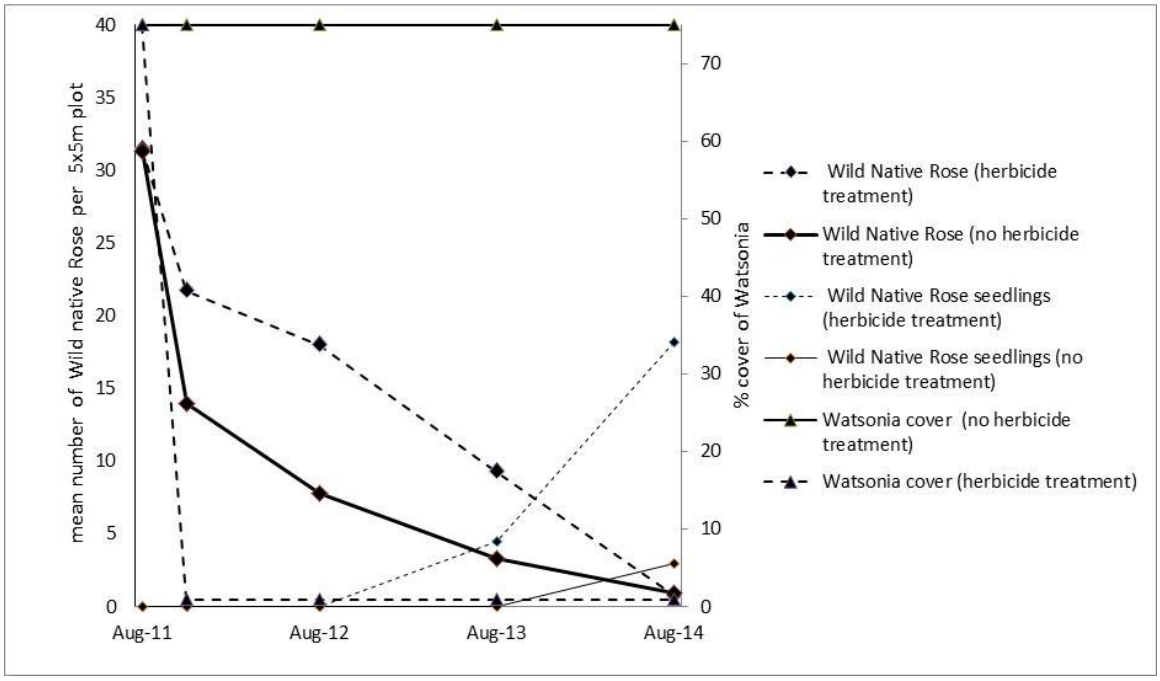

Figure 1: Mean number of *Diplolaena andrewsii* adults and seedlings and cover of Watsonia in 5m x 5m treatment and control plots (n=4) over three years (figure from Brown and Bourke 2014).

Conservation status

Diplolaena andrewsii is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Vulnerable (VU) in Western Australia under International Union for the Conservation of Nature (IUCN) 2001 Red List criteria D1+2 due to less than 1,000 mature individuals being known in the wild and a very restricted area of occupancy and number of locations. The extent of occurrence is approximately 17km^2; and the area of occupancy is 0.026km^2. The species is not listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Habitat degradation due to weed invasion**. A range of weed species were recorded at most subpopulations in John Forrest National Park (Population 2) by Bettink (2011). The two main invasive species are watsonia (*Watsonia meriana* var. *bulbillifera*, *W. borbonica*) and freesia (*Freesia alba x leichtlinii*). Other weed species that may become more of a threat in the future include cape tulip (*Moraea* sp.), hesperantha (*Hesperantha falcata*), bridal creeper (*Asparagus asparagoides*), Perennial veldt grass (*Ehrharta calycina*), paterson's curse (*Echium plantagineum*), fountain grass (*Pennisetum setaceum*), wild gladiolus *(Gladiolus caryophyllaceous*) and wild oat (*Avena fatua*). Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also increase the fire hazard due to the easy ignition of high fuel loads, which are produced annually by many grass weed species.
- **Road, track and firebreak maintenance.** Threats to Population 1 include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Several of these actions also encourage weed invasion.
- **Altered fire regimes.** Although *Diplolaena andrewsii* appears to germinate from soil-stored seed following fire, the species may not have enough time to reach maturity and set seed if the

