Department of
Parks and Wildlife

Interim Recovery Plan No. 352

Cumquat eremophila

(*Eremophila denticulata* subsp. *trisulcata*)

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
DFES	Department of Fire and Emergency Services
DPaW	Department of Parks and Wildlife (also shown as Parks and Wildlife)
DRD	Department of Regional Development
DRF	Declared Rare Flora
EDTFCRT	Esperance District Threatened Flora and Communities Recovery Team
EN	Endangered
EPBC	Environment Protection and Biodiversity Conservation
FMG	Fortescue Metals Group
FMS	Fire management strategy
GLSC	Goldfields Land and Sea Council
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
LGA	Local Government Authority
NRM	Natural Resource Management
PEC	Priority Ecological Community
PICA	Public Information and Corporate Affairs
SCB	Species and Communities Branch
TEC	Threatened Ecological Community
TFSC	Threatened Flora Seed Centre
UCL	Unallocated Crown Land
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 (Parks and Wildlife) Policy Statements Nos. 44 and 50 (CALM 1992; CALM 1994). Plans outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened flora or ecological communities, and begin the recovery process.

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

This updated plan replaces IRP No. 184 Cumquat Eremophila (*Eremophila denticulata* subsp. *trisulcata*) (Fitzgerald *et al*. 2004). The plan will operate from July 2015 to June 2020 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked as Endangered (EN) 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 9 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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Cover photograph by Emma Massenbauer.

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Summary

Scientific name:	*Eremophila denticulata* subsp. *trisulcata*	**Common name:**	Cumquat Eremophila
Family:	Scrophulariaceae	**Flowering period:**	October–June
DPaW region:	South Coast	**DPaW district:**	Esperance
Shire:	Esperance	**NRM region:**	South Coast
IBRA region:	Esperance Plains	**Recovery team:**	Esperance District Threatened Flora and Communities Recovery Team (EDTFCRT)
IBRA subregion:	Recherche		

Distribution and habitat: *Eremophila denticulata* subsp. *trisulcata* is found over a 20km geographic range near Mount Ragged, north-east of Esperance. Plants grow on powdery grey loams over limestone in tall *Eucalyptus ovularis* and *E. fraseri* subsp. *fraseri* woodland.

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 *Eremophila denticulata* subsp. *trisulcata* and that all wild populations are important populations. Habitat critical to the survival of *E. denticulata* subsp. *trisulcata* 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 taxon or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the taxon.

Conservation status: *Eremophila denticulata* subsp. *trisulcata* is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as Endangered (EN) in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B1ab(iv,v)+2ab(iv,v) due to its extent of occurrence estimated to be less than 5,000 km^2; populations being severely fragmented; their being a continuing decline in the number of mature individuals in some populations and its area of occupancy estimated to be less than 500km^2. The taxon is listed as EN under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The main threats to *Eremophila denticulata* subsp. *trisulcata* are changed fire regimes, road works, poor recruitment, vehicles, grazing, trampling, insecure tenure and weeds.

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. 21,500 *Eremophila denticulata* subsp. *trisulcata* seeds are stored in the Threatened Flora Seed Centre (TFSC) at –20°C.
2. The Botanic Gardens and Parks Authority (BGPA) have seven living plants.
3. Roadside markers have been installed at Populations 1 and 2.
4. Surveys carried out in 2013 found one new population and one new subpopulation.
5. Information on fire and disturbance response was obtained following chaining and prescribed fire.

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 subspecies 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 2,558 to 2,686 or more or
- New populations have been found, increasing the number of known populations from five to six or more over the term of the plan with no net loss of mature plants or
- The area of occupancy has increased by >5% 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 2,558 to 2,430 or less or
- The area of occupancy has decreased by >5% over the term of the plan with a loss of mature plants.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Undertake surveys
4. Collect and store seed and cutting material
5. Develop and implement a fire management strategy
6. Obtain biological and ecological information
7. Undertake regeneration trials
8. Liaise with land managers and Aboriginal communities
9. Map habitat critical to the survival of *Eremophila denticulata* subsp. *trisulcata*
10. Promote awareness
11. Undertake feral animal control if required
12. Undertake weed control if required
13. Develop and implement a translocation proposal
14. Review this plan and assess the need for further recovery actions

1. Background

An Interim Recovery Plan (IRP) for *Eremophila denticulata* subsp. *trisulcata* was published in 2004 (Fitzgerald *et al*. 2004) and a review of the plan undertaken in 2013 (see table 1). This revised plan replaces the previous plan.

