INTERIM RECOVERY PLAN NO. 142

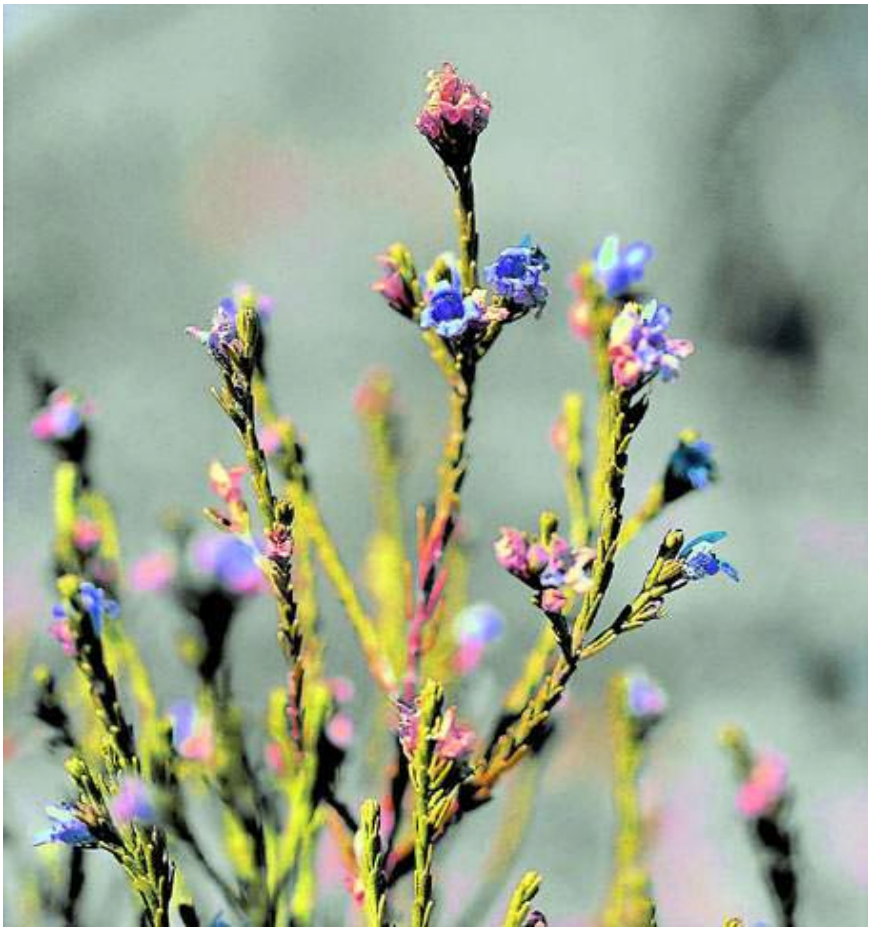
WHORLED EREMOPHILA

(*EREMOPHILA VERTICILLATA*)

INTERIM RECOVERY PLAN

2003-2008

Robyn Phillimore and Andrew Brown



Photograph: S. Hopper
July 2003

Department of Conservation and Land Management
Western Australian Threatened Species and Communities Unit (WATSCU)
PO Box 51, Wanneroo, WA 6946

Natural Heritage Trust
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DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (the Department) Policy Statements Nos. 44 and 50.

IRPs 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.

The Department is committed to ensuring that Critically Endangered taxa are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans and by ensuring that conservation action commences as soon as possible and always within one year of endorsement of that rank by the Minister.

This Interim Recovery Plan, which replaces IRP 99 (2001-2004), will operate from July 2003 to June 2008 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be reviewed after five years and the need for a full Recovery Plan will be assessed.

This IRP was approved by the Director of Nature Conservation on 21 July, 2003. The provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting the Department, as well as the need to address other priorities.

Information in this IRP was accurate at July 2003.

