



Department of  
Parks and Wildlife



Interim Recovery Plan No. **378**

# *Grevillea corrugata*

**Interim Recovery Plan**  
**2017–2022**



**Department of Parks and Wildlife, Western Australia**

March 2017

## 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
CFF	Conservation of Flora and Fauna
CITES	Convention on International Trade in Endangered Species
CR	Critically Endangered
DEC	Department of Environment and Conservation
DAA	Department of Aboriginal Affairs
DMP	Department of Mines and Petroleum
DPaW	Department of Parks and Wildlife
DRF	Declared Rare Flora
EPBC	Environment Protection and Biodiversity Conservation
IBRA	Interim Biogeographic Regionalization 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
PICA	Public Information and Corporate Affairs
RP	Recovery Plan
SCB	Species and Communities Branch
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
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
VU	Vulnerable
WA	Western Australia
WAPC	Western Australian Planning Commission

# 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 flora, fauna and 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This plan will operate from March 2017 to February 2022 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still listed as Threatened 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 8 March 2017 and was approved by the Director of Science and Conservation on 22 March 2017. 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 March 2017.

**Plan preparation:** This plan was prepared by:

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Andrew Crawford	Principal Technical Officer, Threatened Flora Seed Centre, Parks and Wildlife Science and Conservation Division
Catherine Bourke	Flora Conservation Officer, Parks and Wildlife Perth Hills District
Fred and Jean Hort	Parks and Wildlife volunteers
Marnie Mallie	Fire Flora Conservation Officer, Parks and Wildlife Perth Hills District
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Michael Hislop	Contract Consultant, Parks and Wildlife Science and Conservation Division
Vanessa Clarke	Former Senior Environmental Officer, Parks and Wildlife Native Vegetation Conservation Branch

Thanks also to the staff of the Western Australia Herbarium for providing access to Herbarium databases and specimen information.

Cover photograph by Fred and Jean Hort.

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# Summary

<b>Scientific name:</b>	<i>Grevillea corrugata</i>	<b>Shires:</b>	Chittering, Toodyay
<b>Common name:</b>	none	<b>IBRA region:</b>	Jarrah Forest
<b>Family:</b>	Proteaceae	<b>IBRA subregion:</b>	Northern Jarrah Forest JAF01
<b>Flowering period:</b>	August–September	<b>NRM regions:</b>	Swan, Wheatbelt
<b>DPaW region:</b>	Swan	<b>Recovery team:</b>	SRTFCRT
<b>DPaW district:</b>	Perth Hills		

**Distribution and habitat:** *Grevillea corrugata* is currently known from one confirmed population on granite outcrops and hillsides south of Bindoon, growing in loam and clay soils with *Eucalyptus marginata*, *E. wandoo*, *Hakea trifurcata*, *Acacia pulchella*, *A. saligna* and *Gastrolobium spinosum*. Note: two populations north-west of Toodyay that were previously thought to comprise this species are now listed as *Grevillea* aff. *corrugata* in the Western Australian Herbarium.

**Habitat critical to the survival of the species, and important populations:** It is considered that all known habitat for the wild population is critical to the survival of *Grevillea corrugata*, and that the wild population is an important population. Habitat critical to the survival of *G. corrugata* includes the area of occupancy of the population and areas of similar habitat surrounding the population (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:** *Grevillea corrugata* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 23 February 2010. It is ranked as Vulnerable (VU) in Western Australia under International Union for Conservation of Nature (IUCN 2001) criteria D1+D2 due to there being less than five known populations and less than 1,000 mature individuals in the wild. The extent of occurrence is approximately 132km<sup>2</sup> and the area of occupancy has been estimated at less than 1km<sup>2</sup>. The species is listed as Endangered (EN) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

**Threats:** The main threats to the species are road and firebreak maintenance, altered fire regimes, weed invasion, rubbish dumping, utilities maintenance, insecure land tenure 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 notified of the location and threatened status of *Grevillea corrugata*.
2. Declared Rare Flora (DRF) markers have been installed at Subpopulations 1a and 1c.
3. Parks and wildlife research associate Fred Hort completed 239 hours of opportunistic survey for *Grevillea corrugata* between January 2002 and March 2006.
4. Seed collections comprise 290 seeds from Subpopulation 1a, 81 seeds from Subpopulation 1b and 351 seeds from Subpopulation 1c.
5. The Botanic Gardens and Parks Authority (BGPA) currently have two six year old plants growing in their gardens.