The criteria for success in the previous plan – the number of individuals and/or the number of populations have increased over the period of the plan's adoption under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), has been met. Further survey has located one new population and the number of mature individuals in all populations has risen from 800 in 2004 to 2,500 in 2013.

Eremophila denticulata subsp. *trisulcata* requires ongoing recovery work due to a restricted distribution and continuing threats.

Table 1: Status of recovery actions included in previous plan

Recovery action	% implemented	Result
Coordinate recovery actions	Ongoing	Recovery actions have been coordinated by the Esperance District with assistance from the Esperance District Threatened Flora and Communities Recovery Team (EDTFCRT).
Recommend listing as Threatened Flora	Complete	*Eremophila denticulata* subsp. *trisulcata* was listed as Threatened Flora in 2005.
Map habitat critical to the survival of *Eremophila denticulata* subsp. *trisulcata*	Started	Herbarium locations and accurate descriptions of soil and associated species is complete.
Develop and implement a fire management strategy	Further action required	Parks and Wildlife has no specific fire management strategy for this subspecies. Monitoring conducted in 2013 obtained information on post fire response.
Deviate fire break and mine road around populations	Done	A track was deviated around plants at Population 1. However, given the positive response of the taxon to disturbance it is likely that it occurs over a wider area than the road reserve and this action may not be necessary in the future.
Conduct recovery burning and soil disturbance trials	Mostly complete	Population 1 was burnt in 2010 and Population 5 was burnt in 2013. Monitoring will provide information on the subspecies' response.
Monitor populations	Ongoing	The Parks and Wildlife Esperance District Flora Conservation Officer has regularly monitored populations.
Collect seed and cutting material	Complete	21,500 seeds are stored in the Threatened Flora Seed Centre (TFSC) at –20°C. Seed has also been collected for the Millennium Seed Bank Project.
Seek long term protection of habitat	Partially complete	Letters were written to Shire of Esperance and Beaumont gypsum in April 2006 informing them of the threatened taxon and its locations. Population 4 is in a National Park.
Conduct further surveys	Ongoing	Surveys have been conducted north and west of Cape Arid National Park with one new population discovered. The taxon grows in a remote area with few tracks, and it is likely that additional populations may be located.
Obtain biological and ecological information	Ongoing	Germination research was carried out in 2009. Post fire response has been collected from two locations.
Promote awareness	Ongoing	Letters were written to Shire of Esperance and Beaumont gypsum in April 2006 informing them of the threatened taxon and its locations.

		An IRP was prepared and distributed in 2004. An A4 poster has been prepared and distributed.
Quantify impacts and if necessary implement feral animal control	Complete	No impacts were noted during surveys.
Review this IRP	Complete	The plan was reviewed in 2013.

Ongoing recovery actions shown in the previous plan are included in this revised plan. Additional recovery actions include – Liaise with land managers and Aboriginal communities and Develop and implement a translocation proposal.

History

Eremophila denticulata subsp. *trisulcata* was first collected north-northwest of Mount Ragged by Ken Newbey in 1980. Further collections were made in 1986 and 1990. The taxon was removed from the schedule of Declared Rare Flora (DRF) in 1999 and reduced to Priority 4 status following the discovery of what were thought to be new populations. However, taxonomic studies conducted in 2003 found that most of these were a form of the related *E. decipiens* subsp. *decipiens* and *E. denticulata* subsp. *trisulcata* was again listed as DRF in 2005.

There are two subspecies of *Eremophila denticulata* (*E. denticulata* subsp. *denticulata* and *E. denticulata* subsp. *trisulcata*). Both are listed as DRF and in Western Australia are ranked as Vulnerable (VU) and Endangered (EN) respectively.