interval between fires is too short. Conversely, results from the recent weed control trial suggest that, if the period between fire is too long, adult plants may senesce (Brown and Bourke 2014). The role of fire in the persistence of populations over time should be determined. Fire appears to also facilitate weed invasion and when it occurs should be followed up with appropriate weed control.

- **Recreational activities.** These are a threat to Subpopulations 1a and 2a–2i, and to a lesser extent Population 3 of this species. Subpopulation 1a is located in a recreation reserve adjacent to an access track in an area used for camping and is at risk from direct damage from trampling or clearing from walkers and 4WD vehicles, as well as users dumping rubbish. Population 2 is located in a National Park near popular walking trails and therefore is also at risk from being damaged. Population 3 is within a national park, but it is not near any designated trails or recreation sites.
- **Powerline maintenance.** Disturbance during maintenance is a potential threat to Subpopulations 1c and 1d as it may directly damage plants and encourage weed invasion.
- **Poor recruitment.** Subpopulations 2a–2i (excluding 2d) were subject to a wildfire in 2003/04 with good regeneration observed in 2006. However, in a recent visit to Subpopulations 2a, 2c and 2e, plant numbers had decreased significantly.
- **Feral pig activity.** This has been observed in the area of Subpopulation 1b. Feral pigs can damage threatened flora and their habitat by digging large areas of soil in search of food. Pig digging results in the degrading of understory vegetation but also appears to be promoting seedling recruitment of *Diplolaena andrewsii*. Pigs also have the potential to introduce weed seeds and nutrients, and soil disturbance encourages establishment of weeds.
- **Future mining operations.** Mineral extraction leases 70/3003 and 70/3283 (Bauxite Resources Limited) cover the site of Population 1, and, if implemented, have the potential to severely impact the species.

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

Table 2. Summary of population information and threats

TPFL population number & location	Land status	Year / no. of plants	Current condition (plants)	Current habitat condition	Threats
1a. ENE of Upper Swan	Recreation reserve	2006 3 2010 1 2013 0	Poor	Degraded	Track maintenance, recreational activities, weeds, rubbish dumping, altered fire regimes
1b. ENE of Upper Swan	Private property	1995 120 2005 25 2006 30 2009 39 [4] 2010 106 (85)[1] 2013 36 (6)	Moderate	Very good	Firebreak maintenance, feral pig activity, altered fire regimes
1c. ENE of Upper Swan	Private property	2005 58 (2) 2009 26 [2] 2010 3 (35) 2013 36 (18)	Moderate	Good	Firebreak and power line maintenance, altered fire regimes
1d. ENE of Upper Swan	Road reserve	2006 10 2009 14 2010 4 (2)	Moderate	Good	Road, power line and firebreak, maintenance, altered fire regimes

		2013 27 (7)			
1f. ENE of Upper Swan	Road reserve	2006 10 2010 5 (9) 2013 24 (10)	Moderate	Good	Weeds, road maintenance, fire
2a. NE of Swan View	NP	1990 20 1992 10 1996 70 2003 35 [35] 2006 117 (24) 2010 51 (2) [2]	Poor	Good/degraded	Weeds, recreational activities, altered fire regimes
2c. NE of Swan View	NP	2006 45 2008 50 2010 54 2011 6	Healthy	Excellent	Weeds, recreational activities
2d. NE of Swan View	NP	2006 16 (1) 2010 9 (12) [1] 2012 11 (4)	Healthy	Excellent	Weeds
2e. NE of Swan View	NP	2008 164 (<10) 2010 12 (37) [1]	Moderate	Degraded	Weeds, recreational activities
2f. NE of Swan View	NP	2010 127 (5)	Healthy	Good/degraded	Weeds, recreational activities (trampling)
2g. NE of Swan View	NP	2010 54	Poor	Good/degraded	Weeds, recreational activities (trampling)
2h. SE of Swan View	NP	2011 1	Healthy	Excellent/very good	Weeds, recreational activities, altered fire regimes
2i. NE of Swan View	NP	2012 13 [2]	Healthy	Very good	Weeds, fire
3. NE of Swan View	NP	2011 8 2013 73 (15) [4]	Healthy	Good	Weeds, altered fire regimes

