Department of Biodiversity, Conservation and Attractions

GOVERNMENT OF WESTERN AUSTRALIA

Interim Recovery Plan No. **385**

Quairading Triggerplant

(*Stylidium coroniforme* subsp. *amblyphyllum*)

Interim Recovery Plan

Department of Biodiversity, Conservation and Attractions, Western Australia

December 2018

List of Acronyms

The following acronyms are used in this plan:

BGPA	Botanic Gardens and Parks Authority
CFF	Conservation of Flora and Fauna
CITES	Convention on International Trade in Endangered Species
CPC	Conservation and Parks Commission
CR	Critically Endangered
DPLH	Department of Planning, Lands and Heritage
DBCA	Department of Biodiversity, Conservation and Attractions
DPaW	Department of Parks and Wildlife
DRF	Declared Rare Flora
EN	Endangered
EPBC	Environment Protection and Biodiversity Conservation
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
NRM	Natural Resource Management
PICA	Public Information and Corporate Affairs
SCP	Species and Communities Program
SWALSC	South West Aboriginal Land and Sea Council
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
WRTFRT	Wheatbelt Region Threatened Flora Recovery Team
WWF	World Wildlife Fund

Foreword

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

DBCA are committed to ensuring that Threatened Flora (also known as Declared Rare Flora (DRF)) are conserved through the preparation and implementation of Recovery Plans (RPs) or Interim Recovery plans (IRPs), and by ensuring that conservation action commences as soon as possible.

This plan will operate from December 2018 to December 2023 but will remain in force until withdrawn or replaced. It is intended that, if *Stylidium coroniforme* subsp. *amblyphyllum* is still listed as Threatened Flora in Western Australia following five years of implementation, this plan will be reviewed and the need for further recovery actions assessed.

This plan was given regional approval on 16 November 2018 and was approved by the Executive Director of Biodiversity and Conservation Science on 10 December 2018. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting DBCA, as well as the need to address other priorities.

Information in this plan was accurate at June 2018.

Plan preparation. This plan was prepared by:

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Summary

Scientific name:	*Stylidium coroniforme* subsp. *amblyphyllum*	**Shires:**	Quairading, Cunderdin
		NRM region:	Avon
Family:	Stylidiaceae	**IBRA region:**	Avon Wheatbelt
Common name:	Quairading Triggerplant	**IBRA subregion:**	Avon Wheatbelt P2
Flowering period:	mid-September to mid-October	**Recovery team:**	Wheatbelt Region Threatened Flora Recovery Team
DBCA region:	Wheatbelt		

Distribution and habitat: *Stylidium coroniforme* subsp. *amblyphyllum* is found west of Quairading and near Youndegin, growing in shallow soils over sheet laterite. Associated species include *Hakea subsulcata*, *Banksia armata*, *B. nobilis*, *B. rufa*, *Beaufortia incana* and *Grevillea insignis* (Wege and Coates 2007; Western Australian Herbarium 1998–).

Habitat important for the survival of the subspecies, and important subpopulations: It is considered that all known habitat for the wild subpopulations is important for the survival of *Stylidium coroniforme* subsp. *amblyphyllum*, and that wild subpopulations are important subpopulations. Habitat important for the survival of *Stylidium coroniforme* subsp. *amblyphyllum* includes the area of occupancy of subpopulations and areas of similar habitat surrounding and linking subpopulations (these provide potential habitat for subpopulation expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered subpopulations of the subspecies or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the subspecies.

Conservation status: *Stylidium coroniforme* subsp. *amblyphyllum* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 3 November 2015. It was ranked as Endangered (EN) in Western Australia on 11 September 2018 under International Union for Conservation of Nature (IUCN) 2001 Red List criteria B1ab(iii)+2ab(iii) due to it being severely fragmented, its extent of occurrence estimated to be less than 5,000 km^2 (333 km^2), its area of occupancy estimated to be less than 500 km^2 (28 km^2), and there being a continuing decline in its area occupied and quality of its habitat. The subspecies has been nominated for listing as Endangered (EN) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Government of Australia 1999).

Threats: The main threats to *Stylidium coroniforme* subsp. *amblyphyllum* are altered fire regimes, farming practices, grazing, poor recruitment and drought.

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. DBCA, with the assistance of the Wheatbelt Region Threatened Flora Recovery Team, is overseeing the implementation of recovery actions for *Stylidium coroniforme* subsp. *amblyphyllum*.
2. Land managers have been notified of the location and threatened status of the subspecies.
3. The subspecies has been opportunistically surveyed for in areas of suitable habitat.
4. Approximately 1,000 seeds are stored in the Threatened Flora Seed Centre (TFSC) at –18°C. The seeds have not yet been processed.
5. Monitoring of the subspecies has been carried out opportunistically with plant numbers and current threats recorded. Global Positioning System (GPS) locations of plants within subpopulations have been recorded in Geographic Information System databases at the Wheatbelt Region, and at Species and Communities Program (SCP).