Description

Eremophila denticulata subsp. *trisulcata* is an erect shrub 1 to 2.5m high with resinous, shiny branches and alternate, shiny, dark green leaves with entire or, very rarely, obscurely dentate margins. Buds are generally orange while mature flowers, which grow between 15−30mm long, are carmine in colour. The fruit is usually ovoid to subglobular in shape, with the apex depressed and with three furrows deeply trisecting it. These lead to the scientific name *trisulcata*.

Illustrations and/or further information

Brown, A. and Buirchell, B. (2011) *A Field Guide to the Eremophilas of Western Australia*, Simon Nevill Publications; 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. (2007) *Eremophila and allied genera, A monograph of the Myoporaceae*, State Herbarium of South Australia, Rosenburg Publishing, NSW; Western Australian Herbarium (1998–) *FloraBase- the Western Australian Flora*, Department of Parks and Wildlife http://florabase.dpaw.wa.gov.au/.

Distribution and habitat

Eremophila denticulata subsp. *trisulcata* is known from five populations over a range of 20km north-west of Mount Ragged where it grows on powdery grey loams over limestone in tall *Eucalyptus ovularis* and *Eucalyptus fraseri* subsp. *fraseri* woodland with *Melaleuca quadrifaria* and *Melaleuca sheathiana*.

Table 2. Summary of population land vesting, purpose and manager

Population number and location	DPaW district	Shire	Vesting	Purpose	Manager
1. NE of Esperance	Esperance	Esperance	Non vested	UCL/mining lease	FMG Resources (Alan Ridgeway)
3. NE of Esperance	Esperance	Esperance	Non vested	UCL/mining lease	FMG Resources
4. NE of Esperance	Esperance	Esperance	CCWA	National park	DPaW
5. NE of Esperance	Esperance	Esperance	Non vested	UCL/exploration lease	FMG Resources

Biology and ecology

Eremophila denticulata subsp. *trisulcata* is known to be a short-lived disturbance opportunist with plants observed to germinate, flower and senesce over a 12 year period.

Laboratory experiments carried out by Gilovitz *et al.* in 2006 showed the seed of *Eremophila denticulata* subsp. *trisulcata* has a very low germination rate under normal conditions. Heat shock gave the best response suggesting that the taxon responds to fire. The taxon produces abundant fruit and even if a relatively small proportion of seed germinates in any one event will produce a large number of seedlings.

Conservation status

Eremophila denticulata subsp. *trisulcata* is specially protected under the Western Australian *Wildlife Conservation Act 1950* and is ranked as EN in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B1ab(iv,v)+2ab(iv,v) due to its extent of occurrence estimated to be less than 5,000 km^2; populations being severely fragmented; their being a continuing decline in the number of mature individuals in some populations and its area of occupancy estimated to be less than 500km^2. The taxon is listed as EN under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Changed fire regimes.** Although occasional fire is needed for reproduction of this subspecies, the soil seed bank would rapidly be depleted if fire occurs before juvenile plants reach maturity and set enough seed to replenish soil seed bank.
- **Physical damage by road works.** Two of the populations occur on the edge of tracks where they could be damaged by road works.

- **Poor recruitment.** Several large populations that were recorded in the 1990s either could not be relocated during more recent surveys or were represented by very few extant plants.
- **Vehicle traffic.** Traffic along the gypsum mine road and Balladonia track represents a minor threat to Populations 1 and 4 through direct damage to plants or dust.
- **Grazing and trampling.** Recent monitoring indicates that feral animals, including rabbits, camels, and horses, have not had a direct impact on populations but are impacting on adjoining habitat and hence pose a potential threat.

- **Insecure tenure.** Changes in land management practices, including mining and road works, may put populations at risk.
- **Weed invasion.** The effect of weeds is unknown but they are likely to compete for soil moisture and nutrients. Weeds may also increase the chance of fire due to ease of ignition.