**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

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 the population has remained within a 20% range or has increased by >20% from 1382 to 1658 or more or
- New populations have been found, increasing the number of known populations from one to two 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.

- The population is lost or
- The number of mature plants has decreased by >20% to 1106 or less or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

### Recovery actions

1. Coordinate recovery actions	11. Develop and implement translocations
2. Undertake taxonomic research	12. Obtain biological and ecological information
3. Monitor populations	13. Liaise with land managers and aboriginal communities
4. Ensure long-term protection of habitat	14. Map habitat critical to the survival of <i>Grevillea corrugata</i>
5. Reposition DRF markers	15. Promote awareness
6. Develop and implement a fire management strategy	16. Review this plan and assess the need for further recovery actions
7. Undertake weed control	
8. Collect and store seed	
9. Remove rubbish from Subpopulations 1a and c	
10. Undertake surveys	

# 1. Background

## History

*Grevillea corrugata* was first collected from a road verge near Chittering in 1992 by Peter Olde who, with Neil Marriott, formally named the species the following year. During surveys in 1997 and 1998 the population was found to extend onto an adjoining private property and also further down the road a few hundred metres. In 2006, Parks and Wildlife volunteers Fred and Jean Hort discovered what were thought to be two additional populations near Toodyay. However, the taxonomic status of these plants is still unclear and they have been listed in the Western Australian Herbarium as *G. aff. corrugata*.

There is currently one confirmed population of *Grevillea corrugata*, comprising 1382 mature plants.

## Description

*Grevillea corrugata* is a dense, single-stemmed shrub 1.2 to 2.5m high by 1.5 to 2m wide. The branchlets are conspicuously villous when young and are not glaucous. The leaves are simple, 35 to 60mm long, ascending, sessile and mostly subpinnatisect. The leaf lobes are 15 to 35mm long and 0.7 to 1mm wide. The margins are revolute, enclosing the lower surface of the leaf blade, and forming two grooves with the midvein. The hairs are straight. Flowers are white, regular and form the axillary or terminal raceme inflorescence. Each flower has four stamens. The pistil is 3 to 5mm long, with a stipe 1 to 2mm long, ending in an erect pollen presenter. The ovary and styles are glabrous and white. The fruit is oblong or ellipsoidal, glabrous, not viscid, and 7 to 11mm long (Olde and Marriott 1993; Western Australian Herbarium 1998–).

*Grevillea corrugata* is named from the Latin *corrugatus* referring to its strongly wrinkled fruit surface. The species is closely related to *G. curviloba*, particularly subsp. *incurva* as they share strongly rugose fruits with a thickened pericarp, 'loose' leaf margins leaving the undersurface at least partially exposed, and smoothly rounded, protuberant midveins on the leaf undersurface. *G. corrugata* differs in its erect habit, wider distant leaves and villous floral bracts (Olde and Marriott 1993).

Olde and Marriott (1993) state that *Grevillea corrugata* may be the product of hybridisation between *G. curviloba* and another unknown species. However the known population of *G. corrugata* does appear to be morphologically consistent and its seed is viable.

## Illustrations and/or further information

Olde, P.M. and Marriott, N.R. (1993) New species and taxonomic changes in *Grevillea* (Proteaceae:Grevilleoideae) from south west Western Australia. *Nuytsia* 9(2): 237–304; Western Australian Herbarium (1998–) *FloraBase– the Western Australian Flora*. Department of Parks and Wildlife. <https://florabase.dpaw.wa.gov.au/>.

