Government of Western Australia
Department of Environment and Conservation

INTERIM RECOVERY PLAN NO. 312

Ricinocarpos brevis

INTERIM RECOVERY PLAN

2011 – 2016

August 2011

Department of Environment and Conservation

Kensington

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

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.

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

This IRP will operate from August 2011 to July 2016 but will remain in force until withdrawn or replaced. It is intended that, if the species is still ranked as Critically Endangered (CR), this IRP will be reviewed after five years and the need for further recovery actions assessed.

This IRP was given regional approval on 20 June 2011 and was approved by the Director of Nature Conservation on 2 August 2011 2011. The provision of funds identified in this IRP is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate at August 2011.

This IRP was initiated and partially funded by Portman Iron Ore Pty Ltd (now Cliffs Asia Pacific Iron Ore).

IRP PREPARATION

This IRP was prepared by Jennifer Jackson[1] and Robyn Luu[2], with contribution by the Goldfields Threatened Flora Recovery Team.

[1]Conservation Officer, DEC Goldfields Region, PO Box 10173, Kalgoorlie, WA, 6433.
[2]Project Officer, Species and Communities Branch, DEC, Locked Bag 104, Bentley Delivery Centre, 6983.

ACKNOWLEDGMENTS

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

Andrew Brown	Threatened Flora Coordinator, Species and Communities Branch, DEC
Piers Goodman	Formerly of Portman Iron Ore Pty Ltd
Ian Harris	Cliffs Asia Pacific Iron Ore
James Hesford	Formerly of Portman Iron Ore Pty Ltd
Robert Howard	Cliffs Asia Pacific Iron Ore
Gemma McLean	Formerly of Western Botanical
Geoff Cockerton	Western Botanical
Shapelle McNee	Western Botanical
Leonie Monks	Research Scientist, DEC Science Division
David Pickles	EIA Project Coordinator, DEC Goldfields Region
Jonathan Warden	Western Botanical
Paul West	Cliffs Asia Pacific Iron Ore

Cover photographs by G. Cockerton and P. Courtis.

CITATION

This IRP should be cited as:
Department of Environment and Conservation (2011) *Ricinocarpos brevis* Interim Recovery Plan 2011-2016. Interim Recovery Plan No. 312. Department of Environment and Conservation, Perth, Western Australia.

SUMMARY

Scientific Name:	*Ricinocarpos brevis*	Common Name:	**NA**
Family:	**Euphorbiaceae**	Flowering Period:	**May-July**
DEC Region:	**Goldfields**	DEC District:	**NA**
Shire:	**Yilgarn and Menzies**	NRM Region:	**Avon**
Recovery Team:	**Goldfields Region Threatened Flora Recovery Team (GRTFRT)**	IBRA Region:	**Coolgardie and Murchison**

Illustrations and/or further information: **Halford, D.A. and Henderson, R.J.F. (2007) A taxonomic revision of *Ricinocarpos* Desf. (Euphorbiaceae: Ricinocarpinae). *Austrobaileya* 7: 387-449.**

Current status: ***Ricinocarpos brevis* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 2005 and is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN 2001) Red List criteria B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v). The species was listed by the Commonwealth as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in August 2010. It is known from five populations north of Southern Cross. The main threats to the species are mining and exploration activities.**

Description: ***Ricinocarpos brevis* is a non-lignotuberous upright shrub 1 to 1.8 m in height x 1 to 1.5 m in width. The leaves are obovate, 10 to 25 mm long and 4 to 6 mm wide with strongly recurved margins and stellate hairs on both surfaces. Flowering generally occurs during the cooler months and follows seasonal rainfall events. Fragrant white flowers have been recorded from March to July. Fruits with up to three seeds (one ovule per ovary segment) develop during spring and expand to around 12mm in length (Halford & Henderson, 2007).**

Habitat requirements: **At Windarling Range, *Ricinocarpos brevis* is found on rocky ironstone and weathered basalt on the mid to upper debri slopes of the Range. The species is more prevalent on the sheltered, cooler south facing slopes with only minor occurrences noted on the significantly hotter and drier north facing slopes. At Johnston Range, *R. brevis* has been recorded on the gently inclined lower slopes of deep sand over gravel, and the Perrinvale Station population occurs predominately on the southern slopes of a rocky ridge face.**

Habitat critical to the survival of the species, and important populations: **It is considered that all known habitat for wild populations is habitat critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *Ricinocarpos brevis* includes the area of occupancy of the important populations; areas of similar habitat surrounding and linking populations; additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations; and the local catchment for the surface and/or groundwater that maintains the habitat of the species.**

Benefits to other species or ecological communities: **Recovery actions implemented to conserve the habitat of *Ricinocarpos brevis* may also conserve habitat that includes one DRF subspecies (*Tetratheca paynterae* subsp. *paynterae*, CR), four Priority species and one Priority 1 Ecological Community.**

International obligations: **The 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. *Ricinocarpos brevis* is not listed under any specific international treaty, and therefore this plan does not affect Australia's obligations under any other international agreements.**

Indigenous Consultation: **There are four sites of Aboriginal significance within the vicinity of populations of *Ricinocarpos brevis* on Windarling Range, these include the habitat and potential habitat of *R. brevis*. In agreements with Cliffs Asia Pacific Iron Ore Pty Ltd , the claimant groups have recorded a general interest in the environment of the area. Representatives of the groups may visit the general area from time to time, sometimes as part of a community consultative group. Liaison has been included as a recovery action to ensure there will be Indigenous engagement in relation to the recovery actions posed in this plan.**

Social and economic impacts: **Mineral exploration leases cover the areas where *Ricinocarpos brevis* is known to occur and mining is taking place in the area of the Windarling Range populations. The occurrence of *R. brevis* has caused, and has the potential to cause, negative economic impacts through compliance with the environmental impact assessment and approvals process, and the potential restriction of future access to underlying iron ore deposits. There is also potential for translocation sites to complicate future access to mineral resources.**