SUMMARY

Scientific Name: ***Eremophila verticillata*** **Common Name:** Whorled Eremophila
Family: Myoporaceae **Flowering Period:** October to January
Departmental Region: Wheatbelt **Departmental Districts:** Katanning, Narrogin
Shire: Lake Grace **Recovery Teams:** Katanning & Narrogin Districts Threatened Flora Recovery Teams (KDTFRT, NDTFRT)

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998). *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; Chinnock, R.J. (1986). Five endangered new species of Myoporaceae from south-western Australia. *Nuytsia* 5(3), 391-400; Richmond, G. and Coates, D. (1995). Population dynamics, seed biology and conservation of six endangered *Eremophila* species. Unpublished report, Australian Nature Conservation Agency, Canberra and Department of Conservation and Land Management, Western Australia.

Current status: *Eremophila verticillata* was declared as Rare Flora in September 1987 and ranked as Critically Endangered in September 1998. The species currently meets World Conservation Union Red List Category 'CR' under criteria A2c, B1a,b(ii,v)+2a,b(ii,iv) and C1 due its small area of occupancy, low number of plants and a decline in the number of populations, area of occupancy and extent and quality of habitat (IUCN 2000). Threats include mining (extraction of dolomite), poor recruitment, competition from associated native species and weeds, vehicle damage, rising salinity, road maintenance and inappropriate fire regimes.

Distribution and habitat: *Eremophila verticillata* is endemic to Western Australia where it is confined to the Lake Cobham area. The species grows on powdery brown loam over dolomite in open low *Eucalyptus* woodland of *E. longicornis* (Morrell), *E. annulata* and *E. flocktoniae* (Merrit) in association with *Maireana erioclada* and *Threlkeldia diffusa* (Chinnock 1986).

Critical habitat: The critical habitat for *Eremophila verticillata* comprises the area of occupancy of known populations; similar habitat within 200 metres of known populations; corridors of remnant vegetation that link populations; additional nearby occurrences of similar habitat that are not known to contain the species but may have done so in the past and may be suitable for translocations; and the local catchment for surface and ground waters that provide habitat for the species.

Habitat critical to the survival of the subspecies, and important populations: Given that this species is listed as Critically Endangered it is considered that all known habitat containing wild and translocated populations is habitat critical.

Benefits to other species/ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Eremophila verticillata* will also improve the status of remnant vegetation in which it is located.

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. However, as *Eremophila verticillata* is not listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

Role and interests of indigenous people: There are no known indigenous communities interested or involved in the management of areas affected by this plan. Therefore no role has been identified for indigenous communities in the recovery of this species.

Social and economic impacts: The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts. However, a mining lease near the area of one population does not expire until 2004 and it is possible that the protection of this species will have some minimal impact on the extraction of dolomite.

Evaluation of the Plans Performance: The Department of Conservation and Land Management, in conjunction with the Recovery Team will evaluate the performance of this IRP. The plan is to be reviewed within five years of its implementation.

Existing Recovery Actions: The following recovery actions have been or are currently being implemented -
1. Land managers have been made aware of the threatened nature of *Eremophila verticillata* and its location.
2. Declared Rare Flora (DRF) markers are installed at population 1.
3. Dashboard stickers and posters that illustrate DRF markers and describe their purpose have been produced and distributed.
4. In June 1994, staff from DCLM's Science Division and Katanning District conducted an experimental regeneration burn (to promote germination of soil-stored seed) on 10 mature senescing *Eremophila verticillata* plants at Population 1.
5. Approximately 646 seeds were collected from Population 1 in March and April 2000, and 2954 seeds in March 2000. These are stored in DCLM's Threatened Flora Seed Centre (TFSC) at –18°C.

6. The Botanic Garden and Parks Authority currently have seven plants of *Eremophila verticillata* in cultivation, all from cuttings.
7. The Katanning and Narrogin Districts Threatened Flora Recovery Teams are overseeing the implementation of this IRP and will include information on progress in their annual report to DCLM's Corporate Executive and funding bodies.
8. Departmental staff from Katanning and Narrogin District offices regularly monitor both presumed extinct and extant populations.

IRP Objective: The objective of this Interim Recovery Plan is to abate identified threats and maintain and/or enhance *in situ* populations to ensure the long-term preservation of the taxon in the wild.