Plan objective: The objective of this plan is to abate identified threats and maintain or enhance extant subpopulations to ensure the long-term conservation of the subspecies in the wild.

Recovery criteria

Criteria for recovery success: The plan will be deemed a success 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 individuals within known subpopulations has increased by >20% from 943 to 1,132 or more; or
- New subpopulations have been found, increasing the number of known subpopulations from 11 to 12 or more with no net loss of mature plants; or
- The area of occupancy has increased by >10% with no net loss of mature plants.

Criteria for recovery failure: The plan will be deemed a failure if one or more of the following take place over the term of the plan:

- Subpopulations have been lost which result in a reduction in the extent of occurrence; or
- The number of mature individuals has decreased by >10% to 849 or less; or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

Recovery actions

1. Coordinate recovery actions
2. Monitor subpopulations
3. Liaise with land managers and Aboriginal communities
4. Fence subpopulations
5. Protect plants from herbivory
6. Collect and store seed
7. Undertake regeneration trials
8. Obtain biological and ecological information
9. Undertake surveys for new subpopulations
10. Ensure long-term protection of habitat
11. Develop and implement a fire management strategy
12. Develop and implement a Translocation Proposal
13. Map habitat important for the survival of *Stylidium coroniforme* subsp. *amblyphyllum*
14. Promote awareness
15. Review this plan and assess the need for further recovery actions

1. Background

History

Stylidium coroniforme subsp. *amblyphyllum* was first collected by Miss Alice Eaton in 1889 from a location described as the "east sources of the Swan River". This collection was sent to the National Herbarium of Victoria where it remained unrecognised as a new taxon. In 2002 a second collection was made during World Wildlife Fund (WWF) Woodland Watch surveys of private property in the Avon Wheatbelt (Subpopulation 1) and was immediately recognised as significant. Three additional subpopulations (Subpopulations 2, 6 and 7) were discovered over the course of these surveys. The subspecies was named in 2007 (Wege and Coates 2007).

Subpopulations 3, 4, 5 and 8 were discovered by DBCA volunteer Bert Hort during targeted surveys conducted between 2010 and 2014.

In 2012, Subpopulation 9 was discovered on private property registered as Land for Wildlife, a voluntary management agreement which encourages a management focus that fosters biodiversity. It does not confer protection as such, but indicates that landholders are likely to be supportive of the rare flora and manage the area in a sympathetic way.

Subpopulation 10 was discovered in 2016 during a survey of private property by DBCA and York Wildflower Society.

There are currently 11 subpopulations and around 943 plants known, with all but one subpopulation found on private property.

Description

Stylidium coroniforme subsp. *amblyphyllum* is a perennial herb 7 to 22 cm high with a thickened stem stock that can become shallowly buried as the plant ages. The leaves are arranged in a basal rosette and are linear to narrowly oblanceolate, 1 to 3 cm long, 0.8 to 2.3 mm wide, blunt or very shortly mucronate (mucro to 0.2 mm long), marginate and glabrous. The scape is glandular-hairy above the lowest flower and the inflorescence is racemose (rarely paniculate). The hypanthium and capsules are cylindric, glandular-hairy, and sterile in one loculus. The corolla lobes are yellow (more rarely pinkish) with one set of red throat markings, paired laterally, and bear two filiform throat appendages. The stigma is prominently stalked.

Stylidium coroniforme subsp. *amblyphyllum* has the same floral morphology as *S. coroniforme* subsp. *coroniforme* (which is also listed as Threatened Flora) but differs in having leaves and floral bracts with blunt to very shortly mucronate apices (Wege and Coates 2007). The subspecies name is derived from the Greek *ambly–* (blunt) and *–phyllum* (leaf), in reference to its distinctive leaves, which are unique in the genus.

Illustrations and/or further information

Wege, J.A. and Coates, D.J. (2007) Observations on the rare triggerplant *Stylidium coroniforme* (Stylidiaceae) and the description of two allied taxa of conservation concern. *Nuytsia* 17: 433–444; Western Australian Herbarium (1998–) *FloraBase—the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. http://florabase.dpaw.wa.gov.au/

Distribution and habitat

Stylidium coroniforme subsp. *amblyphyllum* is found west of Quairading and near Youndegin, growing in shallow soil over sheet laterite. Associated species include *Banksia armata*, *B. nobilis*, *B. rufa*, *Beaufortia incana*, *Grevillea insignis* and *Hakea subsulcata* (Wege and Coates 2007; Western Australian Herbarium 1998–). The extent of occurrence is 333 km^2 and the area of occupied habitat is less than 0.55 km^2. The area of occupancy is estimated to be 28 km^2 using the IUCN 2km x 2km grid method.