## Distribution and habitat

*Grevillea corrugata* is known from one confirmed population south of Bindoon, growing in loam and clay soils on granite outcrops and hillsides. Associated species include *Eucalyptus marginata*, *E. wandoo*, *Hakea trifurcata*, *Acacia pulchella*, *A. saligna* and *Gastrolobium spinosum*.

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

Population number & location	DPaW district	Shire	Vesting	Purpose	Manager
1a. S Bindoon	Perth Hills	Shire of Chittering	LGA	Road reserve	Shire of Chittering
1b. S Bindoon	Perth Hills	Shire of Chittering	Private property	Freehold	Landowners
1c. S Bindoon	Perth Hills	Shire of Chittering	LGA	Road reserve	Shire of Chittering
1d. S Bindoon	Perth Hills	Shire of Chittering	LGA	Road reserve	Shire of Chittering
1e. S Bindoon	Perth Hills	Shire of Chittering	Private property	Freehold	Landowners
1f. S Bindoon	Perth Hills	Shire of Chittering	Private property	Freehold	Landowners

## Biology and ecology

*Grevillea corrugata* is believed to be a relatively short-lived species that is killed by fire and regenerates from soil stored seed. An estimated 400 seedlings found in 2006 following a wildfire had dwindled to 145 mature plants by 2008.

## Conservation status

*Grevillea corrugata* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 23 February 2010. It is ranked as Vulnerable (VU) in Western Australia under International Union for Conservation of Nature (IUCN 2001) criteria D1+D2 due to there being less than five known populations and less than 1,000 mature individuals in the wild. The extent of occurrence is approximately 132km<sup>2</sup> and the area of occupancy has been estimated at less than 1km<sup>2</sup>. The species is listed as Endangered (EN) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

## Threats

- **Road and firebreak maintenance.** Threats include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Herbicide spraying in 2002 resulted in the death of six plants in Subpopulation 1a.
- **Altered fire regimes.** Although *Grevillea corrugata* regenerates from soil-stored seed following fire, frequent burning would deplete the seed store and may also facilitate weed invasion.
- **Weed invasion.** 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.
- **Rubbish dumping.** This is a threat to Subpopulations 1a and 1c.
- **Utilities maintenance.** Maintenance activities are a potential threat to Subpopulation 1a as they could directly damage plants or encourage weed invasion.

- **Insecure land tenure.** The population is found on land tenure that is not consistent with conservation and is of poor and deteriorating quality.

The intent of this plan is to provide actions that will mitigate immediate threats to *Grevillea corrugata*. 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**

Population number & location	Land status	Year / no. of plants	Condition	Threats
<b>1a. Chittering</b>	Road reserve	1998 30 2006 10 (217) 2008 74 (27) [2] 2011 160 (1)	Good/degraded	Road maintenance, weeds, utilities maintenance, rubbish dumping
<b>1b. Chittering</b>	Private property	2000 2 2016 9		Firebreak maintenance
<b>1c. Chittering</b>	Road reserve	2000 3 2008 71 (46) [2] 2011 843 (16) [28]	Good/degraded	Road maintenance, weeds, rubbish dumping, fire
<b>1d. Chittering</b>	Road reserve	2011 As above	Good/degraded	Road maintenance, weeds, rubbish dumping, fire
<b>1e. Chittering</b>	Private property	2006 (270) 2016 298 (33)	Good/degraded	Weeds, fire
<b>1f. Chittering</b>	Private property	2011 72 (13) [4]	Good/degraded	Weeds, fire

Note: ( ) = number of seedlings; [ ] = number dead. The population is considered to be an important population. Subpopulations c and d are combined.