Recovery criteria

Criteria for success: The number of individuals within populations and/or the number of populations have increased by 10% or more.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by 10% or more.

Recovery actions

1. Coordinate recovery actions.
2. Stimulate germination of the soil seed bank.
3. Conduct further surveys.
4. Undertake weed control using proven, best practice methods.
5. Vest unallocated Crown land in the Conservation Commission as a Class A reserve.
6. Rehabilitate habitat.
7. Collect seed and cutting material.
8. Propagate plants for future translocation.
9. Develop and implement a translocation proposal.
10. Develop and implement a fire management strategy.
11. Continue liaison with land managers.
12. Fencing.
13. Monitor populations.
14. Promote awareness.
15. Obtain biological and ecological information.
16. Write a full Recovery Plan.

1. BACKGROUND

History

J. Wrigley made the first known collection of *Eremophila verticillata* (housed at the South Australian Herbarium) from near Newdegate in 1968. In 1980, P. Luscombe made a collection of the species (Population 4), which is also housed at the South Australian Herbarium, from private property between Kalgarin and Pingaring. Although this second population was found on a similar soil type and geological formation as the first, plants were morphologically slightly different, with very hairy branches and leaves that were grey in appearance (personal communication B. Chinnock[1]). The plants were located in an area of land that, at the time, was being prepared for cropping and which resulted in the destruction of the population. No plants have been located in that area since.

In 1987 a population consisting of around 2000 plants (Population 2) was discovered by DCLM staff from Katanning District. The population was located in a strip of topsoil that had been redistributed following dolomite mining. At the time, the site was under a mining and grazing lease. The grazing lease expired in December 1989 and has not been renewed. The mining lease is still current and expires in 2004, but is renewable.

Eremophila verticillata is currently known from two extant populations containing a total of around 567 mature plants. Surveys for plants in the area of three old populations (Populations 3, 4 and 5) have proven unsuccessful and all three are currently presumed extinct.

Description

Eremophila verticillata is a small shrub to 1 m high and 80 cm across. Its erect or spreading branches are nearly cylindrical in cross-section. The lower section of the branches may be bare of leaves on mature plants. The leaves are fleshy, stalkless, green to purplish, in whorls of 3 and are pressed against the branches. They are a narrow oblong in shape, 2.5 to 6 cm long by 1 mm wide. The flowers are tubular, violet and have a white interior with purple spots. The outside of the corolla is covered with soft hairs. The fruits are dry, egg-shaped, 2 to 3 mm long by 1 to 2.5 mm wide, beaked, slightly separated at the apex and covered with feather-like hairs (Brown *et al.* 1998).

Eremophila verticillata is closely related to *E. ternifolia* but differs in its smaller, narrower, appressed leaves and different shaped fruit, in which the carpels are neither unequal or free in the upper half (Chinnock 1986).

Distribution and habitat

Eremophila verticillata is endemic to Western Australia where it is apparently confined to the Lake Cobham area. Habitat is powdery brown loam over dolomite in open low *Eucalyptus* woodland of *E. longicornis* (Morrell), *E. annulata* and *E. flocktoniae* (Merrit) over *Maireana erioclada* and *Threlkeldia diffusa* (Chinnock 1986). Other associated species include *Melaleuca thyoides*, *Dodonaea concinna* and *Enchylaena tomentosa.*

Biology and ecology

Eremophila is endemic to Australia and is represented in all mainland States. Currently, there are some two hundred named species and many unnamed ones. While most occur in semi-arid and arid regions, they are found in a range of habitats over a wide area. *Eremophila* species are not found in the high rainfall south-west corner of Western Australia. The plants are commonly referred to as emu bushes or poverty bushes.

The pollinator of *Eremophila verticillata* is unknown, although cabbage butterflies (*Pieris rapae*) have been observed feeding on the flowers.