Note: ( ) = number of seedlings/juveniles; [ ] = number dead; Populations in **bold text** are considered to be important populations; Population 1e was merged with 1b and Population 2b was merged with 2a.

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 *Diplolaena andrewsii* 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
- A 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

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

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Diplolaena andrewsii* will also improve the status of associated native vegetation, including the two Declared Rare Flora (DRF) and three Priority flora listed in the table below.

Table 3. Conservation–listed flora species occurring within 500m of *Diplolaena andrewsii*

Species name	Conservation status (WA)	Conservation status (EPBC Act)
Anthocercis gracilis	DRF (VU)	VU
Thelymitra dedmaniarum	DRF (CR)	EN (listed as *Thelymitra manginii*)
Acacia oncinophylla subsp. *oncinophylla*	Priority 3	
Darwinia pimelioides	Priority 4	
Drosera occidentalis subsp. *occidentalis*	Priority 4	

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

Diplolaena andrewsii does not occur within or adjacent to any Threatened Ecological Communities (TECs) or 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. *Diplolaena andrewsii* 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 one site of Aboriginal significance (#3536; Swan River) adjacent to Population 1 of *Diplolaena andrewsii*. There are also four sites adjacent to Populations 2 and 3, including site #'s 3188 (Darling Range); 3720 (Blackadder and Woodbridge Creek); 3759 (Jane Brook); and 3785 (Rocky Pool). 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 management for this species at these sites. Indigenous opportunity for future involvement in the implementation of the recovery plan is included as an action in the plan. Indigenous involvement in management of land covered by an agreement under the *Conservation and Land Management Act 1984* is also provided for under the joint management arrangements in that Act, and will apply if an agreement is established over any reserved lands on which this species occurs.

Social and economic impacts

Some social and economic impacts may occur in relation to populations of *Diplolaena andrewsii* on private property (Subpopulations 1b and 1c) through the loss of land available for development. For populations under the management of the City of Swan (Subpopulations 1a, 1d and 1f) impact may be through the cost of implementing recovery actions and restrictions imposed on the management of the land, including maintenance of the road infrastructure. Mineral exploration leases also cover the area where Population 1 of *Diplolaena andrewsii* occurs and there is potential for economic impact should mining operations go ahead. In addition, five sites of Aboriginal significance occur in the areas of populations and recovery actions may potentially impact on Indigenous interests.

Affected interests

The implementation of this plan has some implications for the City of Swan and private landholders in those areas where populations occur on lands not specifically managed for conservation. Mining tenement holders Bauxite Resources Limited may also be affected by actions referred to in this plan.

Evaluation of the plan's performance

Parks and Wildlife with assistance from the Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) 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

Criteria for recovery success: The plan will be considered a success if one or more of the following take place.

- No important populations have been lost and the number of mature plants within those populations has remained within a 5% range or has increased by >5% over the term of the plan from 471 to 495 or more or
- New populations have been found, increasing the number of known populations from three to four or more over the term of the plan with no net loss of mature plants or
- The area of occupancy has increased by >10% over the term of the plan with no net loss of mature plants.

Criteria for recovery failure: The plan will be considered a failure if one or more of the following take place.

- Important populations have been lost or
- The number of mature plants has decreased by <5% from 471 to 447 or less or
- The area of occupancy has decreased by >10% over the term of the plan with a loss of mature plants.