## 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 *Grevillea corrugata* may require assessment.

Actions that result in any of the following may potentially significantly impact 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

It is considered that all known habitat for the wild population is critical to the survival of *Grevillea corrugata*, and that the wild population is an important population. Habitat critical to the survival of *G. corrugata* includes the area of occupancy of the population and areas of similar habitat surrounding the population (these provide potential habitat for population expansion and 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 *Grevillea corrugata* will also benefit the Priority flora listed in the table below.

**Table 3. Conservation-listed flora species occurring within 500m of *Grevillea corrugata***

Species name	Conservation status (WA)	Conservation status (EPBC Act)
<i>Hypocalymma sylvestre</i>	Priority 1	-
<i>Lasiopetalum</i> sp. Toodyay	Priority 1	-
<i>Tetradlea spartea</i>	Priority 2	-
<i>Tetradlea pilifera</i>	Priority 3	-

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](http://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation_code_definitions_18092013.pdf)

*Grevillea corrugata* does not occur within or adjacent to any known 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. 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 the population of *Grevillea corrugata*. However, 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. 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 of private land containing *Grevillea corrugata* may need to be modified to include weed control and restricted stock access. Road and firebreak maintenance and other activities in the vicinity

of populations may also need to be modified. Recovery actions refer to continued liaison between affected stakeholders.

## Affected interests

The implementation of this plan has some implications for the Shire of Chittering and private landholder. Recovery actions refer to continued liaison between affected stakeholders.

## Evaluation of the plan's performance

Parks and Wildlife with the assistance of 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 *in situ* 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 the population has remained within a 20% range or has increased by >20% from 1382 to 1658 or more or
- New populations have been found, increasing the number of known populations from one to two 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.

- The population is lost or
- The number of mature plants has decreased by >20% to 1106 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 the assistance of the SRTFCRT is overseeing the implementation of recovery actions for *Grevillea corrugata*.

Land managers have been notified of the location and threatened status of *Grevillea corrugata*. Notifications detail their legal obligations in regards to its protection.

Declared Rare Flora (DRF) markers have been installed at Subpopulations 1a and 1c. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed.

Between January 2002 and March 2006, Parks and Wildlife's research associate Fred Hort completed many hours of opportunistic survey for *Grevillea corrugata* in the Darling Range. During this time he discovered populations of a very similar taxon, now listed as *Grevillea aff. corrugata*.

Some 290 seeds from Subpopulation 1a and 432 seeds from Subpopulation 1c are stored in the Parks and Wildlife Threatened Flora Seed Centre (TFSC) at  $-18^{\circ}\text{C}$ . During viability testing the germination rate was 60, 80 and 79% respectively.

The Botanic Gardens and Parks Authority (BGPA) have two six year old plants in their gardens, grown from seed collected from Subpopulation 1a.

### 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 SRTFCRT, will oversee the implementation of recovery actions for *Grevillea corrugata* and will include information on progress in annual reports.

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

## 2. Undertake taxonomic research

The Toodyay populations currently listed as *Grevillea* aff. *corrugata* in the Western Australian Herbarium require further taxonomic research to ascertain their relationship with *G. corrugata*.

<b>Action:</b>	Undertake taxonomic research
<b>Responsibility:</b>	Parks and Wildlife (Science and Conservation Division)
<b>Cost:</b>	\$20,000 in years 1 and 2

## 3. Monitor populations

Monitoring of populations of *Grevillea corrugata* and its 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 *Grevillea corrugata* are included in other recovery actions detailed below.

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

## 4. Ensure long-term protection of habitat

Parks and Wildlife will investigate ways and means of improving the security of *Grevillea corrugata* habitat. This may include vesting change, acquiring land or developing management plans in consultation with land owners/managers.

<b>Action:</b>	Ensure long-term protection of habitat
<b>Responsibility:</b>	Parks and Wildlife (Perth Hills District), in consultation with Department of Lands (DOL)
<b>Cost:</b>	\$3,000 per year

## 5. Reposition DRF markers

DRF markers at Subpopulation 1a require repositioning.