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

TPFL subpopulation number & location	DBCA Region	Shire	Vesting	Purpose	Manager
1. WNW of Quairading	Wheatbelt	Quairading	Private property	Freehold	Landowners
2. WNW of Quairading	Wheatbelt	Quairading	Private property	Freehold	Landowners
3a. WNW of Quairading	Wheatbelt	Quairading	Private property	Freehold	Landowners
3b. WNW of Quairading	Wheatbelt	Quairading	Private property	Freehold	Landowners
4. WNW of Quairading	Wheatbelt	Quairading	Private property	Freehold	Landowners
5. WNW of Quairading	Wheatbelt	Quairading	CPC	CFF	DBCA
6. WNW of Quairading	Wheatbelt	Quairading	Private property	Freehold	Landowners
7. WNW of Quairading	Wheatbelt	Quairading	Private property	Freehold	Landowners
8. NW of Quairading	Wheatbelt	Quairading	Private property	Freehold	Landowners
9. SE of Youndegin	Wheatbelt	Cunderdin	Private property	Freehold	Landowners
10a. SE of York	Wheatbelt	Beverley	Private property	Freehold	Landowners
10b. SE of York	Wheatbelt	Beverley	Private property	Freehold	Landowners
11. WNW of Quairading	Wheatbelt	Beverley	Private property	Freehold	Landowners

CPC, Conservation and Parks Commission; CFF, Conservation of Flora and Fauna

Biology and ecology

Stylidium coroniforme subsp. *amblyphyllum* usually flowers from mid-September to mid-October, peaking toward the end of September and into early October; however, flowering was recorded in late November 2013 following above-average September rainfall. Like many other perennial triggerplants, this taxon is unlikely to flower under drought conditions. Individuals produce from one to around 20 flowering scapes and each scape produces about five to 75 flowers. Fruiting has been recorded in late November.

Stylidium flowers are protandrous, with a fast-moving column first depositing pollen on visiting insects and later, when the anthers are empty and the stigma mature, retrieving pollen from insects. While this promotes cross-pollination, geitonogamy (resulting in self-pollination) is likely to occur (Wege *et al.* 2015). Reduction in seed set after self-pollination (compared to that after cross-pollination) is widespread in the genus due to recessive lethal or incompatibility factors (James 1979; Coates 1982; Burbidge and James 1991). Specific pollinators have not been recorded for

S. coroniforme subsp. *amblyphyllum*, but based on observations of other taxa with similar floral morphologies, it is likely to be pollinated by bee flies, syrphid flies and native solitary bees.

Like *Stylidium coroniforme* subsp. *coroniforme*, and other perennial species within the genus, *S. coroniforme* subsp. *amblyphyllum* is thought to be relatively short-lived, disturbance adapted, and typically goes through bottleneck-flush cycles associated with temporary habitat perturbations, such as fire, which may result in high variability in the number of individuals. The lack of natural disturbance in the closely related *S. amabile* may have contributed to population decline through poor recruitment (Chant and Page 2010). However, fluctuations in *S. coroniforme* subsp. *coroniforme* subpopulation sizes were found by Coates (1992) to be of little consequence in terms of allelic diversity, and maintenance of high levels of genetic diversity in small subpopulations may be part of the genetic system found in this subspecies and other triggerplants.

Conservation status

Stylidium coroniforme subsp. *amblyphyllum* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 3 November 2015. It was ranked as Critically Endangered (CR) in Western Australia under International Union for Conservation of Nature (IUCN) 2001 Red List criteria B1ab(iii) due to it being severely fragmented, its extent of occurrence estimated to be less than 100 km^2, and there being a continuing decline in its area occupied and quality of its habitat. The subspecies extent of occurrence is now known to be greater than 100 km^2 and consequently the subspecies was re-ranked as Endangered under criteria B1ab(iii)+2ab(iii) on 11 September 2018. The subspecies has been nominated for listing as Endangered (EN) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Government of Australia 1999).