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

Table 3. Summary of population information and threats

Population number and location	Land status	Year	number of plants	Condition of habitat	Threats
1.* NE Esperance	UCL	1990 1996 2004 2005 2013	120 148 842 240+ 2,550 [12 dead]	Moderate	Firebreak maintenance, road works, vehicles, clearing, insecure tenure, change fire regimes, poor recruitment, grazing, weeds
3. NE Esperance	UCL	1990 2004	1,500 0	Moderate	Changed fire regimes, insecure tenure, poor recruitment
4. NE Esperance**	National park	1996 2003 2004 2013	40 100 15 8 (26) [4dead]	Moderate	Road works, vehicles, poor recruitment, changed fire regimes
5*. NE Esperance**	UCL	2013	(2)	Excellent	Firebreak maintenance, insecure tenure, changed fire regimes

Populations in **bold text** are considered to be important populations; () = number of seedlings; * populations 1 and 2 are now considered a single population; ** Population 5 in the previous plan was found to be a continuation of Population 4. *** Population 5 in this plan is a new population.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions for development and/or land management activities in the immediate vicinity of *Eremophila denticulata* subsp. *trisulcata* should be subject to an assessment of potential environmental impacts.

Actions that could result in any of the following may potentially result in a significant impact on *Eremophila denticulata* subsp. *trisulcata*:

- Damage or destruction of occupied or potential habitat
- Poor recruitment
- A major increase in disturbance in the vicinity of a population
- Alteration of the local surface hydrology or drainage
- Reduction in population size

Habitat critical to the survival of *Eremophila denticulata* subsp. *trisulcata* and important populations

Eremophila denticulata subsp. *trisulcata* is ranked as EN and is only known from four locations. It is therefore considered that all known habitat for wild populations is critical to the survival of the taxon, and that all wild populations are important populations. Habitat critical to the survival of *E. denticulata* subsp. *trisulcata* 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 or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the taxon.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat *Eremophila denticulata* subsp. *trisulcata* will also improve the status of associated native vegetation, including one Priority 2 taxon (*Olearia laciniifolia*).

Eremophila denticulata subsp. *trisulcata* 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. *Eremophila denticulata* subsp. *trisulcata* 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.

Indigenous consultation

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Sites Register revealed five sites (491, 1642, 1643, 1640 and 2442) of Aboriginal significance in the general area of populations of *Eremophila denticulata* subsp. *trisulcata* and input and involvement has been sought through the Goldfields Land and Sea Council (GLSC) and DAA to determine if there are any issues or interests with respect to the management of this taxon. Opportunity for future Aboriginal involvement in the implementation of the plan is included as an action in the plan. Aboriginal involvement in management of land covered by an agreement under the *Conservation and Land Management Act 1984* is also provided for under the joint management arrangements in that Act, and will apply if an agreement is established over any reserved lands on which this taxon occurs.

Social and economic impacts

The implementation of this plan has the potential to have social and economic impacts as several populations occur on active mining and exploration tenements and on the margins of a private (mining) road. Negotiations with lease holders will continue with regard to future management of these areas. Populations also occur on a strategic firebreak that protects farmland and national park from potentially large wildfires.

Affected interests

The implementation of this plan has implications for mining companies where Populations 1, 3 and 5 occur.

Evaluation of the plan's performance

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

2. Recovery objective and criteria

Plan objective

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

Recovery criteria

Criteria for recovery success: The plan will be 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 2,558 to 2,686 or more or
- New populations have been found, increasing the number of known populations from five to six or more over the term of the plan with no net loss of mature plants or
- The area of occupancy has increased by >5% 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 2,558 to 2,430 or less or
- The area of occupancy has decreased by >5% over the term of the plan with a loss of mature plants.

3. Recovery actions

Existing recovery actions

Parks and Wildlife is overseeing the implementation of this plan and, with the assistance of the Esperance District Threatened Flora and Communities Recovery Team (EDTFCRT), is including information on progress in annual reports.

Twenty one thousand five hundred seeds collected from Population 1 are currently stored at Parks and Wildlife's Threatened Flora Seed Centre (TFSC) at –20°C.