Affected interests: **Stakeholders potentially affected by the implementation of this plan are the owners of the Pastoral leases, Cliffs Asia Pacific Iron Ore Pty Ltd and other mining tenement holders for areas where *Ricinocarpos brevis* occurs.**

Evaluation of the plan's performance: **DEC, in consultation with the GRTFRT and Koolyanobbing Project Community Reference Group (KPCRG), will evaluate the performance of this IRP. 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.**

IRP objective: **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.**

Recovery criteria
Criteria for success: **The number of populations have remained stable or have increased and/or the number of mature individuals in populations have remained stable or have increased over the term of the plan.**
Criteria for failure: **The number of populations have decreased and/or the number of mature individuals in populations have decreased over the term of the plan.**

Existing recovery actions: **The following recovery actions have been or are currently being implemented:**

1. **A census of *R. brevis* completed in 2010 by Cliffs Asia Pacific Iron Ore Pty Ltd confirmed the *R. brevis* populations at the Windarling Range to have approximately 12,000 individuals. There are approximately 3,000 individuals at the Perrinvale Station population and the *R. brevis* population at the Johnston Range has been estimated at 3,000 individuals.**
2. **A regional aerial survey for *R. brevis* was undertaken by Cliffs Asia Pacific Iron Ore Pty Ltd during 2009 targeting a number of previously unsurveyed BIF ranges in the northern Yilgarn area did not detect further populations.**
3. **A condition monitoring program for the Windarling Range *R. brevis* population has been undertaken by Cliffs Asia Pacific Iron Ore Pty Ltd since 2003, with approximately 340 individuals monitored annually (as a subset);**
4. **Approximately 16,880 (2004), 169,000 (2008) and 6,300 (2009) *R. brevis* seeds have been collected from the Windarling Range populations by Cliffs. These seeds are currently held by by Landcare Services on behalf of Cliffs Asia Pacific Iron Ore Pty Ltd and the DEC Threatened Flora Seed Centre;**
5. **Studies on the soil seed store, seed viability and germination were undertaken by Cliffs Asia Pacific Iron Ore Pty Ltd during 2003 at the Windarling Range *R. brevis* populations. No appreciable seed was found in soils from under *R. brevis* plants.**
6. **Preliminary studies on flowering, pollination and seed predation were completed between 2004 and 2006.**
7. **Cuttings from 35 individuals of *R. brevis* were taken during 2006 by Cliffs Asia Pacific Iron Ore Pty Ltd for propagation trials. Subsequent collections were also taken in 2007 and 2008. Results have been poor with five cuttings surviving.**
8. **Seed germination trials were undertaken during 2006 and 2010 with some germination experienced in response to scarification, Giberellic Acid (GA3) and/or smoke water. Further germination trials were carried out in 2010, with GA3 and smoke water resulting in the highest germination response in these trials (Landcare Services, 2010).**
9. ***In situ* seed germination establishment trials were set up at Windarling in July 2010 by Cliffs Asia Pacific Iron Ore Pty Ltd.**
10. **A weed management plan, developed and implemented by Cliffs Asia Pacific Iron Ore Pty Ltd , has reduced the risk of establishment of more prolific and invasive weed species on Windarling Range.**
11. **A mining exclusion zone that was established under Ministerial Statement 627 for the protection of *Tetratheca paynterae* subsp. *paynterae* will concurrently secure around 20% of plants in the *Ricinocarpos brevis* populations at Windarling Range.**
12. **Non-mining areas outside of the mining exclusion zone at Windarling have been designated as local conservation areas. Signs have been installed demarcating the conservation areas and access has been restricted.**
13. **The Koolyanobbing Project Community Reference Group (KPCRG) was established in 2003, with the Group's Terms of Reference relating to the provision of community feedback and input on environmental aspects of mining at the Windarling Range.**
14. ***R. Brevis* was listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in July 2010 as part of the Commonwealth Government and DEC Species Information Partnership.**

Ongoing and future recovery actions

1. **Coordinate recovery actions.**
2. **Monitor populations and refine knowledge on the distribution, numbers and extent of all populations.**
3. **Map habitat critical to the survival of *Ricinocarpos brevis*.**
7. **Develop and implement a fire management strategy.**
8. **Maintain adequate seed/germplasm collections.**
9. **Undertake weed control, monitor effectiveness and**

4. **Undertake a *Ricinocarpos brevis* research program.**
5. **Achieve improved protection of habitat.**
6. **Further investigate translocation as a conservation strategy.**

implement additional control if required.

10. **Promote awareness of *Ricinocarpos brevis* and IRP initiatives.**
11. **Liaise with KPCRG, relevant mineral exploration lease holders and Indigenous groups.**
12. **Review this IRP and assess the need for further recovery actions.**

1. BACKGROUND

History

The first collection of *Ricinocarpos brevis* was made from north of Windarling Peak by Ken Newbey in September 1981 but was not verified as that species until January 2003. The type specimens were collected from Windarling Range by F. and M. Mollemans in June 1990 and given the phrase name *R.* sp. Diemals (F. H. & M. P. Mollemans 3096) at that time. The species was subsequently provided the manuscript name *R. brevis* by Rod Henderson (Brisbane Herbarium) and Frans Mollemans. The formal description of *R. brevis* was published in 2007 (Halford & Henderson, 2007).

***Ricinocarpos brevis* was listed by DEC as a Priority 1 flora species in September 1990, highlighting it as a poorly known species of conservation interest. During 2003, botanical consultants Western Botanical checked all prior records of *Ricinocarpos brevis*, including previously reported locations along the central and western Jackson Ranges, (Mattiske, 2001). However, the taxon was confirmed as only occurring on Windarling Range at that time (Western Botanical, 2004). It has since been found in two other locations over a geographic range of 100 km.**

Following an Environmental Impact Assessment, Cliffs Asia Pacific Iron Ore Pty Ltd (formerly Portman Iron Ore Pty Ltd) was granted environmental approval to mine at Windarling by the State Minister for the Environment on 3 June 2003 and by the Commonwealth Minister for the Environment and Heritage on 4 September 2003. Conditions of approval included constraints on the extent of mining at Windarling to limit the impact on the Declared Rare Flora (DRF) taxon *Tetratheca paynterae* subsp. *paynterae*. At the time of the environmental assessment and approval *Ricinocarpos brevis* was listed as a Priority 1 species (Priority flora species are not protected under the Western Australian *Wildlife Conservation Act 1950*) but mining constraints implemented for *Tetratheca paynterae* subsp. *paynterae* served to limit the impact on the taxon.