<b>Action:</b>	Reposition DRF markers
<b>Responsibility:</b>	Parks and Wildlife (Perth Hills District), Shire of Chittering
<b>Cost:</b>	\$1,000 in year 1

## 6. Develop and implement a fire management strategy

*Grevillea corrugata* is thought to be killed by fire but regenerate from soil-stored seed. It is important therefore that a fire regime with appropriate fire frequency, intensity and seasonality be applied to areas occupied by the species. The development of a fire management strategy, in consultation with

land owners/managers, including recommendations on prescribed fire frequency, intensity and seasonality, strategies for reacting to and preventing wildfire, and consideration regarding the need, method of construction, and maintenance of firebreaks is recommended.

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

## 7. Undertake weed control

Weeds are a potential threat to all populations and the following actions are recommended:

1. Determine which weeds are present.
2. Control invasive weeds by hand removal and/or spot spraying as they first emerge.
3. Monitor the success of the treatment on weed death, and the tolerance of *Grevillea corrugata* and associated native plant species to the treatment methods.
4. Report on the method and success of the treatment.
5. Revegetate with site-specific species (in autumn) to suppress weeds.

<b>Action:</b>	Undertake weed control
<b>Responsibility:</b>	Parks and Wildlife (Perth Hills District), Shires of Chittering and Toodyay
<b>Cost:</b>	\$10,000 per year

## 8. Collect and store seed

To guard against the extinction of the natural population of *Grevillea corrugata* it is recommended that additional seed be collected and stored at the Threatened Flora Seed Centre (TFSC). Collections should aim to sample and preserve the maximum range of genetic diversity possible by collecting from the widest range of reproductive plants.

<b>Action:</b>	Collect and store seed
<b>Responsibility:</b>	Parks and Wildlife (Perth Hills District, TFSC)
<b>Cost:</b>	\$5,000 per year

## 9. Remove rubbish from subpopulations 1a and 1c

Remove rubbish dumped at subpopulations 1a and 1c.

<b>Action:</b>	Remove rubbish from subpopulations 1a and c
<b>Responsibility:</b>	Parks and Wildlife (Perth Hills District), Shire of Chittering
<b>Cost:</b>	\$5,000 per year

## 10. Undertake surveys

Surveys for *Grevillea corrugata* should be undertaken in areas of potentially suitable habitat. All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and prevent duplication of effort.

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

## 11. Develop and implement translocations

Translocations may be required for the long term conservation of *Grevillea corrugata* if the natural population declines.

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).

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

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

## 12. Obtain biological and ecological information

It is recommended that research on the biology and ecology of *Grevillea corrugata* include:

1. Assessment of pollination effectiveness.
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.

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

### 13. Liaise with land managers and aboriginal communities

Parks and Wildlife Perth Hills District staff will liaise with land managers to ensure that populations of *Grevillea corrugata* are not accidentally damaged or destroyed, and the habitat is maintained in a suitable condition for the conservation of the species. Consultation with the Aboriginal community will take place to determine if there are any issues or interests in areas that are habitat for the species.

<b>Action:</b>	Liaise with land managers and aboriginal communities
<b>Responsibility:</b>	Parks and Wildlife (Perth Hills District)
<b>Cost:</b>	\$4,000 per year

### 14. Map habitat critical to the survival of *Grevillea corrugata*

Although habitat critical to the survival of *Grevillea corrugata* is alluded to in Section 1, it has not been mapped. If additional populations are located, habitat critical to their survival will also be determined and mapped.