A prescribed burn was undertaken at Population 1 by Departmental Science Division and Katanning District staff in 1994, as part of a study on six *Eremophila* species. Ten mature, senescing plants were burnt. Monitoring

[1] Bob Chinnock, Botanist, The Botanic Gardens of Adelaide and State Herbarium

of the burn site in June 1995 by staff from DCLM's Katanning District recorded 13 seedlings with an average height of 5 cm, most occurred close to parent plants. One seedling was located 13 m away from the nearest possible parent, but was still within the burn area. Seven plants currently remain at this site. No epicormic growth was observed, suggesting that the species is killed by fire and regenerates only from soil-stored seed. A visual assessment of the relative density of the starch grains within the roots did, however, result in a visual starch rating of six, suggesting the species may also possess some characteristics of a resprouter (Richmond and Coates 1995).

Threats

Eremophila verticillata was declared as Rare Flora in September 1987 and ranked as Critically Endangered In September 1998. It currently meets World Conservation Union Red List Category 'CR' under criteria A2c, B1a,b(ii,v)+2a,b(ii,iv) and C1 due to its small area of occupancy, low number of plants, a decline in the number of populations and a decline in area and quality of habitat (IUCN 2000). The main threats are mining (extraction of dolomite), poor recruitment, competition from associated native species and weeds, vehicle damage, salinity, road maintenance and inappropriate fire regimes.

- **Extraction of dolomite** is a possible future threat to one population of *Eremophila verticillata*. The mining lease on the area of Population 2 expires in 2004 and is renewable.

- **Poor regeneration**, due to lack of appropriate disturbance, threatens both populations. Mature plants are beginning to senesce and very few young plants have been observed in recent years.

- **Competition** from a dodder species (*Cassytha* sp.) is a minor threat to Population 2. Dodder covers some adult plants, competes for light, nutrients and possibly pollinators and physically restricts the *Eremophila*.

- **Vehicular damage** has occurred to some plants at Population 2. The placement of a barrier at the site was deemed impractical due to the likelihood of vehicles driving around it. Liaison will continue to ensure that further damage does not occur (Recovery Action 11). If deemed necessary, fencing will be considered.

- **Weed invasion** is a major threat to Population 2 and a minor threat to Population 1. The area containing Population 2 has been mined in the past and has been part of a grazing lease. The resulting disturbance has encouraged a proliferation of weeds at the site. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase the fire hazard due to the easy ignition of high fuel loads.

- **Salinity** is a possible future threat. Both populations occur near a salt lake and some signs of increasing salinity, including the death of some native vegetation and an increase in salt-tolerant species, is evident. Monitoring of both populations is required.

- **Road maintenance** is a possible future threat to Population 1. Construction of drainage channels, soil movement and road widening may impact on the population. Relevant land managers have been informed of the location of the population and the threatened status of the species.

- **Inappropriate fire regimes** may affect the long-term viability of populations. Adult plants of *Eremophila verticillata* are likely to be killed by fire, with recruitment from soil-stored seed. The soil seed bank would be depleted if fires occur before these juvenile plants reach maturity. Appropriate fires that occur a number of years apart are likely to be required for the species to regenerate. Further investigation is required and will be addressed in Recovery Action 15.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1. W of Lake Cobham	Unallocated Crown Land	1980 60 2001 7	Moderate	Road maintenance, mining, salinity, weeds, inappropriate fire regimes
2. NW of Lake Cobham	Unallocated Crown Land	1991 2000 2000 560+ [80+ dead]	Moderate	Weeds, mining, competition, senescence and poor recruitment, salinity, inappropriate fire regimes
3. NW of Lake Cobham	Unallocated Crown Land	1980 3 1986 0	Presumed extinct	
4. S of Karlgarin	Private Property	1980 1 hectare of healthy plants 2000 0	Presumed extinct	
5. E of Newdegate	Unallocated Crown Land	Unknown	Presumed extinct	

Critical habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or listed threatened ecological community. Habitat is defined as the biophysical medium or media occupied (continuously, periodically or occasionally) by an organism or group of organisms or once occupied (continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind have the potential to be reintroduced. (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

The critical habitat for *Eremophila verticillata* comprises:

- the area of occupancy of the known populations,
- areas of similar habitat ie. powdery brown loam in open low *Eucalyptus* woodland of *E. longicornis, E. annulata* and *E. flocktoniae*, within 200 metres of known populations (these provide potential habitat for natural recruitment),
- corridors of remnant vegetation that link populations (these are necessary to allow pollinators to move between populations),
- the local catchment which provides the correct water table for the species (the species occurs adjacent to a lake and is dependent on maintenance of local surface hydrology),
- additional occurrences of similar habitat, ie. powdery brown loam in open low *Eucalyptus* woodland of *E. longicornis, E. annulata* and *E. flocktoniae* that do not currently contain the species (these represents possible future translocation sites).