***Ricinocarpos brevis* was gazetted as DRF under the Western Australian *Wildlife Conservation Act 1950* on 8 February 2005. Since that time two new populations have been found, extending the regional distribution for *Ricinocarpos brevis* to over 100km. In 2007 Adrienne Markey and Steve Dillon collected *R. brevis* from a survey quadrat near the Johnston Range during a DEC Science survey of the Banded Ironstone Formations of the Yilgarn region (Markey & Dillon, in review). In 2008 a third population was found on unallocated Crown land south of Perrinvale Station by botanical consultants during a flora survey for proposed exploration activities (Warden, 2008).**

A regional aerial survey for *Ricinocarpos brevis*, undertaken by Cliffs Asia Pacific Iron Ore Pty Ltd in 2009, did not detect further populations (Warden, 2009). The survey targeted more than 10 banded iron formation ranges located north of Windarling and focused mainly on south facing slopes. As it occurred over just 2 days it was not considered exhaustive.

Description

***Ricinocarpos brevis* is a non-lignotuberous upright shrub 1 to 1.8m in height x 1 to 1.5m in width. The leaves are obovate, 10 to 25mm long and 4 to 6mm wide with strongly recurved margins and stellate hairs on both surfaces. Flowering generally occurs during the cooler months and may follow seasonal rainfall events. Fragrant white flowers have been recorded from March to July. Fruits with up to three seeds (one ovule per ovary segment) develop during spring, expand to around 12mm in length and dehisce explosively in October (Halford & Henderson, 2007; S. McNee, pers. comm.).**

Distribution and habitat

***Ricinocarpos brevis* is known from five populations (Table 2) over a geographic range of 100 km in the northern Yilgarn region. Four of the populations (Windarling and Johnston Ranges) occur on Diemals Station. Diemals Station is a pastoral station used for low intensity beef cattle production and the normal range of stock does not appear to extend to the slopes of the ranges where the taxon occurs. Significant**

iron ore mining operations currently occur on Windarling Range as part of the Cliffs Asia Pacific Iron Ore Pty Ltd Koolyanobbing Project. The fifth population at Perrinvale Station is on UCL.

The DEC is currently preparing the Northern Yilgarn Conservation Reserves draft management plan, due to be released in 2011, after new nature conservation and mining arrangements for the area were announced by the Western Australian State Government in September 2010. Within this arrangement a part of Diemals Station, which includes the Windarling Range will become reserved for the purpose of conservation and mining, however the area including the Johnston Range is not proposed to be included in this reserve system.

Windarling Populations

***Ricinocarpos brevis* occurs in association with the majority of ironstone outcrops in the Windarling Range. It occupies the upper to mid slopes where the shallow clay-loam soils (commonly less than 0.5m deep as observed in track cuttings) derived from weathered basalt are strewn with ironstone boulders and rubble and overly massive ironstone subcrops. Occasional plants are present on exposed ironstone outcrops with *Tetratheca paynterae* subsp. *paynterae* (DRF), and some also occur in drainage foci on the range. Mining operations have impacted on 38% of the original population at Windarling, and the plants remaining over the Range is estimated at over 12,000 (McNee & Barwick, 2010 in prep.). Proposed mining (currently subject to environmental approvals) will further impact the Windarling population.**

Population near the Johnston Range

The population south-west of the Johnston Range is 32 km to the north of the Windarling population. The population grows in an area on deep soils over gently inclined lower slopes and pediments. There are no ironstone outcrops associated with this population. Most of the Johnston Range is covered with vegetation that has been lightly grazed (Markey & Dillon, in review), however a survey of the population in June 2009 showed no evidence of grazing in the area of the population. The southern-most portion of the Johnston Range where this population occurs appears to be recovering well from a wildfire that occurred approximately 10 years ago. This population is estimated at having approximately 3,000 individuals over an area of approximately 30 hectares (DEC, 2009).

Perrinvale Station Population

This population is approximately 100 km ENE of the Johnson Range population. It covers an area of approximately 80 hectares with less than 3,000 plants counted during a survey in September 2008. The *Ricinocarpos brevis* was observed growing over four rocky ridge slopes, predominately on the southern most facing slopes. The population was found to be well established and in a healthy condition when surveyed in 2008 (Barwick, 2008).

Previous records at Jackson Range

The Western Australian Herbarium has one collection of *Ricinocarpos brevis* from the Jackson Ranges, apparently collected in November 2001 (DEC, 2010). However, an extensive search for the species in this area in October 2003 did not locate any plants (Western Botanical, 2004). At the location where *R. brevis* was apparently collected from the Jackson Range, a Priority 1 species, *Beyeria rostellata,* was found. The species is superficially similar in morphology to *R. brevis*. During the many botanical surveys completed since 2003, *R. brevis* has not been recorded in any of the prominent ironstone ranges south of Windarling Range, including the Jackson Ranges, Koolyanobbing Ranges, Die Hardy Ranges or the Helena and Aurora Range.