Threats

- **Altered fire regimes.** Infrequent fire may be needed to stimulate recruitment from soil-stored seed. However, fire is likely to kill mature plants (though some resprouting may potentially occur if stems are buried) and frequent fire would deplete the soil seed store. Fire is also likely to facilitate weed invasion and should be followed up with appropriate weed control.
- **Farming practices.** Farming practices are a threat to Subpopulation 3b and include fertiliser and chemical drift, trampling of habitat and plants by stock, and weed invasion.
- **Grazing.** Grazing by rabbits and kangaroos (and stock at Subpopulation 3b) is a potential threat to *Stylidium coroniforme* subsp. *amblyphyllum*. Grazing of the flowering scapes has been observed previously (Wege *et al*. 2015). Grazing may also have an impact on the establishment of seedlings thereby limiting natural recruitment. The lessee of private property containing Subpopulation 11 intends moving stock (sheep) into the paddock adjacent to where the species occurs after harvest (January) (B. Hort pers. comm.). Plants will have finished flowering for the season, so grazing by sheep will not be an issue, but the sheep will degrade the associated habitat through trampling and grazing.
- **Poor recruitment.** The biology of the subspecies is insufficiently known to be certain of the effect of drought and temperature extremes on seed germination and seedling survival. The subspecies appears to require a disturbance to recruit, but if disturbance is too frequent, occurs at the wrong time of the year or is followed by a drought, subpopulations may be severely impacted.
- **Drought** is a threat to the subspecies and may be considered equivalent to a major disturbance. Drought may also delay surveys for additional subpopulations given that plants are unlikely to flower and therefore more difficult to detect.

The intent of this plan is to identify actions that will mitigate immediate threats to *Stylidium coroniforme* subsp. *amblyphyllum*. Although climate change may have a long-term effect on the subspecies, actions taken directly to prevent its impact are beyond the scope of this plan.

Table 2. Summary of subpopulation information and threats

TPFL subpopulation number & location	Land status	Year/no. mature plants	Condition		Threats
			Plants	Habitat	
1. WNW of Quairading	Private property	2002 localised 2004 75		Moderate	Fire, grazing, poor recruitment, drought
2. WNW of Quairading	Private property	2007 occasional			Fire, grazing, poor recruitment, drought
3a. WNW of Quairading	Private property	2013 15 (23) 2015 43 2017 75	Healthy	Excellent	Fire, grazing, poor recruitment, drought
3b. WNW of Quairading	Private property	2014 9 2015 10 2017 57	Healthy	Excellent	Farming practices, poor recruitment, fire, grazing, drought
4. WNW of Quairading	Private property	2013 15 (3) 2015 16 2017 15	Healthy	Good	Fire, grazing, poor recruitment, drought
5. WNW of Quairading	Nature reserve	2013 71 (40) 2015 139	Healthy	Good	Fire, grazing, poor recruitment, drought
6. WNW of Quairading	Private property	2004 36 2008 52			Fire, grazing, poor recruitment, drought
7. WNW of Quairading	Private property	2004 18		Good	Fire, grazing, poor recruitment, drought
8. NW of Quairading	Private property	2013 16 (6) 2015 31 2018 30	Moderate	Degraded	Fire, grazing, poor recruitment, drought
9. SE of Youndegin	Private property	2012 40–50			Fire, grazing, poor recruitment, drought
10a. SE of York	Private property	2016 23	Healthy	Good	Fire, grazing, poor recruitment, drought
10b. SE of York	Private property	2016 97	Healthy	Good	Fire, grazing, poor recruitment, drought
11. WNW of Quairading	Private property	2017 312 (117)	Healthy	Excellent	Fire, grazing, poor recruitment, drought

Note: ( ) = number of juveniles/seedlings.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions that result in any of the following may potentially have a significant impact on the subspecies:

- 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 subpopulation.

Habitat important for the survival of the subspecies, and important subpopulations

Stylidium coroniforme subsp. *amblyphyllum* is listed as Threatened (Endangered) flora in Western Australia and it is considered that all known habitat for the wild subpopulations is important for the survival of the subspecies, and that wild subpopulations are important subpopulations. Habitat important for the survival of *S. coroniforme* subsp. *amblyphyllum* includes the area of occupancy of subpopulations and areas of similar habitat surrounding and linking subpopulations (these provide potential habitat for subpopulation expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered subpopulations of the subspecies or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the subspecies.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Stylidium coroniforme* subsp. *amblyphyllum* will also benefit the four Threatened Flora and three Priority Flora species listed in the table below:

Table 3. Conservation-listed flora species occurring within 500 m of *Stylidium coroniforme* subsp. *amblyphyllum*