3. Recovery actions

Existing recovery actions

Parks and Wildlife, with assistance from the SRTFCRT, is overseeing the implementation of recovery actions for *Diplolaena andrewsii*.

Land managers have been made aware of *Diplolaena andrewsii* and its locations. Notifications detail the current DRF status of the species and the associated legal obligations in regards to its protection.

Parks and Wildlife research associate Fred Hort completed over 87 hours of opportunistic survey for *Diplolaena andrewsii* between August 2005 and January 2006, with no new populations located. He has also searched a large area of the Darling Scarp while looking for other DRF species but has not seen *D. andrewsii* outside its known range.

A weed management plan for *Diplolaena andrewsii* was prepared by Parks and Wildlife Swan Region in 2011 using funds obtained through the State Natural Resource Management (NRM) program. The proposal aimed to:

- Complete survey and mapping of individuals within Population 2 using a Differential Global Positioning System (DGPS);
- Identify what other weed control programs are being undertaken in the area by Parks and Wildlife volunteers;
- Compile a fire history map of the area;
- Complete survey (recording presence/absence) of weed species within 50m radius of populations;
- Identify the priority weed species (based on invasiveness, impact and potential/current distribution);
- Complete mapping priority weed species using a DGPS, and if appropriate map beyond the boundaries of populations to an appropriate distance, depending on such factors as the slope and position in the landscape (for movement of seed in water);
- Compile maps, information and recommendations in the form of a weed management plan for Population 2;
- Complete detailed mapping using DGPS of all plants within Population 1 (Shire reserve, road reserve and private property locations).

A weed control trial was implemented (see Brown and Bourke 2014) at Subpopulations 2f and g between 2011 to 2014 to assess the impact of the herbicide Dalapon 2,2-DPA on *Diplolaena andrewsii* and to control Watsonia, as per recommendations made in the Weed Management Plan. A series of control and treatment plots were established with *D. andrewsii* plants tagged and numbered and Watsonia treated with herbicide prior to flowering. In the first year of treatment, the herbicide was found to be very effective in controlling Watsonia, but there was a dramatic decline in the number of live adult *D. andrewsii* plants over the following three years. As the decline occurred in both the control and treatment plots, it doesn't appear to be related to herbicide application.

Some 435 *Diplolaena andrewsii* seeds collected from Population 2 in November 2008 are stored in the Parks and Wildlife TFSC at –18°C. The seed has yet to be processed and germination tested.

Active weed spraying programs have been undertaken by the City of Swan and landowners at Subpopulations 1a, 1b and 1f.

Botanic Gardens and Parks Authority (BGPA) have six cutting grown *Diplolaena andrewsii* plants in their conservation garden and seven grafted plants in their nursery.

Future recovery actions

Parks and Wildlife is overseeing the implementation of this plan and, with the assistance of the SRTFCRT, will include information on progress in annual reports. Where recovery actions are implemented on lands other than those managed by Parks and Wildlife, permission has been or will be sought from the appropriate land managers prior to actions being undertaken.

The following recovery actions are roughly in order of descending priority, influenced by their timing over the term of the plan. However this should not constrain addressing any recovery action if funding is available and other opportunities arise.

1. Coordinate recovery actions

Parks and Wildlife, with assistance from the SRTFCRT, will coordinate recovery actions for *Diplolaena andrewsii* and include information on progress in annual reports.

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

2. Monitor populations

Monitoring of grazing (kangaroos), weed invasion, habitat degradation, hydrology (including salinity), population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity should, where possible, be conducted annually. Pig activity will also be monitored and, if necessary, may need to be controlled through baiting or other methods.

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

3. Undertake regeneration trials

As populations of *Diplolaena andrewsii* are senescing and fire has been shown to be an effective means of germinating soil stored seed in the wild, fire regeneration trials will be undertaken in conjunction with weed control.

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

4. Implement actions listed in weed management plan

Weeds are a threat to the majority of populations. The following actions as per Bettink (2011) will be implemented:

- Control priority weeds in all populations;
- Liaise with and support land managers in controlling watsonia in all populations;
- Treat infestation front and implement control trials of freesia within Populations 2 and 3;
- Map and control encroachment of cape tulip into Population 1; and
- Use any unplanned fires to implement broad scale watsonia control.