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

Pop. No. & Location	DEC Region	Shire	Vesting	Purpose	Manager
1a, b, c Windarling Range	**Goldfields**	**Yilgarn**	**Non vested**	**Pastoral lease/ current mining activities**	**Transit Holdings Pty Ltd, Diemals Pastoral Lease. Cliffs Asia Pacific Iron Ore Pty Ltd (during mining operations)**
2. Windarling Range	**Goldfields**	**Yilgarn**	**Non vested**	**Pastoral lease/**	**Transit Holdings Pty Ltd,**

				current mining activities	**Diemals Pastoral Lease. Cliffs Asia Pacific Iron Ore Pty Ltd (during mining operations)**
3. Windarling Range	**Goldfields**	**Yilgarn**	**Non vested**	**Pastoral lease/ current mining activities**	**Transit Holdings Pty Ltd, Diemals Pastoral Lease. Cliffs Asia Pacific Iron Ore Pty Ltd (during mining operations)**
4. Southwest of Johnston Range	**Goldfields**	**Menzies**	**Non vested**	**Pastoral lease**	**Transit Holdings Pty Ltd, Diemals Pastoral Lease**
5. Perrinvale Station	**Goldfields**	**Menzies**	**Non vested**	**UCL**	**Department of Planning**

Populations in bold text **are considered to be Important Populations.**

Biology and Ecology

***Ricinocarpos brevis* plants shed foliage and sacrifice stems under times of water stress, resprouting new leaves and stem tips from epicormic buds on stems following seasonal rainfall. Under prolonged severe water stress, plants can be almost leafless during summer months. This response was observed during an extended dry period (spring 2004 to autumn 2005). Regeneration commenced with new leaves growing from old stems in September 2005, four months after the onset of significant drought breaking rains (Western Botanical, in prep., Eckermann, in prep.).**

***Ricinocarpos brevis* has separate male and female flowers which bloom at different times on the same plant following sufficient autumn and winter rainfall.**

It is suggested that *Ricinocarpos brevis* is moth pollinated, perhaps at night, as it has small white flowers with a light sweet fragrance (Western Botanical, 2004). Pollination rates are noted to vary and effective viable seed set varies from year to year. However a good seed set is generally attributed to good rainfall (S. McNee, pers. comm.). A good seed set was observed in October 2004, 2008 and 2009 while little viable seed was noted in 2005, 2006, 2007 and 2010.

***Ricinocarpos brevis* is an obligate seeder, geosporous species with seeds shedding over a short period during the first few hot days in late spring, i.e. October. It is postulated that the seeds can be stored for long periods in the soil without losing significant viability, however, this has not been tested. Germination is likely after the seed coat has naturally weathered. Experimental success in germination has been achieved using GA3 and smoke water, with minimal germination of untreated seed or seed that has been scarified only (Landcare Services, 2010). There is evidence that *R. brevis* seed will germinate in episodic pulse-events without disturbance or fire but following suitable seasonal conditions. This is based on a large number of young plants less than 0.25 m high (23% of the population) being recorded in a 2003 survey following good seasonal rainfall (Western Botanical, 2004).**

When on the plant, *Ricinocarpos brevis* seed is subject to some predation by a small (4 mm long) undescribed moth larva identified as a Microlepidoptera in the super-family Gelechioidea (Dr. T. Edwards, pers. comm.). Rates of predation vary from plant to plant in any given year, however seed remaining on the plant post seed release, which is usually in October, is more susceptible (S. McNee, pers. Comm.).

A preliminary study of soils collected from under *Ricinocarpos brevis* plants has found in the order of two to five viable seeds per kilogram of topsoil (0 to 10 cm depth) within three metres of mature plants. This indicates that either seed is predated or relocated within the environment following dehiscence (Western Botanical, 2004).

Fire appears to have a negligible role in the plant's ecology at Windarling Range given the habitat is characterised by low fuel loads and low frequency of fire. However, plants at Johnston Range were noted in 2007 as occurring in a relatively recent post-fire situation with the age since fire estimated at around 10 years (DEC, 2009).

Threatening processes

***Ricinocarpos brevis* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 2005 and is currently ranked as CR under World Conservation Union (IUCN 2001) Red List criteria B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v). The species was listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in August 2010. The primary threat to *Ricinocarpos brevis* is direct removal and loss of habitat by mining and exploration activities, with possible secondary threats associated with nearby mining operations and natural environmental factors resulting from climate change.**

Threats include:

- Mining (Direct removal): **Implementation of a mining proposal approved under the State *Environmental Protection Act 1986* and *Mining Act 1978* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* has resulted in *Ricinocarpos brevis* being impacted by iron ore mining operations on Windarling Range as part of the Cliffs Asia Pacific Iron Ore Pty Ltd Koolyanobbing Expansion Project. Approximately 38% of plants in known pre-mining populations on Windarling Range have been taken in development of orebodies between January 2004 and April 2011.**

- Mining (indirect effects): **Nearby mining activities on Windarling Range present secondary threats through exposure to increased dust levels; inadvertent disturbance through errant flying rock (from blasting) and rock fall; interruption to surface drainage and soil-moisture conditions; effects on pollinator populations and activity arising from disturbance to habitat and other possible effects on reproductive biology.**

- Exploration (direct and indirect effects): **Direct impacts through exploration activities were reported at the population south-west of the Johnston Range (the species was not identified as being there prior to exploration). However a survey of the population in 2009 did not detect any significant impacts. Other indirect impacts could also include the increased risk of fire, increased erosion, increased access, interruptions to surface drainage, and an increased risk of plant diseases and weeds being introduced into the populations.**

- Weed Invasion: **Several minor pastoral weed species with aerial dispersed seeds occur in low numbers across the range of *Ricinocarpos brevis*. A weed management plan, developed and implemented by Cliffs Asia Pacific Iron Ore Pty Ltd , has reduced the risk of establishment of more prolific and invasive weed species on Windarling Range.**

- Predation: ***Ricinocarpos brevis* seed is subject to some predation by a small undescribed moth larva. Seed remaining on the plant post seed release, which is usually in October, is more susceptible to this predation. Livestock have not been recorded in the immediate area of *R. brevis* populations, however there is evidence of a herbivore cutting branches with a clean diagonal cut to plants less than 25cm high on the Windarling Range populations.**

- Inappropriate fire regimes **may be a threat to all populations of *Ricinocarpos brevis.* Although the species is known to germinate from soil-stored seed following fire and occasional fire may be beneficial, frequent fire should be prevented from occurring in the area of known populations of *R. brevis*. Fire may also facilitate weed invasion and should be followed up with appropriate weed control.**

The intent of this plan is to provide actions that will deal with immediate threats to *Ricinocarpos brevis*. Although climate change may have a long-term effect on the species, actions taken directly to prevent the impact of climate change are beyond the scope of this plan. Changes in threatening processes caused by climate change (e.g. fire behaviour, drought, and responses of weed and pest species) will be addressed in a direct manner applicable to those threatening processes.