Species name	Conservation status (WA)	Conservation status (*EPBC Act 1999*)
Guichenotia seorsiflora	DRF (CR)	CR
Hakea aculeata	DRF (EN)	VU
Melaleuca sciotostyla	DRF (EN)	EN
Thomasia montana	DRF (VU)	VU
Darwinia sp. Wyalgima Hill (L.W. Sage, J.P. Pigott & E.B. Pigott LWS1549)	Priority 1	-
Chamelaucium sp. Dryandra (D. Rose 446)	Priority 2	-
Acacia phaeocalyx	Priority 3	-

For a description of conservation codes for Western Australian flora see https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities

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. *Stylidium coroniforme* subsp. *amblyphyllum* 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 Planning, Lands and Heritage (DPLH) Aboriginal Heritage Sites Register revealed no sites of Aboriginal significance adjacent to subpopulations of *Stylidium coroniforme* subsp. *amblyphyllum*. However, input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and DPLH to determine if there are any issues or interests with respect to management for this subspecies. 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 subspecies occurs.

Social and economic impacts

Management of private land containing a subpopulation of *Stylidium coroniforme* subsp. *amblyphyllum* may need to be modified to include rabbit control, restricting access to stock and fire management.

Affected interests

The implementation of this plan has some implications for private landholders, particularly as subpopulations occur on lands that are not specifically managed for conservation.

Evaluation of the plan's performance

DBCA with assistance from the Wheatbelt Region Threatened Flora Recovery Team (WRTFRT) 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* subpopulations to ensure the long-term conservation of the subspecies in the wild.

Recovery criteria

Criteria for recovery success: The plan will be deemed a success 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 individuals within known subpopulations has increased by >20% from 943 to 1,132 or more; or

- New subpopulations have been found, increasing the number of known subpopulations from 11 to 12 or more with no net loss of mature plants; or
- The area of occupancy has increased by >10% with no net loss of mature plants.

Criteria for recovery failure: The plan will be deemed a failure if one or more of the following take place over the term of the plan:

- Subpopulations have been lost which result in a reduction in the extent of occurrence; or
- The number of mature individuals has decreased by >10% to 849 or less; or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

3. Recovery actions

Existing recovery actions

DBCA, with the assistance of the WRTFRT, is overseeing the implementation of recovery actions for *Stylidium coroniforme* subsp. *amblyphyllum*.

Notifications to land owners/managers detail the current Threatened status of *Stylidium coroniforme* subsp. *amblyphyllum* and the associated legal obligations in regards to its protection.

Volunteer Bert Hort has conducted extensive surveys of all likely, accessible habitats in the district over several years (but limited by access to some private property). Extensive surveys of private property in the region, and more broadly in the Avon Wheatbelt, have been conducted as part of the WWF Woodland Watch initiative, during which four new subpopulations were discovered (Subpopulations 1, 2, 6 and 7).

Approximately 1,000 *Stylidium coroniforme* subsp. *amblyphyllum* seeds are stored in the Threatened Flora Seed Centre (TFSC) at –18°C (see table 4). The seeds have not yet been processed.

Table 4. TFSC collection details for *Stylidium coroniforme* subsp. *amblyphyllum*

Accession number	Date collected	TPFL subpopulation number	Collection type	No. seed in storage	Estimated germinable seed
04206 Base 1	23/11/2013	5	B/74	Not yet processed	Not yet tested
04207 Base 1	23/11/2013	3	B/18	1,660	Not yet tested

Collection type: 'B' = a bulked collection/number of plants sampled.

Monitoring has been carried out opportunistically with plant numbers and current threats recorded. Global Positioning System (GPS) locations of plants within the subpopulation have been recorded in Geographic Information System databases at the Wheatbelt Region and at Species and Communities Program (SCP).

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 DBCA, permission has been or will be sought from the appropriate land managers prior to actions being undertaken.

1. Coordinate recovery actions

DBCA with assistance from the WRTFRT will oversee the implementation of recovery actions for *Stylidium coroniforme* subsp. *amblyphyllum* and will include information on progress in annual reports.

Action: Coordinate recovery actions
Responsibility: DBCA (Wheatbelt Region), with assistance from the WRTFRT
Cost: $8,000 per year

2. Monitor subpopulations

Monitoring of subpopulations and their habitat should be undertaken to identify trends or potential management requirements. Subpopulation monitoring should record the health and expansion or decline in subpopulations, and other observations such as pollinator activity or seed production. Site monitoring should include observations of grazing, habitat degradation including weed invasion, and hydrological status (drought). Specific monitoring of hydrology and activities relating to research into the biology and ecology of *Stylidium coroniforme* subsp. *amblyphyllum* are included in other recovery actions detailed below.