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

Given that this species is listed as threatened it is considered that all known habitat is habitat critical. In addition, all populations, including translocated populations, are considered important to the survival of the species.

Benefits to other species/ecological communities

All populations are located within an area of low *Eucalyptus* woodland adjacent to a small lake. Recovery actions implemented to improve the quality or security of the habitat of *Eremophila verticillata* populations will improve the status of the remnant vegetation in which the populations are located.

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. However, as *Eremophila verticillata* is not listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

Role and interests of indigenous people

There are no known indigenous communities interested or involved in the management of areas affected by this

plan. Therefore no role has been identified for indigenous communities in the recovery of this species.

Social and economic impacts

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts. However, a current mining lease near the area of one population expires in 2004, but is renewable, and it is possible that the protection of this species will have some minimal impact on the extraction of dolomite.

Evaluation of the Plan's Performance

The Department of Conservation and Land Management, in conjunction with the Katanning District Threatened Flora Recovery Team will evaluate the performance of this Interim Recovery Plan. The plan is to be reviewed within five years of its implementation. Any changes to management / recovery actions will be documented accordingly.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments or on-ground works in the immediate vicinity of the population or within the defined critical habitat of *Eremophila verticillata* require assessment. No developments should be approved unless the proponents can demonstrate that they will not have a significant impact on the species, or its habitat or potential habitat, or the local surface and ground water hydrology.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

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

Criteria for success: The number of individuals within populations and/or the number of populations have increased by 10% or more.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by 10% or more.

3. RECOVERY ACTIONS

Existing recovery actions

The Shire of Lake Grace, private property owners, the mining lessee, Department of Land Administration and Department of Minerals and Energy have been formally notified of the presence and threatened status of *Eremophila verticillata*. The notification details the Declared Rare status of the taxon and associated legal responsibilities.

Declared Rare Flora (DRF) markers have been installed at Population 1. These alert workers to the presence of threatened flora and help prevent accidental damage during maintenance works. An awareness of the markers is being promoted to relevant bodies through dashboard stickers and posters. These illustrate DRF markers, inform of their purpose and provide a contact telephone number if such a marker is encountered.

Staff from DCLM's Science Division and Katanning District conducted an experimental burn on 10 mature (7 taken completely, 3 defoliated), senescing *Eremophila verticillata* plants at Population 1 in June 1994.

Approximately 646 seeds collected from Population 1 in March and April 2000 are stored in DCLM's Threatened Flora Seed Centre (TFSC) at –18°C. The initial germination rate of the seed was found to range between 73 and 80%. A further collection of 2954 seeds was made in March 2000 and had an initial germination

rate of 73%. Collection of *E. verticillata* seed is difficult and requires many trips due to the fruits ripening gradually rather than all at once (unpublished data, A. Cochrane[2]).

The Botanic Garden and Parks Authority (BGPA) currently have seven cultivated plants of *Eremophila verticillata* (three in the nursery and four in the Botanic Gardens), all of which were grown from cuttings. Propagation of *E. verticillata* from cuttings appears to be relatively successful but variable (personal communication A. Shade[3]).

The Katanning and Narrogin Districts Threatened Flora Recovery Teams (KDTFRT, NDTFRT) are overseeing the implementation of this IRP and will include information on progress in their annual report to DCLM's Corporate Executive and funding bodies.

Departmental staff from Katanning and Narrogin District offices regularly monitor both presumed extinct and extant populations.