Table 3. Summary of population information and threats

Population number &	Land Status	Survey Year and	Condition	Threats

Location		number of plants		
1a, b, c Windarling Range	**Pastoral**	**2009: 2528**	**Healthy**	**Mining and secondary effects resulting from mining, exploration and environmental factors, weeds, seed predation, inappropriate fire regimes**
2. Windarling Range	**Pastoral**	**2009: 8635**	**Healthy**	**Mining and secondary effects resulting from mining, exploration and environmental factors, weeds, seed predation, inappropriate fire regimes**
3. Windarling Range	**Pastoral**	**2009: 1102**	**Healthy**	**Mining and secondary effects resulting from mining, exploration and environmental factors, weeds, seed predation, inappropriate fire regimes**
4. South-west of Johnston Range	**Pastoral**	**2009: estimated 3000 plants**	**Healthy**	**Exploration activities, weeds, seed predation, inappropriate fire regimes**
5. Perrinvale Station	**UCL**	**2008: 2982 plants**	**Healthy**	**Exploration activities, weeds, seed predation, inappropriate fire regimes**

Guide for decision-makers

Section 1 provides details of current and possible future threats. Development and/or land clearing in the immediate vicinity of populations of *Ricinocarpos brevis* will require assessment. Developments or clearing should not be approved unless the proponents can demonstrate that their actions will have no significant negative impact on the species, its habitat or potential habitat or on the local surface hydrology, such that drainage in the habitat of the species would be altered.

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

Given that *Ricinocarpos brevis* is ranked as CR, it is considered that all known habitat for wild populations is habitat critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *R. brevis* includes the area of occupancy of the important populations; areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators); additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations; and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to conserve the habitat of *Ricinocarpos brevis* will also help conserve habitat that includes one DRF and three Priority flora species. These taxa are listed in the table below.

Table 4. Conservation-listed flora species occurring in habitat of *Ricinocarpos brevis*

Species Name	Conservation Status (Western Australia)	Conservation Status (EPBC Act 1999)
Tetratheca paynterae* subsp. *paynterae	**Critically Endangered**	**Endangered**
Austrostipa blackii	**Priority 3**	**-**
***Spartothamnella* sp. Helena and Aurora Range**	**Priority 3**	**-**
Banksia arborea	**Priority 4**	**-**

For a description of Priority categories see Smith (2010).

***Ricinocarpos brevis* also occurs in association with two Priority Ecological Communities (PECs).**

Table 4. PECs in which *Ricinocarpos brevis* occurs in association

TEC Title	Conservation Status (Western Australia)	Conservation Status (EPBC Act 1999)

Windarling Ranges vegetation complexes (banded ironstone formation)	**Priority 1**	**-**
Banded ironstone hills with *Banksia arborea*	**Priority 1**	**-**

For a description of the TEC and PEC categories see DEC (2007).

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. *Ricinocarpos brevis* is not listed under any specific international treaty, and therefore this plan does not affect Australia's obligations under any other international agreements.

Role and interests of Indigenous people

A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has identified four sites of Aboriginal significance within the vicinity of the populations of *Ricinocarpos brevis* on the Windarling Range (DIA, 2010). In agreements with Cliffs Asia Pacific Iron Ore Pty Ltd, the claimant groups have recorded a general interest in the environment of the area. Representatives of the groups may visit the general area from time to time, sometimes as part of a community consultative group. Liaison has been included as a recovery action to ensure there will be Indigenous engagement in relation to the recovery actions posed in this plan. No sites were recorded as being near the Johnston Range and Perrinvale Station populations.

Table 5. Sites of Aboriginal significance within the vicinity of *Ricinocarpos brevis*

Site number and name	Site type	Access and Restrictions
20090 W3.1 – Windarling 3.1 Artefact Scatter	**Artefacts/Scatter**	**Open and none**
20345 Ky31 – Windarling 3	**Ceremonial, mythological**	**Closed, female access only**
26007 Windarling rockshelter	**Artefacts/Scatter**	**Open and none**
26888 Windarling Scatter 5	**Artefacts/Scatter**	**Open and none**

Social and economic impacts

Mineral exploration leases cover the areas where *Ricinocarpos brevis* is known to occur and mining is taking place at the Windarling Range populations. The occurrences of *R. brevis* has caused, and has the potential to cause, negative economic impacts through compliance with the environmental impact assessment and approvals process, and the potential restriction of future access to underlying iron ore deposits. There is also potential for translocation sites to complicate future access to mineral resources.

Affected interests

Stakeholders potentially affected by the implementation of this plan are the owners of the Pastoral leases, Cliffs Asia Pacific Iron Ore Pty Ltd and the holders of other mineral exploration licences for areas where *Ricinocarpos brevis* occurs.

Evaluation of the plan's performance

DEC, in consultation with the Goldfields Region Threatened Flora Recovery Team (GRTFRT) and Koolyanobbing Project Community Reference Group (CRG), will evaluate the performance of this IRP. 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 OBJECTIVES AND CRITERIA

Objective

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 populations have remained stable or have increased and/or the number of mature individuals in populations have remained stable or have increased over the term of the plan.**

Criteria for failure: **The number of populations have decreased and/or the number of mature individuals in populations have decreased over the term of the plan.**