Table 4. TFSC collection details for *Eremophila denticulata subsp. trisulcata*.

Accession number	Date collected	Population number	Collection type	Seeds/follicles in storage	Germination rate (%)
01672	1/02/2005	1	B/16	279 fruit	not yet conducted
01673	1/02/2005	1	B/160	6,962 seed	57
02047	21/05/2006	1	B/54	not yet processed	
02872	9/09/2008	1	B/100	5,973 seed	
02873	9/09/2008	1	B/100	3,107 seed	

02874	9/09/2008	1	B/100	3,414 seed	
02875	9/09/2008	1	B/100	2,044 seed	

'B' = a bulked collection and the number of plants sampled.

All land managers have been formally notified of the presence of *Eremophila denticulata* subsp. *trisulcata*. Roadside markers have been installed at Population 1.

A review of *Eremophila denticulata* subsp. *trisulcata* specimen locations at the WA Herbarium has been undertaken to clarify the locality of plants in listed populations. Some of the location descriptions were found to not match coordinates, and what was thought to be six populations in 2004, was actually only four populations. This was also verified by checking field locations.

Laboratory based germination research on *Eremophila denticulata* subsp. *trisulcata* seed was carried out by Gillovitz *et al*. in 2009. Lab based investigations examined water permeability of the fruit coat; short duration and high temperature heat shock; exposure to diurnally alternating temperatures simulating natural temperature variation; leaching to remove potential water soluble germination inhibitors; and the effect of site soil on germination.

Surveys for the subspecies were carried out in 2013. One new population was found and another senescing population had new plants germinating where lightning had struck and started a small fire. Two monitoring plots were installed at Population 1 prior to a control burn of the scrub rolled area at this site in 2010. This will enable fire ecology information to be collected on the subspecies.

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 these recovery actions are implemented on lands other than those managed by Parks and Wildlife, permission has been or will be sought from the appropriate land managers prior to actions being undertaken.

1. Coordinate recovery actions

Parks and Wildlife with assistance from the EDTFCRT will coordinate recovery actions for *Eremophila denticulata* subsp. *trisulcata* and will include information on progress in annual reports.

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

2. Monitor populations

Monitoring of grazing, habitat degradation, weed invasion, population stability (expansion or decline), time to flowering, pollinator activity, seed production, recruitment, and longevity should be undertaken.

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

3. 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 *Eremophila denticulata* subsp. *trisulcata* documented to increase survey efficiency and prevent duplication of effort.

Surveys should focus on areas of similar habitat where fire or mechanical disturbance has occurred two to three years previously as the taxon is easily seen and identified when at this age.

A collection by D. Edinger (#08228213) from 2006 needs to be confirmed as it represents a potential new population.

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

4. Collect and store seed and cutting material

To guard against the extinction of natural populations it is recommended that seed be collected and stored at the TFSC and the Botanic Gardens and Parks Authority (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). If it is not feasible to collect seed, living collections from cuttings or storage of tissue culture material should be undertaken.

Collections from Populations 3, 4 and 5 are needed as a priority as there is currently no stored seed from these populations.

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

5. Develop and implement a fire management strategy

Although occasional fire is needed for the reproduction of *Eremophila denticulata* subsp. *trisulcata*, adult plants of the taxon are killed by fire and the soil seed bank is likely to be depleted if fire occurs before juvenile plants reach maturity. A fire management strategy should be developed that includes recommendations on fire frequency, intensity and seasonality, strategies for reacting to wildfire and the need, method of construction and maintenance of firebreaks.

In the event of a wildfire in the vicinity of populations, Parks and Wildlife needs to liaise closely with the Department of Fire and Emergency Services (DFES) as it is likely to be the Hazard Management Authority for the incident.

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

6. Obtain biological and ecological information

Research on the biology and ecology of *Eremophila denticulata* subsp. *trisulcata* should include:

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

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

7. Undertake regeneration trials

Disturbance events (physical or fire) may be the most effective means of germinating *Eremophila denticulata subsp. trisulcata* seed in the wild. It is therefore recommended that recovery burning and soil disturbance be trialled over a part of Population 4 which was previously known to span 2km and is currently senescing, to determine the effectiveness of different regimes in encouraging recruitment. The trial of both fire and soil disturbance would ascertain which method is most effective.