Future recovery actions

Where populations occur on lands other than those managed by the Department, permission has been or will be sought from the appropriate land managers prior to recovery actions being undertaken.

1. Coordinate recovery

The KDTFRT and NDTFRT will continue to coordinate the implementation of recovery actions for *Eremophila verticillata* and will include information on progress in their annual report to DCLM's Corporate Executive and funding bodies.

Action: Coordinate recovery
Responsibility: The Department (Katanning & Narrogin Districts) through the KDTFRT & NDTFRT
Estimated Cost: $600 per year.

2. Stimulate germination

Fire has proved to be an effective method in stimulating the germination of dormant *Eremophila verticillata* seed. Other methods, including smokewater, may also be trialed.

Action: Stimulate germination of soil-stored seed
Responsibility: The Department (Katanning & Narrogin Districts) through the KDTFRT & NDTFRT
Estimated Cost: $3,600 in first and second years, $1,100 in subsequent years.

3. Surveys

Surveys, conducted by Departmental staff with assistance of local volunteers and wildflower society members, will take place during the plant's flowering period (October to January).

Action: Conduct surveys
Responsibility: The Department (Katanning & Narrogin Districts) through the KDTFRT & NDTFRT
Estimated Cost: $2,000 per year.

4. Weed control

Weeds are a major threat to Population 2 and a possible future threat to Population 1. Native dodder is a minor threat to Population 2.

1. Experience and research to date in similar situations has shown that the use of selective herbicides to control grasses may result in infestation by broad leaf weeds. As there are currently no herbicides available for

[2] Anne Cochrane, Manager, the Department's Threatened Flora Seed Centre
[3] Amanda Shade, Horticulturist, Botanic Garden and Parks Authority

broad leaf weeds that can be used in a non-selective way and there are several native grasses present at Population 1 which would be inadvertently killed when spraying for exotic grasses, care must be taken when implementing weed control.

2. Broad spectrum, non-residual herbicides, e.g. glyphosate, can be used for spot control of weeds utilising techniques such as direct application or the use of temporary spray shields. Generally these techniques have been under utilised in respect to threatened flora and practical methods of application in the field require further development.
3. Hand removal of native dodder and weeds will be undertaken around *Eremophila verticillata* plants. Care must be taken as hand weeding has the potential to increase weed levels (at least temporarily) as a result of soil disturbance.
4. Within the five-year scope of an IRP weed control will be a short-term protective measure. Long term conservation of populations of CR flora will require further habitat rehabilitation including the replacement of weeds with appropriate native species.

Action: Undertake weed control using proven, best practice methods
Responsibility: The Department (Katanning District, Science Division) through the KDTFRT
Estimated Cost: $800 per year.

5. Care, control and management of Lake Cobham

Negotiations will continue with the Lake Grace Shire and DOLA in relation to the future care, control and management of Lake Cobham which contains both extant populations of *Eremophila verticillata*.

Action: Review the care, control and management of Lake Cobham
Responsibility: The Department (Katanning District) through the KDTFRT
Cost: $500 per year until completion.

6. Habitat rehabilitation

Restoration of *Eremophila verticillata* habitat will be achieved through the re-introduction of endemic plant species back into the old mine site at Population 2. During rehabilitation works, mounds of soil left from mining operations will be flattened out and may stimulate germination of soil-stored native seed.

Action: Rehabilitate habitat
Responsibility: The Department (Katanning District) through the KDTFRT
Estimated Cost: $3,000 in first, second and third years.

7. Seed and cuttings

Preservation of germplasm is essential to guard against the possible future extinction of wild populations. Seed and cutting collections can also be used to propagate plants for the establishment of a living collection at the BGPA and for future translocations back into the wild.

Action: Collect seed and cutting material
Responsibility: The Department (Katanning District, TFSC) and BGPA, through the KDTFRT
Estimated Cost: $3,400 in first and second years.

8. Propagation

The propagation of plants for translocation is essential as both wild populations of *Eremophila verticillata* are threatened through poor recruitment and degraded habitat. Plants will be propagated at the BGPA for planting in the second and third years of IRP implementation.