3. RECOVERY ACTIONS

Existing recovery actions

- **A census of *Ricinocarpos brevis* was completed by Cliffs Asia Pacific Iron Ore Pty Ltd and confirmed that there are more than 12,000 plants in the populations at the Windarling Range (McNee & Barwick, 2010 in prep.), and approximately 3,000 individuals at the Perrinvale Station population (Barwick, 2008). The *R. brevis* population at the Johnston Range has been estimated at 3000 individuals (DEC, 2009).**
- **A regional aerial survey for *Ricinocarpos brevis* undertaken by Cliffs Asia Pacific Iron Ore Pty Ltd during 2009 that targeted a number of previously unsurveyed banded iron formation ranges in the northern Yilgarn area did not detect further populations.**
- **A representative monitoring program (intensive monitoring of a subset of 262 individuals) was established in December 2003 for *Ricinocarpos brevis* individuals within a mining exclusion zone, adjacent to the approved mining area on the Windarling Range. Monitoring of an additional 50 plants was established in 2005 at the western extent of the population, adjacent to a westerly orebody (W2) on the Windarling Range. Another subset of 31 plants further to the east were also incorporated in 2007. The condition of these plants has been monitored annually. The methodology of this monitoring was reviewed in April 2009, with the decision made that the monitoring of *R. brevis* should reflect that of the monitoring for *Tetratheca paynterae* subsp. *paynterae*. Cliffs Asia Pacific Iron Ore Pty Ltd are yet to design and implement this new methodology. The results are reported annually to the DEC.**
- **Approximately 16,880 (2004), 169,000 (2008) and 6,300 (2009) *Ricinocarpos brevis* seeds were collected from the Windarling Range populations by Cliffs Asia Pacific Iron Ore Pty Ltd. These seeds are currently held by Cliffs Asia Pacific Iron Ore Pty Ltd and the DEC Threatened Flora Seed Centre.**
- **Soil was collected from the base of *Ricinocarpos brevis* individuals within the approved mining area on the south slope of Windarling Range in late 2003. Studies on this soil for seed store has been undertaken with no appreciable seed found in soils collected from under *R. brevis* plants (Western Botanical, 2004).**
- **Preliminary studies on flowering, pollination and seed predation have been undertaken by Cliffs Asia Pacific Iron Ore Pty Ltd between 2004 and 2006 (Western Botanical, 2004).**
- **Cuttings from 35 plants within an approved W3/5 mine pit extension area were collected in August 2006 for propagation trials. Subsequent collections were undertaken in September 2006, July 2007, September 2008 and December 2008. The resulting plants are being managed by an accredited nursery in Oakford, Western Australia. To date propagation results have been very poor, there are currently five older plants surviving from the cuttings collected in 2006 (B. Eckermann, pers. comm.). Cuttings have been taken from these five surviving plants for striking in 2009 to provide better quality material, and look to have had better success.**
- **Seed germination trials were undertaken during 2006 and 2010 with some germination experienced in response to scarification, GA3 and/or smoke water. Giberellic acid and smoke water resulted in the highest germination response in the 2010 germination trials (Landcare Services, 2010).**
- ***In situ* seed germination and establishment trials were set up at Windarling in July 2010 by Cliffs Asia Pacific Iron Ore Pty Ltd.**
- **A weed management plan, developed and implemented by Cliffs Asia Pacific Iron Ore Pty Ltd, has reduced the risk of establishment of more prolific and invasive weed species on Windarling Range.**
- **A mining exclusion zone that was established under Ministerial environment approvals (Statement 627, 3 June 2003; Commonwealth – 4 September 2003) for the protection of *Tetratheca paynterae***

subsp. *paynterae* will concurrently secure around 20% of the *Ricinocarpos brevis* population at Windarling Range.

- **Non-mining areas outside of the mining exclusion zone at Windarling have been designated as local conservation areas. Signs have been installed demarcating the conservation areas and access has been restricted.**
- **The Koolyanobbing Project Community Reference Group (KPCRG) was established in 2003 with the Group's Terms of Reference relating to the provision of community feedback and input on environmental aspects of mining at the Windarling Range. Progress on the implementation of management and monitoring measures and the development of an IRP for *Ricinocarpos brevis*, are reported to the group.**
- ***Ricinocarpos brevis* was listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in July 2010 as part of the Commonwealth Government and DEC Species Information Partnership.**

Ongoing and future Recovery Actions

Where recovery actions occur on lands other than those managed by DEC, permission has been or will be sought from appropriate owners/land managers prior to recovery actions being undertaken. The following recovery actions are generally in order of descending priority, influenced by their timing over the life of the plan. However this should not constrain addressing any of the actions if funding is available and other opportunities arise.

1. Coordinate recovery actions

The Goldfields Region Threatened Flora Recovery Team (GRTFRT) will continue to oversee the implementation of the recovery actions for *Ricinocarpos brevis* and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies. The GRTFRT will liaise with the KPCRG to ensure effective delivery of conservation actions.

Action:	**Coordinate recovery actions.**
Responsibility:	**DEC (Goldfields Region) through the GRTFRT.**
Cost:	**$3,000 per year.**

2. Monitor populations and refine knowledge on the distribution, plant numbers and extent of all populations

Monitoring of factors such as weed invasion, grazing, habitat degradation, population stability (expansion or decline), pollinator activity, seed predation and production, recruitment, and longevity is essential. Populations should be inspected annually and Threatened and Priority Flora Report Forms (TPFRFs) completed.

The condition of *Ricinocarpos brevis* plants not directly impacted by mining activities on the Windarling Range will continue to be monitored for any indirect impacts by Cliffs Asia Pacific Iron Ore Pty Ltd.

Action:	**Monitor populations.**
Responsibility:	**DEC (Goldfields Region) through the GRTFRT; in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population.**
Cost:	**$5,000 per year (expenditure by Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population is higher than this).**

3. Map habitat critical to the survival of *Ricinocarpos brevis*

It is a requirement of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) (Section 207A) that spatial data relating to habitat critical to the survival of the species be determined. Critical habitat to the survival of the species is alluded to in Section 1, and a significant amount of the area for the Windarling Range Population has already been accurately mapped. Further mapping is required for the

remaining two populations and will be addressed under this action. If additional populations are located, habitat critical to their survival will also be determined and mapped.