Action:	Implement actions listed in weed management plan
Responsibility:	Parks and Wildlife (Perth Hills District)
Cost:	$10,000 per year, as required

5. Install DRF markers

DRF markers are required at Subpopulations 1d and 1f to reduce the likelihood of accidental damage.

Action:	Install DRF markers
Responsibility:	Parks and Wildlife (Perth Hills District), City of Swan
Cost:	$4,000 in year 1

6. Manage recreational impacts

Monitor recreational/visitor impacts at Populations 2 and 3 and Subpopulation 1a and implement management actions as required. If necessary, access may be prevented through the installation of barriers such as large logs, bollards and fencing. Signs indicating the significance of the area may also be used to discourage visitors from entering the area.

Action:	Manage recreational impacts
Responsibility:	Parks and Wildlife (Perth Hills District), City of Swan
Cost:	$10,000 in years 1 and 2

7. Develop and implement a fire management strategy

A fire management strategy, including recommendations on fire frequency, intensity and seasonality, precautions to prevent wildfire and strategies for reacting to wildfire, and the need, method of construction, and maintenance of firebreaks, wil be developed and implemented. Fire, where possible, will be prevented from occurring in the habitat of populations, except where it is being used experimentally as a recovery tool. Permanent quadrats will be established to monitor post fire response. 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 (Perth Hills District, Swan Region)
Cost:	$10,000 in year 1, and $6,000 in years 2–5

8. Collect and store seed

To guard against the extinction of natural populations it is recommended that seed be collected and stored at the TFSC and BGPA. Collections should aim to sample and preserve the maximum range of genetic diversity possible (which should be determined by an appropriate molecular technique such as genetic fingerprinting if feasible).

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

9. Undertake surveys

Surveys should be undertaken in areas of potentially suitable habitat. Where feasible, volunteers from landcare groups, wildflower societies and naturalists clubs will be encouraged to participate. All surveyed areas will be recorded and the presence or absence of the subspecies documented to increase future survey efficiency and prevent duplication of effort.

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

10. Ensure long-term protection of habitat

Parks and Wildlife will investigate the possibility of land outside reserves that contains populations of *Diplolaena andrewsii* being placed in the reserve system or otherwise protected, such as through a conservation covenant.

Action:	Ensure long-term protection of habitat
Responsibility:	Parks and Wildlife (Perth Hills District, Species and Communities Branch (SCB) Nature Conservation Covenant Program and Land Unit), in consultation with Department of Lands (DOL) and Department of Mines and Petroleum (DMP)
Cost:	$4,000 per year

11. Obtain biological and ecological information

Research on the biology and ecology of *Diplolaena andrewsii* will include:

1. Identification of pollinators and their habitat requirements.
2. Seed viability.
3. Conditions necessary for natural germination.
4. Response to disturbance, competition, drought, inundation and grazing.
5. Longevity of plants, time taken to reach maturity, and minimum viable population size.
6. The impact of changes in hydrology.

Action:	Obtain biological and ecological information
Responsibility:	Parks and Wildlife (Science and Conservation Division, Perth Hills District, Swan Region)
Cost:	$50,000 in years 1–3

12. Liaise with land managers and Aboriginal communities

Parks and Wildlife will liaise with land managers to ensure that populations of *Diplolaena andrewsii* are not accidentaly damaged or destroyed, and the habitat is maintained in a suitable condition for the conservation of the taxon. Consultation with the Aboriginal community will take place to determine if there are any issues or interests in areas that are habitat for the taxon.