Action: Monitor subpopulations
Responsibility: DBCA (Wheatbelt Region), with assistance from the WRTFRT
Cost: $8,000 per year

3. Liaise with land managers and Aboriginal communities

As all but one subpopulation of *Stylidium coroniforme* subsp. *amblyphyllum* occur on private property, staff from DBCA Wheatbelt Region will liaise with land owners/managers to ensure subpopulations are not accidentally damaged or destroyed, and the habitat is maintained in a suitable condition for the conservation of the subspecies. Consultation with Aboriginal communities will take place to determine if they have any issues or interests in areas that provide habitat for the subspecies.

Action: Liaise with land managers and Aboriginal communities
Responsibility: DBCA (Wheatbelt Region)
Cost: $4,000 per year

4. Fence subpopulations

Private property locations containing subpopulations of *Stylidium coroniforme* subsp. *amblyphyllum* (such as Subpopulation 3b and Subpopulation 11) that are stocked with livestock may require fencing to prevent grazing and trampling.

Action: Fence subpopulations
Responsibility: DBCA (Wheatbelt Region), land owners/managers
Cost: $20,000 in year 5

5. Protect plants from herbivory

When annual monitoring of *Stylidium coroniforme* subsp. *amblyphyllum* ascertains that the threat by rabbits and kangaroos is high, baiting for rabbits using 1080 oats should be undertaken where practical. Ripping or fumigating warrens may also be implemented. Control measures are likely to be required on an ongoing basis. Additional protective measures such as fencing or caging of plants or groups of plants may be required in areas that are heavily grazed.

Action: Protect plants from herbivory
Responsibility: DBCA (Wheatbelt Region), land owners/managers
Cost: $20,000 in year 1; $8,000 per years 2-5

6. Collect and store seed

Although some seed has been collected, further collections are required to guard against the extinction of known natural subpopulations and it is recommended that seed be collected and stored at DBCA's Threatened Flora Seed Centre (TFSC). Collections should aim to sample and preserve the maximum range of genetic diversity possible.

Action: Collect and store seed
Responsibility: DBCA (Wheatbelt Region, TFSC)
Cost: $10,000 per year

7. Undertake regeneration trials

Habitat disturbance (physical or fire) is known to promote recruitment in many species of *Stylidium* and it is recommended that disturbance trials be undertaken for *S. coroniforme* subsp. *amblyphyllum*. Permanent quadrats will be established to monitor the response of the subspecies.

Action: Undertake regeneration trials
Responsibility: DBCA (Biodiversity and Conservation Science, Wheatbelt Region)
Cost: $10,000 in years 1 and 3, $4,000 in years 2, 4 and 5

8. Obtain biological and ecological information

It is recommended that research on the biology and ecology of *Stylidium coroniforme* subsp. *amblyphyllum* 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 subpopulation size.
7. The impact of changes in hydrology.

Action: Obtain biological and ecological information
Responsibility: DBCA (Biodiversity and Conservation Science, Wheatbelt Region)
Cost: $50,000 in years 1–3

9. Undertake surveys for new subpopulations

Surveys should be undertaken in areas of potentially suitable habitat, with all surveyed areas recorded and the presence or absence of *Stylidium coroniforme* subsp. *amblyphyllum* documented to improve survey efficiency and prevent duplication of effort. Where feasible, volunteers will be encouraged to participate. Areas should be resurveyed following disturbance such as fire.

Action: Undertake surveys for new subpopulations
Responsibility: DBCA (Wheatbelt Region), with assistance from the WRTFRT and volunteers
Cost: $10,000 per year

10. Ensure long-term protection of habitat

Improved security of the subpopulations and their habitat will be investigated and may include land acquisition for conservation reservation or conservation covenants.

Action: Ensure long-term protection of habitat
Responsibility: DBCA (Wheatbelt Region, SCP), land owners
Cost: $1,000 per year

11. Develop and implement a fire management strategy

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

Action: Develop and implement a fire management strategy
Responsibility: DBCA (Wheatbelt Region)
Cost: $10,000 in year 1, and $6,000 in years 2–5

12. Develop and implement a Translocation Proposal

Translocations may be required for the long term conservation of *Stylidium coroniforme* subsp. *amblyplyllum* if natural subpopulations decline, with the first priority being augmentation of secure subpopulations.

Information on the translocation of Threatened plants and animals in the wild is provided in DBCA Corporate Policy Statement No. 35 (DPaW 2015*a*), DBCA Corporate Guideline No. 36 (DPaW 2015*c*) and the Australian Network for Plant Conservation (ANPC) Translocation Guidelines (Vallee *et al*. 2004). The ANPC Translocation Guidelines state that a translocation may be needed when a species is represented by few subpopulations and the creation of additional self-sustaining, secure subpopulations may decrease its susceptibility to catastrophic events and environmental stochasticity. For small subpopulations which may be declining in size or subject to high levels of inbreeding, successful subpopulation enhancement may increase subpopulation stability and hence long-term viability.