Action: **Map habitat critical to the survival of *Ricinocarpos brevis.***
Responsibility: **DEC (Species and Communities Branch (SCB), Goldfields Region) through the GRTFRT.**
Cost: **$6,000 in year 2.**

4. Undertake a *Ricinocarpos brevis* research program

Improved knowledge of the biology and ecology of *Ricinocarpos brevis* will provide a better scientific basis for management of the wild populations. Cliffs Asia Pacific Iron Ore Pty Ltd have undertaken a range of research and investigations to date. To further our knowledge and to apply effective management for *R. brevis,* an understanding of the following is particularly necessary:

- **The pollination biology of the species and the requirements of pollinators.**
- **Investigate the population genetic structure, levels of genetic diversity between populations and minimum viable population size.**
- **Soil seed bank dynamics, including seed bank location and viability.**
- **The role of natural disturbances (fire and physical), competition, rainfall, grazing and predation in germination and recruitment.**
- **The reproductive strategies, phenology and seasonal growth of the species.**
- **Longevity of plants and time taken to reach maturity.**

Action: **Undertake a *Ricinocarpos brevis* research program.**
Responsibility: **DEC (Science Division, Goldfields Region) through the GRTFRT.**
Cost: **$20,000 per year.**

5. Achieve improved protection of habitat

Currently the Windarling Range population and the Perrinvale Station population are included within the boundaries of PECs. A nomination for the inclusion of the Johnston Range population into a PEC covering the Johnston Range BIF will be written up and sent to the Western Australian threatened ecological community scientific committee for consideration.

Action: **Achieve improved protection of habitat for the Johnston Range population.**
Responsibility: **DEC (Goldfields Region, Species and Communities Branch) through the GRTFRT.**
Cost: **$1,500 per year.**

6. Further investigate translocation as a conservation strategy

Currently no populations of *Ricinocarpos brevis* occur on secure land tenure (refer to Action 5), and with the Windarling population under threat from mining activities, translocation is one option for the long-term conservation of this taxon. In July 2010 Cliffs Asia Pacific Iron Ore Pty Ltd commenced an in situ seed germination trial at Windarling to determine if *R. brevis* can be established from seed on rehabilitated drill pad sites. The results from this study will contribute to knowledge on the translocation potential of *R. brevis*. Future translocation trials should be developed using a small number of plants (or seed) and any trials should be performed as a series of small scale experimental translocations on *R. brevis*. The results of these smaller translocation trials will be utilised in the development of a full translocation proposal. Given the variability in the climate and extremely harsh habitat of the Yilgarn region, successful translocation techniques may be difficult to develop. Information on the translocation of threatened plants and animals in the wild is provided in DEC's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM 1995). Translocations should meet the standards set in the Australian Network for Plant Conservation translocation guidelines (Vallee et al 2004). All translocation proposals require endorsement by DEC's Director of Nature Conservation.

Action: **Develop and implement a translocation trial.**

Responsibility: **DEC (Science Division, Goldfields Region) through the GRTFRT; in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population.**

Cost: **$10,000 per year for first three years (expenditure by Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population is higher than this).**

7. Develop and implement a fire management strategy

If possible, fire will be prevented from occurring in the habitat of *Ricinocarpos brevis* populations, except where it is being used experimentally as a recovery tool. A fire management strategy will be developed that recommends fire frequency, intensity, season, and control measures.

Action: **Develop and implement a fire management strategy**

Responsibility: **DEC (Goldfields Region) through the GRTFRT**

Cost: **$2,500 in first year and $1,000 in subsequent years**

8. Maintain adequate seed/germplasm collections

Adequate seed/germplasm collections from all three populations should be maintained to ensure material with a broad genetic base is available for translocation and on-going *ex situ* conservation. Seed should be stored in appropriate conditions, especially for conservation collections (Offord & Meagher, 2009). Field collection of material will be subject to approval.

Action: **Maintain adequate seed/germplasm collections.**

Responsibility: **DEC (Goldfields Region) through the GRTFRT and the Threatened Flora Seed Centre for seed storage; in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population** .

Cost: **$5,000 per year (expenditure by Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population is higher than this).**

9. Undertake weed control, monitor effectiveness and implement additional control if required

The current level of threat from weeds is low. However, if weed numbers increased (such as after fire) they may impact on *Ricinocarpos brevis* by competing for resources, degrading habitat, exacerbating grazing pressure, and increasing the risk and severity of fire. If monitoring indicates that the threat from weeds has increased, weed control will be undertaken in consultation with the land managers. Regular monitoring will need to be conducted to ensure this does not become a major threat.

1. **Monitor all populations for weed intrusions.**
2. **Select appropriate herbicides after determining which weeds are present.**
3. **Control invasive weeds by hand removal or spot spraying when weeds first emerge.**
4. **Schedule weed control to include other threatened flora populations within the area.**
5. **Regularly monitor weeds and implement additional weed control if required.**

The tolerance of associated native plant species to herbicides at the site of *Ricinocarpos brevis* is not known and weed control programs will be undertaken in conjunction with research and in a manner that minimises negative impacts on associated native flora.

Action**:** **Undertake weed control, monitor effectiveness and implement additional control if required.**

Responsibility**:** **DEC (Goldfields Region) through the GRTFRT; in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population.**

Cost**:** **$2,000 per year (expenditure by Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population is higher than this).**

10. Promote awareness of *Ricinocarpos brevis* and IRP initiatives

The importance of biodiversity conservation and the need for the long-term protection of wild populations of *Ricinocarpos brevis* will be promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals will also be encouraged. An information sheet will be produced, and will include a description of the plant, its habitat, threats, recovery actions and photos. This will be distributed to the public and other resource development companies that work in the Northern Yilgarn area through DEC's Goldfields Regional office and at the office and library of the Shire of Yilgarn. Such information distribution may lead to the discovery of new populations.

For the Windarling Range population, awareness of Declared Rare Flora including *R. brevis* will be promoted to personnel working in the vicinity of populations of this species. Awareness will be raised with mine-site personnel working at and around the Windarling minesite via the site environmental induction.