<b>Action:</b>	Map habitat critical to the survival of <i>Grevillea corrugata</i>
<b>Responsibility:</b>	Parks and Wildlife (Species and Communities Branch (SCB), Perth Hills District)
<b>Cost:</b>	\$6,000 in year 2

### 15. Promote awareness

The importance of biodiversity conservation and the protection of *Grevillea corrugata* will be promoted through direct contact with affected land managers, and more broadly through the print and electronic media and by setting up poster displays. Formal links with local naturalist groups and interested individuals will also be encouraged.

<b>Action:</b>	Promote awareness
<b>Responsibility:</b>	Parks and Wildlife (Perth Hills District, SCB and Public Information and Corporate Affairs (PICA)), with assistance from the SRTFCRT
<b>Cost:</b>	\$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 *Grevillea corrugata* is still listed as Threatened at the end of the five-year term of this plan, the need for further recovery actions or a review of this plan will be assessed and a revised plan prepared if necessary.

<b>Action:</b>	Review this plan and assess the need for further recovery actions
<b>Responsibility:</b>	Parks and Wildlife (SCB, Perth Hills District)
<b>Cost:</b>	\$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
Undertake taxonomic research	High	Parks and Wildlife (Parks and Wildlife Science and Conservation Division)	2018
Monitor populations	High	Parks and Wildlife (Perth Hills District), with assistance from the SRTFCRT	Ongoing
Ensure long-term protection of habitat	High	Parks and Wildlife (Perth Hills District), DOL, DMP	Ongoing
Reposition DRF markers	High	Parks and Wildlife (Perth Hills District), Shire of Chittering	2017
Develop and implement a fire management strategy	High	Parks and Wildlife (Perth Hills District)	Developed by 2017 with implementation ongoing
Undertake weed control	High	Parks and Wildlife (Perth Hills District), Shires of Chittering and Toodyay	Ongoing
Collect and store seed	High	Parks and Wildlife (Perth Hills District, TFSC)	2022
Remove rubbish from Populations 1a and c	High	Parks and Wildlife (Perth Hills District), Shire of Chittering	2022
Undertake surveys	High	Parks and Wildlife (Perth Hills District) with assistance from the SRTFCRT and volunteers	Ongoing
Develop and implement translocations	High	Parks and Wildlife (Parks and Wildlife Science and Conservation Division, Perth Hills District), BGPA	2022
Obtain biological and ecological information	High	Parks and Wildlife (Parks and Wildlife Science and Conservation Division, Perth Hills District)	2019
Liaise with land managers and aboriginal communities	Medium	Parks and Wildlife (Perth Hills District)	Ongoing
Map habitat critical to the survival of <i>Grevillea corrugata</i>	Medium	Parks and Wildlife (SCB, Perth Hills District)	2018
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)	2022

## 4. Term of plan

This plan will operate from March 2017 to February 2022 but will remain in force until withdrawn or replaced. If the species is still listed as Threatened after five years, the need for further recovery actions will be determined.

## 5. References

- Department of Parks and Wildlife (2015a) Corporate Policy Statement No. 35 *Conserving Threatened Species and Ecological Communities*. Perth, Western Australia.
- Department of Parks and Wildlife (2015b) Corporate Guideline No. 35 *Listing and Recovery of Threatened Species and Ecological Communities*. Perth, Western Australia.
- Department of Parks and Wildlife (2015c) Corporate Guideline No. 36 *Recovery of Threatened Species through Translocation and Captive Breeding or Propagation*. Perth, Western Australia.
- Government of Australia (1999) Endangered Species Protection Act 1999. Government Printer, Canberra.
- International Union for Conservation of Nature (2001) *IUCN Red List Categories: Version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.
- Olde, P.M. and Marriott, N.R. (1993) New species and taxonomic changes in *Grevillea* (Proteaceae:Grevilleoideae) from south west Western Australia. *Nuytsia* 9(2): 237–304.
- Vallee, L., Hogbin, T., Monks, L., Makinson, B., Matthes, M. and Rossetto, M. (2004) Guidelines for the Translocation of Threatened Australian Plants. Second Edition. *The Australian Network for Plant Conservation*. Canberra, Australia.
- Western Australian Herbarium (1998–) *FloraBase – the Western Australian Flora*. Department of Parks and Wildlife. <http://florabase.dpaw.wa.gov.au/>.