Depending on the characteristics of the subspecies, Vallee *et al*. (2004) suggest a minimum viable subpopulation 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 DBCA's Executive Director of Biodiversity and Conservation Science. 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: DBCA (Biodiversity and Conservation Science, Wheatbelt Region), BGPA
Cost: $42,000 in years 1 and 2; and $26,500 in subsequent years as required

13. Map habitat important for the survival of *Stylidium coroniforme* subsp. *amblyphyllum*

Although spatial data relating to habitat important for the survival of *Stylidium coroniforme* subsp. *amblyphyllum* has been identified in Section 1, it has not been mapped. If additional subpopulations are located, habitat important for their survival will also be determined and mapped.

Action: Map habitat important for the survival of *Stylidium coroniforme* subsp. *amblyphyllum*
Responsibility: DBCA (SCP, Wheatbelt Region)
Cost: $6,000 in year 2

14. Promote awareness

The importance of biodiversity conservation and the protection of *Stylidium coroniforme* subsp. *amblyphyllum* will be promoted through direct contact with 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.

Action: Promote awareness
Responsibility: DBCA (Wheatbelt Region, SCP, Public Information and Corporate Affairs (PICA)), with assistance from the WRTFRT
Cost: $7,000 in years 1 and 2; $5,000 in years 3–5

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

If *Stylidium coroniforme* subsp. *amblyphyllum* 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.

Action: Review this plan and assess the need for further recovery actions
Responsibility: DBCA (SCP, Wheatbelt Region)
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	DBCA (Wheatbelt Region), with assistance from the WRTFRT	Ongoing
Monitor subpopulations	High	DBCA (Wheatbelt Region), with assistance from the WRTFRT	Ongoing
Liaise with land managers and Aboriginal communities	High	DBCA (Wheatbelt Region)	Ongoing
Fence subpopulations	High	DBCA (Wheatbelt Region), land owners/managers	2023
Protect plants from herbivory	High	DBCA (Wheatbelt Region), land owners/managers	Ongoing
Collect and store seed	High	DBCA (Wheatbelt Region, TFSC)	2023
Undertake regeneration trials	High	DBCA (Biodiversity and Conservation Science, Wheatbelt Region)	2023
Obtain biological and ecological information	High	DBCA (Biodiversity and Conservation Science, Wheatbelt Region)	2021
Undertake surveys for new subpopulations	High	DBCA (Wheatbelt Region), with assistance from the WRTFRT and volunteers	Ongoing
Ensure long-term protection of habitat	High	DBCA (Wheatbelt Region, SCP), land owners	2023
Develop and implement a fire management strategy	Medium	DBCA (Wheatbelt Region)	Developed by 2019, implementation ongoing
Develop and implement a Translocation Proposal	Medium	DBCA (Biodiversity and Conservation Science, Wheatbelt Region), BGPA	2023
Map habitat important for the survival of *Stylidium coroniforme* subsp. *amblyphyllum*	Medium	DBCA (SCP, Wheatbelt Region)	2020
Promote awareness	Medium	DBCA (Wheatbelt Region, SCP, PICA), with assistance from the WRTFRT	2023
Review this plan and assess the need for further recovery actions	Medium	DBCA (SCP, Wheatbelt Region)	2023

4. Term of plan

This plan will operate from December 2018 to December 2023 but will remain in force until withdrawn or replaced. If the subspecies is still listed as Threatened after five years, a review of this plan will be completed, the need for further recovery actions determined, and a revised plan prepared if necessary.

5. References

Burbidge, A.H. and James S.H. (1991) Postzygotic seed abortion in the genetic system of *Stylidium* (Angiospermae: Stylidiaceae). *Journal of Heredity* 82: 319–328.

Chant, A. and Page, C. (2010) *Stylidium amabile* disturbance trial. *Watsnu* 16(1): 4–5.

Coates, D.J. (1982) Chromosome variation and species relationships in the scale-leaved triggerplants (*Stylidium* section *Squamosae*). *Australian Journal of Botany* 30: 121–130.

Coates, D.J. (1992) Genetic consequences of a bottleneck and spatial genetic structure in the triggerplant *Stylidium coroniforme* (Stylidiaceae). *Heredity* 69: 512–520.

Department of Parks and Wildlife (2015*a*) Corporate Policy Statement No. 35 *Conserving Threatened Species and Ecological Communities*. Perth, Western Australia.