Action: Propagate plants for future translocation
Responsibility: The Department (Katanning District) and the BGPA through the KDTFRT
Estimated Cost: $1,500 in first and second years.

9. Translocation

Although translocations are generally undertaken under full Recovery Plans, the threats to both known wild populations of *Eremophila verticillata* requires the implementation of a translocation proposal within the time frame of this IRP. A translocation proposal has been prepared and is being be coordinated by the KDTFRT. Information on the translocation of threatened animals and plants in the wild is provided in DCLM's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna.*

Action: Implement the translocation proposal
Responsibility: The Department (Science Division, Katanning District) through the KDTFRT
Estimated Cost: $13,300 in first year and $6,200 in subsequent years.

10. Fire management strategy

Eremophila verticillata is an opportunistic species that germinates from soil-stored seed following fire and soil disturbance. However, frequent fire will kill plants before they reach maturity and may result in the accumulation of insufficient soil stored seed for regeneration. Except for recovery purposes, fire should be excluded from the area of populations. A fire management strategy will be developed to determine fire control measures and fire frequency.

Action: Develop and implement a fire management strategy
Responsibility: The Department (Katanning District) through the KDTFRT
Estimated Cost: $2,600 in first year and $1,000 in subsequent years.

11. Liaison

Land managers have been officially notified of the occurrence of the species. DCLM staff will continue to liase with them to ensure the populations are not damaged or destroyed accidentally.

Action: Liaise with land managers
Responsibility: The Department (Katanning District) through the KDTFRT
Estimated Cost: $800 per year.

12. Fencing

A fence will be erected alongside Population 2 to protect plants from vehicle damage.

Action: Fence Population 2
Responsibility: The Department (Katanning District) through the KDTFRT
Cost: $1,200 in the first year.

13. Monitoring

Monitoring of factors such as weed invasion, habitat degradation, salinity levels and population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential. Both known populations of *Eremophila verticillata* will be inspected annually. Special attention will be given to salinity levels and it's impact, with soil salinity and pH readings taken during winter and summer. Presumed extinct populations will be monitored annually for possible germination of soil-stored seed.

Monitoring of translocated plants will be undertaken according to the timetable set out in the Translocation Proposal.

Action: Monitor populations
Responsibility: The Department (Katanning & Narrogin Districts) through the KDTFRT & NDTFRT
Estimated Cost: $1,600 per year.

14. Community awareness

The importance of biodiversity conservation and the need for the long-term protection of *Eremophila verticillata* in the wild will be promoted to the general community through the local print, electronic media and poster displays. An information sheet, which includes a description of the plant, its habitat type, threats, management actions and photos have been produced. Formal links with local naturalist groups and interested individuals will be encouraged.

Action: Promote community awareness
Responsibility: The Department (Katanning & Narrogin Districts, Corporate Relations) through the KDTFRT & NDTFRT
Estimated Cost: $1,600 in first year and $900 in subsequent years.

15. Biology and ecology

Better knowledge of the biology and ecology of *Eremophila verticillata* will provide a scientific basis for management of wild populations. An understanding of the following is necessary for effective management:

1. Soil seed bank dynamics and the role of various disturbances (including inundation), competition, rainfall and grazing in germination and recruitment.
2. The pollination biology of the subspecies, and the requirements of pollinators.
3. The reproductive strategies, phenology and seasonal growth of the species.
4. The population genetic structure, levels of genetic diversity and minimum viable population size.
5. The impact of salinity on *Eremophila verticillata* and its habitat.

Action: Obtain biological and ecological information
Responsibility: The Department (Science Division, Katanning District) through the KDTFRT
Estimated Cost: $18,800 per year.

16. Recovery Plan

If *Eremophila verticillata* is still ranked as Critically Endangered at the end of the fourth year of the five-year term of this Interim Recovery Plan, the need for a full Recovery Plan or a review of this IRP will be assessed and a plan prepared if necessary.

Action: Review the need for a full Recovery Plan
Responsibility: The Department (WATSCU, Katanning & Narrogin Districts) through the KDTFRT & NDTFRT
Estimated Cost: $20,700 in the final year.