Actions: **Promote awareness of *Ricinocarpos brevis* and IRP initiatives.**
Responsibility: **DEC (Goldfields Region, SCB, Strategic Development and Corporate Affairs Division) through the GRTFRT; in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population.**
Cost: **$3,000 in year 1; and $1,000 per year thereafter (expenditure by Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population is higher than this).**

11. Liaise with KPCRG, relevant mineral exploration lease holders Indigenous groups

The progress of *Ricinocarpos brevis* research, management and recovery activities on the Windarling Range population will continue to be reported to the KPCRG. Developments will be reported as they arise, at the next meeting of the group, or in written updates which are provided every two months between meetings. The formal progress reports required by 31st March each year (refer to action 1) will also be provided to the group. Input and involvement will also be sought from Aboriginal groups that have an active interest in areas that are habitat of the species.

Staff from DEC's Goldfields Region will liaise with appropriate land managers to ensure that populations of *Ricinocarpos brevis* are not accidentaly damaged or destroyed. Indigenous consultation will take place to determine if there are any issues or interests in areas that are habitat for *R. brevis.*

Action: **Liaise with KPCRG, relevant mineral exploration lease holders and Indigenous groups.**
Responsibility: **DEC (Goldfields Region) through the GRTFRT, in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for liaison with the KPCRG.**
Cost: **$1,000 per year.**

12. Review this IRP and assess the need for further recovery actions

If *Ricinocarpos brevis* is still ranked as CR at the end of the fifth year of the five-year term of this IRP, the need for further recovery actions, or a review of this IRP will be assessed and a revised plan prepared if necessary.

Action: **Review this IRP and assess the need for further recovery actions.**
Responsibility: **DEC (SCB, Goldfields Region) through the GRTFRT.**
Cost: **$2,000 in year 5.**

Table 5. Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion Date
Coordinate recovery actions	**High**	**DEC (Goldfields Region) through GRTFRT.**	**Ongoing**
Monitor populations and refine knowledge on the distribution, plant numbers and extent of all	**High**	**DEC (Goldfields Region) through GRTFRT; in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling population.**	**Ongoing**

populations			
Map habitat critical to the survival of *Ricinocarpos brevis*	**High**	**DEC (Species and Communities Branch (SCB), Goldfields Region) through the GRTFRT.**	**2015**
Undertake a *Ricinocarpos brevis* research program	**High**	**DEC (Science Division, Goldfields Region) through the GRTFRT.**	**2015**
Achieve improved protection of habitat	**High**	**DEC (Goldfields Region, Land Acquisition Branch) through the GRTFRT.**	**2015**
Further investigate translocation as a conservation strategy	**High**	**DEC (Science Division, Goldfields Region) through the GRTFRT, in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population.**	**2015**
Develop and implement a fire management strategy	**High**	**DEC (Goldfields Region) through the GRTFRT**	**Developed by 2011 with implementation ongoing**
Maintain adequate seed/germplasm collections	**Medium**	**DEC (Goldfields Region) through the GRTFRT and the Threatened Flora Seed Centre, in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population.**	**Ongoing**
Undertake weed control, monitor effectiveness and implement additional control if required	**Medium**	**DEC (Goldfields Region) through the GRTFRT, in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population.**	**Ongoing**
Promote awareness of *Ricinocarpos brevis* and IRP initiatives	**Medium**	**DEC (Goldfields Region, SCB, Strategic Development and Corporate Affairs Division) through the GRTFRT, in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the Windarling Range population.**	**Ongoing**
Liaise with KPCRG, relevant mineral exploration lease holders and Indigenous groups	**Medium**	**DEC (Goldfields Region) through the GRTFRT, in conjunction with Cliffs Asia Pacific Iron Ore Pty Ltd for the liaison with the KPCRG.**	**Ongoing**
Review this IRP and assess the need for further recovery actions	**Medium**	**DEC (SCB, Goldfields Region) through the GRTFRT.**	**2015**

4. TERM OF PLAN

This IRP will operate from August 2011 to July 2016 but will remain in force until withdrawn or replaced. If the taxon is still ranked CR after 5 years, the need for further recovery actions will be assessed.

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6. PERSONAL COMMUNICATIONS

Shapelle McNee – Botanist, Western Botanical.
Dr. Ted Edwards - CSIRO, Canberra.
Ben Eckermann - Botanist, Western Botanical.

7. TAXONOMIC DESCRIPTION

Abridged description courtesy of Mr. David Halford, Queensland Herbarium, August 2006.

Monoecious or apparently dioecious, densely and intricately twiggy shrubs 1-1.8m high. Young branchlets terete, with a dense greyish-white indumentum; hairs stellate, ± sessile or shortly stipitate, multiangulate. Leaves with petioles 0.9-2 mm long, densely hairy; laminae narrowly oblong, (4-)7-12(-21) mm long, 1.4-2(-4) mm across; adaxial surface stellate-pubescent but becoming scabrid by the persistent tuberculate bases of deciduous hairs; abaxial surface floccosely hairy below; base obtuse to cuneate; margins usually recurved to midrib; apex obtuse. Inflorescences of a single male or female flower, or umbelliform with either two female flowers or one female and one or two male flowers, terminal on branchlets. Flowers conspicuous; calyx 5-lobed; petals 5, spreading, slightly shorter to a little longer than calyx. Male flowers with slender pedicel, 4-8 mm long; calyx white woolly stellate hairy abaxially and adaxially; petals white with veins outlined with red colouration, ovate, 4.3-5.8 mm long, 2.5-3.2 mm wide, glabrous; stamens 25-45; free portion of filaments 0.8-1.5 mm long, erect to spreading at anthesis, glabrous. Female flowers with pedicel usually stout, 2-5(-7) mm long; calyx whitish grey, stellate-

pubescent abaxially and adaxially, persistent; petals white but turning brown, elliptic to rhomboidal, 2.3-4.1 mm long, 1.5-1.8 mm wide, glabrous; ovary ± ovoid, 3.5-4.2 mm long, densely loosely stellate-pubescent; style ± obsolete; stigmatic limbs red, 0.7-1.5 mm long, deeply 2-lobed. Fruits ellipsoidal to ovoid, 8-9 mm long, 6-7 mm across, stellate-pubescent; persistent calyx lobes a quarter to half the fruit length. Seeds ovoid, c. 5.5 mm long (including caruncle), c. 4 mm wide, c. 2.7 mm deep; testa smooth.