Care should be taken as these processes inherently carry a significant risk of depletion of soil seed bank reserves. The construction of firebreaks around burn plots and attendance of sufficient staff to deal with accidental escapes is therefore recommended. Records will be maintained for future research.

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

8. Liaise with land managers and Aboriginal communities

Staff from Parks and Wildlife's Esperance District will liaise with land managers to ensure that populations of *Eremophila denticulata* subsp. *trisulcata* are not accidentaly damaged or destroyed and the habitat is maintained in a suitable condition for the conservation of the taxon. Aboriginal consultation will also take place to determine if there are any issues or interests in areas that are habitat for the taxon. In addition, ways and means of improving the security of populations and associated habitat will be investigated.

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

9. Map habitat critical to the survival of *Eremophila denticulata* subsp. *trisulcata*.

Although habitat critical to the survival of the subspecies 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 *Eremophila denticulata* subsp. *trisulcata*
Responsibility:	Parks and Wildlife (SCB, Esperance District)
Cost:	$6,000 in year 2

10. Promote awareness

The importance of biodiversity conservation and the protection of *Eremophila denticulata* subsp. *trisulcata* will be promoted using local print and electronic media and by setting up poster displays. An information sheet that includes a description of the plant, its habitat type, threats and 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 (Esperance District, SCB, Public Information and Corporate Affairs (PICA)), with assistance from the EDTFCRT
Cost:	$7,000 in years 1 and 2; $5,000 in years 3–5

11. Undertake feral animal control if required

Plots will be established to quantify the impacts of feral animals on populations of *Eremophila denticulata* subsp. *trisulcata* and associated habitat. If data are produced that indicate a significant threat, staff from Parks and Wildlife's Esperance District will undertake feral animal control.

Action:	Undertake feral animal control if required
Responsibility:	Parks and Wildlife (Esperance District)
Cost:	$4,000 in years 1, 3 and 5

12. Undertake weed control if required

Plots will be established to quantify the impacts of weeds on populations of *Eremophila denticulata* subsp. *trisulcata* and associated habitat. If data are produced that indicate weeds to be a significant threat, staff from Parks and Wildlife's Esperance District will undertake weed control.

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

13. Develop and implement a translocation proposal

Translocation may be deemed desirable for the conservation of *Eremophila denticulata* subsp. *trisulcata* if natural populations are lost or their threat rating is high. If required, a translocation proposal will be developed and suitable translocation sites selected. Information on the translocation of Threatened plants and animals in the wild is provided in Parks and Wildlife's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM 1995), and the Australian Network for Plant Conservation translocation guidelines (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.

Action:	Develop and implement a translocation proposal
Responsibility:	Parks and Wildlife (Science, Esperance District), BGPA
Cost:	$42,000 in years 1 and 2; and $26,500 in years 3–5 as required

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

If *Eremophila denticulata* subsp. *trisulcata* is still ranked as EN 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, Esperance District)
Cost:	$6,000 at the end of year 5

Table 5. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	Parks and Wildlife (Esperance District), with assistance from the EDTFCRT	Ongoing
Monitor populations	High	Parks and Wildlife (Esperance District), with assistance from the EDTFCRT	Ongoing
Undertake surveys	High	Parks and Wildlife (Esperance District), with assistance from the EDTFCRT and volunteers	Ongoing
Collect and store seed and cutting material	High	Parks and Wildlife (Esperance District, TFSC), BPGA	2020
Develop and implement a fire	High	Parks and Wildlife (Esperance District), DFES	2020