Department of Parks and Wildlife (2015*b*) Corporate Guideline No. 35 *Listing and Recovery of Threatened Species and Ecological Communities*. Perth, Western Australia.

Department of Parks and Wildlife (2015*c*) Corporate Guideline No. 36 *Recovery of Threatened Species through Translocation and Captive Breeding or Propagation*. Perth, Western Australia.

Government of Australia (1999) *Environment Protection and Biodiversity Conservation Act*.

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.

James, S.H. (1979) Chromosome numbers and genetic systems in the Trigger Plants of Western Australia (*Stylidium*; Stylidiaceae). *Australian Journal of Botany* 27: 17–25.

Stack, G., Willers, N. and Brown, A. (2003) *Wongan Hills Triggerplant (*Stylidium coroniforme*) Interim Recovery Plan 2003–2008*. Department of Conservation and Land Management, Western Australia.

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.

Wege, J.A. (2007) New species and circumscriptions in *Stylidium* (Stylidiaceae). *Nuytsia* 17: 415–432.

Wege, J.A. and Coates, D.J. (2007) Observations on the rare triggerplant *Stylidium coroniforme* (Stylidiaceae) and the description of two allied taxa of conservation concern. *Nuytsia* 17: 433–444.

Wege, J., Hort, B. and Moore, N. (2015) *Form to nominate a Western Australian species for listing as threatened, change of category or delisting 2015*. Department of Parks and Wildlife, WA.

Western Australian Herbarium (1998–) *FloraBase—the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. http://florabase.dpaw.wa.gov.au/.

6. Taxonomic description

The following description has been updated from Wege and Coates (2007).

Stylidium coroniforme

Caespitose perennial herb, 7–22 cm high; *stems* thickened, contracted or shortly elongated, branched or unbranched, partly buried or slightly elevated above the soil, bearing persistent leaf bases, stilt roots present. *Glandular trichomes* 0.15–0.3 mm long, with a translucent stalk and red to red-black, ellipsoid head. *Leaves* in a basal rosette, linear to oblanceolate, (1–)2–4 cm long, 0.8–2.8 mm wide, blunt to prominently mucronate, margin white with minute prominences, surface glabrous. *Scapes* 4–25 cm long, 0.6–2.5 mm wide, glandular-hairy above the lowest flower, otherwise glabrous; sterile bracts absent. *Inflorescence* racemose (rarely paniculate), *c*. 6–40-flowered; bracts ovate, 3–11 mm long, subacute to mucronate, ± hyaline, glabrous to sparingly glandular-hairy; prophylls situated at base of hypanthium, similar to the bracts but smaller; pedicels to 4 mm long, glandular-hairy. *Hypanthium* cylindric, straight to slightly arcuate, compressed in T.S. and with one cell of ovary infertile, 6–16 mm long, 0.7–2 mm wide, glandular-hairy. *Calyx lobes* free, 2–4 mm long, 0.6–1.5 mm wide, subacute, ± hyaline, glandular-hairy. *Corolla* yellow (rarely pinkish) with one set of red throat markings and a yellow throat, flushed red on reverse, abaxially glandular-hairy; lobes paired laterally, *c.* equal in length or with the anterior pair slightly shorter; anterior lobes elliptic, anterior margin strongly arcuate, 3.5–5.5 mm long, 2–3.3 mm wide; posterior lobes elliptic, often slightly falcate, 3.8–6.2 mm long, 2–3 mm wide; tube 2–4 mm long. *Labellum* orbicular to ovate, 0.7–1.2 mm long, 0.5–1.2 mm wide, with a red, papillose margin; lateral appendages red to yellowish, 0.7–1.8 mm long, papillose. *Throat appendages* 2 (1 on each anterior corolla lobe), yellow with red tips, filiform to subulate, 0.7–1.8 mm long, sometimes absent or reduced in size in cultivated material. *Column* 9.5–15 mm long, sharply angled at the tip (such that the anthers are perpendicular to the column axis), glabrous; anthers with red subtending hairs; stigma entire, circular to elliptic, 0.4–0.6 mm long, 0.2–0.5 mm wide. *Capsules* cylindrical, *c.* 12–18 mm long excluding calyx lobes. *Seed* brown, *c.* 1 mm long, *c.* 0.5 mm wide, papillose.

Stylidium coroniforme* subsp. *amblyphyllum

Leaves linear to narrowly-oblanceolate, 1–3 cm long, 0.8–2.3 mm wide, subacute to very shortly mucronate, mucro <0.2 mm long. *Floral bracts* subacute to very shortly mucronate.