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

13. Map habitat critical to the survival of *Diplolaena andrewsii*

Although habitat critical to the survival of *Diplolaena andrewsii* is alluded to in Section 1, it has not yet been mapped. 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 *Diplolaena andrewsii*
Responsibility:	Parks and Wildlife (SCB, Perth Hills District)
Cost:	$6,000 in year 2

14. Promote awareness

The importance of biodiversity conservation and the protection of *Diplolaena andrewsii* will be promoted through the print and electronic media and by setting up poster displays. An information sheet, which includes a description of the plant, its habitat type, threats, management actions and photos, will be produced. Formal links with local naturalist groups and interested individuals will also be encouraged.

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

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

If *Diplolaena andrewsii* is still ranked as VU at the end of the five-year term of this plan, the plan will be reviewed and the need for further recovery actions assessed.

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

Table 4. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	Parks and Wildlife (Perth Hills District),with assistance from the SRTFCRT	Ongoing
Monitor populations	High	Parks and Wildlife (Perth Hills District), with assistance from the SRTFCRT	Ongoing
Undertake regeneration trials	High	Parks and Wildlife (Science and Conservation Division, Perth Hills District, Swan Region)	2018
Implement actions listed in weed management plan	High	Parks and Wildlife (Perth Hills District)	Ongoing
Install DRF markers	High	Parks and Wildlife (Perth Hills District), City of Swan	2016
Manage recreational impacts	High	Parks and Wildlife (Perth Hills District), City of Swan	2017
Develop and implement a fire management strategy	High	Parks and Wildlife (Perth Hills District, Swan Region)	Developed by 2016 with implementation ongoing
Collect and store seed	High	Parks and Wildlife (Perth Hills District, TFSC), BGPA	2020
Undertake surveys	High	Parks and Wildlife (Perth Hills District), with assistance from the SRTFCRT and volunteers	Ongoing
Ensure long-term protection of habitat	High	Parks and Wildlife (Perth Hills District, SCB Nature Conservation Covenant Program and Land Unit), in consultation with DOL and DMP	2020
Obtain biological and ecological information	High	Parks and Wildlife (Science and Conservation Division, Perth Hills District, Swan Region)	2018
Liaise with land managers and Aboriginal communities	Medium	Parks and Wildlife (Perth Hills District)	Ongoing
Map habitat critical to the survival of *Diplolaena andrewsii*	Medium	Parks and Wildlife (SCB, Perth Hills District)	2017
Promote awareness	Medium	Parks and Wildlife (Perth Hills District, SCB and PICA), with assistance from the SRTFCRT	Ongoing
Review this plan and assess the need for further recovery actions	Medium	Parks and Wildlife (SCB, Perth Hills District)	2020

4. Term of plan

This plan will operate from July 2015 to June 2020 but will remain in force until withdrawn or replaced. If *Diplolaena andrewsii* is still ranked VU after five years, the need for further recovery actions will be assessed and a revised plan prepared if necessary.

5. References

Bettink, K. (2011) Draft Weed Management and Restoration Plan for *Diplolaena andrewsii* Ostenf. (Native Wild Rose).

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Western Australian Herbarium (1998–) FloraBase – The Western Australian Flora. Department of Parks and Wildlife. http://florabase.dec.wa.gov.au/.

6. Taxonomic description

Diplolaena andrewsii

Marchant, N.G., Wheeler, J.R., Rye, B.L., Bennett, E.M., Lander, N.S. and Macfarlane, T.D. (1987) Flora of the Perth Region, Part One. Western Australian Herbarium, Department of Agriculture, Western Australia.

Shrub to 1m high; branchlets with ferruginous stellate hairs which are often stipitate. Leaves chartaceous, flat, broadly ovate, 13–30 x 10–20mm, sparsely stellate-hairy on upper surface, densely stellate-hairy on lower surface with hairs which are often stipitate, apex obtuse. Flower heads small, 10–20mm across. Outer involucral bracts thin, broadly ovate, 5–10 x 5–7mm, sparsely stellate–hairy outside, hairy with white, woolly, stellate hairs inside; inner bracts reddish brown with white membranous margins, oblong, 10–12mm long, glabrous outside. Petals narrowly oblong, ca 5mm long, white-ciliate at the apex. Stamens exserted, pale red, 10–15mm long.