management strategy			
Obtain biological and ecological information	High	Parks and Wildlife (Science, Esperance District)	2018
Undertake regeneration trials	High	Parks and Wildlife (Science, Esperance District)	2020
Liaise with land managers and Aboriginal communities	High	Parks and Wildlife (Esperance District)	Ongoing
Map habitat critical to the survival of *Eremophila denticulata* subsp. *trisulcata*	High	Parks and Wildlife (SCB, Esperance District)	2016
Promote awareness	Medium	Parks and Wildlife (Esperance District, SCB, PICA), with assistance from the EDTFCRT	2020
Undertake feral animal control if required	Medium	Parks and Wildlife (Esperance District)	2020
Undertake weed control if required	Medium	Parks and Wildlife (Esperance District)	Ongoing
Develop and implement a translocation proposal	Medium	Parks and Wildlife (Science, Esperance District), BGPA	2020
Review this plan and assess the need for further recovery actions	Medium	Parks and Wildlife (SCB, Esperance District)	2020

4. Term of plan

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

5. References

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6. Taxonomic description

***Eremophila denticulata* - Chinnock, R. (2007)**

Erect sparsely to densely branched glabrous shrub to 1–2.5m tall. *Branches* triquetrous, non-tuberculate, obscurely glandular-papillose, resinous, shiny. *Leaves* alternate, petiolate; petiole 5–10mm long; lamina elliptic, acute, margin denticulate except towards base or entire, (26-) 34–59 (-65) × (5.3-) 6.8–16 (-22), prominently minutely glandular-papillose, resinous, shiny; deep green. *Flowers* 1 per axil, pedicellate; pedicel terete, straight or sigmoidly curved, (5-) 15–30mm long, glandular-papillose, resinous. *Sepals* 5, imbricate, lanceolate-triangular, acute, 3.5–13 × 0.9–2.5mm; outer surface glandular-papillose, slightly resinous, inner surface glandular-puberulous, margins glandular-papillose. *Corolla* 25–30mm long, bud orange, open flower carmine, unspotted; outer surface glandular-pubescent, inner surface of lobes glandular-pubescent but with longer glandular hairs extending from base of lobes of upper lip down tube; lobes acute, lobe of lower lip, acute, reflexed. *Stamens* 4, exserted; filaments glandular-pubescent in basal half; anthers glabrous. *Ovary* ovoid but distinctly 3-sided, 3.5–4.5 × 2.5–3.5mm, 3-locular with 2 ovules per locule, glabrous; style glabrous. *Fruit* dry, ovoid, prominently beaked, splitting near apex into three segments, or depressed ovoid to subglobular, apex depressed, prominently three furrowed, each of segments with a shallow medial furrow, 10–15 × 8–20mm; exocarp pale brown, papery, glabrous; endocarp blackish-brown, prominently three-furrowed, apex beaked or very depressed. *Seed* unknown. *Chromosome number* unknown.

Notes

This species is known only from the Phillips and Hamersley Rivers and an area north east of Esperance in Western Australia. Mueller (1887) recorded the species for "near Eucla, Bate." Black (1929, 1957) recorded the species for South Australia "near Eucla" and presumably he followed Mueller and assumed that the species would most likely be in the western part of the state if it occurs at Eucla. This South Australian record was rejected by Chinnock (1978).

E. denticulata is closely allied to *E. decipiens* Ostenf., but differs from this species in having glabrous angled branches, larger broader glossy leaves and a larger prominently beaked or sulcated fruit with three locules.

188b. Subsp. *trisulcata* Chinnock, subsp. nov.

Leaves with entire or, very rarely, obscurely denticulate margins; sepals 6.5–13mm long; fruit depressed ovoid to subglobular, apex depressed with three furrows deeply trisecting it, 10–15 × 11–20mm.

Distribution and Ecology

Eremophila denticulata subsp. trisulcata is known only from the Eyre Botanical District in the areas north and north west of Mt Ragged where it grows on powdery grey loams in tall *Eucalyptus* woodland over *Melaleuca* shrubland.

Conservation status: 2E. Hopper *et al.* (1991) gave this subspecies a Conservation and Land Management priority rating of 2. The species occurs as scattered individuals or in small populations. Mr W. Archer (pers. comm.) located one population of over 100 individuals E of Mt Buraminya and a smaller one nearby.

Derivation of epithet

Latin *trisulcata*, three-furrowed.