## 6. Taxonomic description

### ***Grevillea corrugata***

Olde, P.M. and Marriott, N.R. (1993) New species and taxonomic changes in *Grevillea* (Proteaceae:Grevilleoideae) from south west Western Australia. *Nuytsia* 9(2): 237–304.

*Juveniles* not seen. *Adults*: single-stemmed dense shrubs 1.5–2.5m tall, 1.5–2m wide with numerous spreading to ascending branches; branchlets slightly angular and conspicuously villous when very young, rounded and openly to sparsely subvillous with age, longitudinally ribbed. *Leaves* 4–6cm long, 5–9cm wide, ascending, sessile, subpinnatisect, sometimes tripartite or pinnate, usually biternate, occasionally the central lobe with up to 5 secondary lobes with rare tertiary bi- or tripartite division; leaf rachis channelled, straight to slightly refracted; ultimate lobes (0.8)1.5–3(3.4)cm long, 0.7–1.2mm wide, linear-subulate, straight, pungent, the basal lobes patent to spreading; distance from axis of attachment to first lobe 2–20 mm, during branchlet elongation the distance reducing from 20mm on first-formed leaves to 5–10mm on the fifth-formed leaf, the intervening rachis on late-formed leaves with a strip of unfurled lamina 1–1.2mm wide on either side of the midvein extending from basal lobe to the axis of attachment and bearing a flat margin; upper surface glabrous or sparsely tomentose, the midvein and faint edge-veins also evident on some leaf lobes; lower surface mostly enclosed by the margin but with some exposure at the sinuses or occasionally beside the midvein, glabrous or with a few wavy hairs, midvein rounded, protuberant and surmounted on raised laminal tissue; margin loose, smoothly to angularly recurved or revolute. *Conflorescences* subsessile, simple to 3-branched at the base, usually terminal on short axillary branchlets and subtended by a vegetative branchlet, sometimes axillary; unit conflorescence 1–2.5cm long, 2cm wide at the base, ovoid to subglobose, open, partly exceeding the

foliage, development acropetal; floral rachises 0.8–2cm long, loosely tomentose-villous; floral bracts 3.5–4mm long, 3mm wide, ovate-cymbiform, villous or sparsely so outside, caducous. *Flowers* mostly glabrous; pedicels 7–9 mm long; toral rim, slightly lipped at the margin; *perianth* white, 4mm long, 0.7mm wide actinomorphic, narrowly oblong-obovoid to ellipsoid, sometimes a few scattered, erect trichomes on the inner surface 1.5–2mm from the base; tepals separating below the limb before anthesis, free to the base and rolling independently back after; limb 1–1.2mm long, 1.2mm wide, subglobose, the segments ribbed, the style completely enclosed before anthesis; *pistil* 3.5–4mm long, glabrous; stipe 1.5mm long, flexuous; ovary c. 1mm long, globose; style white, constricted for c. 0.2mm above the ovary, dilating to c. 0.5 mm wide, the dilation ovoid, tapering above to the style-end; pollen-presenter 0.5–0.8mm long, conico-cylindrical, its base 0.4mm wide, straight to slightly oblique, scarcely to not broader than the style, the stigma 0.25–0.3mm wide. *Fruits* (almost mature) 7–11mm long, 3–6mm wide, 3–5mm deep,  $\pm$ perpendicular to the stipe, oblong-ellipsoid, echinulo-rugose with irregular raised asperities sometimes joined in continuous ridges; style deciduous; pericarp 0.8mm thick. *Seed* (released from immature fruit) 7mm long, 3mm wide, obovoid, biconvex; outer face smooth; inner face with a broad waxy intramarginal border; margin shortly recurved.