4. TERM OF PLAN

This Interim Recovery Plan will operate from June 2003 to May 2008 but will remain in force until withdrawn or replaced. If the taxon is still ranked Critically Endangered after five years, the need to review this IRP or to replace it with a full Recovery Plan will be determined.

5. ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this Interim Recovery Plan:

Brett Beecham	Regional Ecologist, DCLM's Wheatbelt Region
Bruce Bone	District Manager, DCLM's Katanning District
Bob Chinnock	Botanist, Adelaide Botanic Gardens and State Herbarium
Anne Cochrane	Manager, Threatened Flora Seed Centre, DCLM's Science Division
Greg Durell	District Operations Officer, DCLM's Narrogin District
Mal Graham	Former District Operations Officer, DCLM's Katanning District
Kim Kershaw	Conservation Officer, DCLM's Narrogin District

Bethea Loudon Conservation Officer, DCLM's Katanning District
Leonie Monks Research Scientist, DCLM's Science Division
Amanda Shade Horticulturist, Botanic Garden and Parks Authority

We would like to thank the staff of DCLM's WA Herbarium for providing access to Herbarium databases and specimen information, and DCLM's Wildlife Branch for their extensive assistance.

6. REFERENCES

Department of Conservation and Land Management (1992) Policy Statement No. 44 *Wildlife Management Programs*. Department of Conservation and Land Management, Western Australia.

Department of Conservation and Land Management (1994) Policy Statement No. 50 *Setting Priorities for the Conservation of Western Australia's Threatened Flora and Fauna*. Department of Conservation and Land Management, Western Australia.

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7. TAXONOMIC DESCRIPTION

Chinnock, R.J. (1986) Five endangered new species of Myoporaceae from south-western Australia. *Nuytsia* 5(3), 391-400.

Eremophila verticillata is a low spreading shrub up to 0.8 m high and 1 m diameter, emitting a strong, slightly offensive odour. *Branches* terete, erect or spreading, non-tuberculate, sparsely to densely hirsute. *Leaves* sessile, in whorls or 3, appressed to branches, green to purplish, fleshy, narrowly oblong, 2.5-6 x 1 mm, obtuse, hirsute on adaxial surface, obscurely glandular-papillose on abaxial surface. *Flowers* 1 per axil, sessile. *Sepals* 4, valvate, green, subequal, linear to lanceolate, (1)1.5-5 x 0.3-1 mm, acute, outside surface glabrous or glandular-pubescent, inside surface glandular-pubescent. *Corolla* (5)8-11 mm long, violet, but inside of tube white on lower side and purple spotted, 2-lipped, outside surface pubescent, hairs consisting of short glandular and longer eglandular ones, lower half of medial lobe of lower lip villous, with hairs extending down tube below lobe; lobes obtuse, medial lobe of lower lip dilated, emarginate. *Stamens* included, glabrous. *Ovary* ovoid, c. 1.5 x 0.5 mm, green, bilocular with one ovule per loculus, hirsute; style glabrous. *Fruit* dry, ovoid, 2-3 x 1-2.5 mm, beaked and slightly separated into two at apex, hirsute with short glandular and longer eglandular hairs. *Seed* unknown.

Australian Government

Department of the Environment and Heritage

ADDENDUM

Whorled Eremophila (*Eremophila verticillata*) Interim Recovery Plan 2003-2008

In adopting this plan under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the Minister for the Environment and Heritage has approved the following modifications.

Critical Habitat

The plan identifies a broad area as critical habitat, including buffer zones of a set distance around known populations. The Threatened Species Scientific Committee does not necessarily believe that such an area qualifies as habitat critical to the survival of the species, as defined in the EPBC Act.

Recovery Criteria

For the purposes of reviewing this recovery plan under the EPBC Act, the Recovery Criteria are amended to read as follows:

Criteria for success: The number of individuals within populations and/or the number of populations have increased by 10% or more over the period of the plan's adoption under the EPBC Act.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by 10% or more over the period of the plan's adoption under the EPBC Act.