INTERIM RECOVERY PLAN NO. 191

IRWIN'S CONOSTYLIS

(*CONOSTYLIS DIELSII* SUBSP. *TERES*)

INTERIM RECOVERY PLAN 2005-2009

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Photograph: Alanna Chant

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

FOREWORD

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

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

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

This Interim Recovery Plan will operate from January 2005 to December 2009 but will remain in force until withdrawn or replaced. It is intended that this IRP will be reviewed after five years.

This IRP was given regional approval on 10 February 2005 and approved by the Director of Nature Conservation on 25 February 2005 The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate in January 2005.

ACKNOWLEDGMENTS

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

Carly Naughton	Horticulturalist, Botanic Garden and Parks Authority
Greg Kitson	Operations Officer, CALM's Geraldton District
Anthony Desmond	Program Leader Nature Conservation, CALM's Midwest Region

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and CALM's Wildlife Branch for assistance.

SUMMARY

Scientific Name:	*Conostylis dielsii* subsp. *teres*	**Common Name:**	Irwin's Conostylis
Family:	Haemodoraceae	**Flowering Period:**	July - August
CALM Region:	Midwest	**CALM District:**	Geraldton
Shires:	Irwin, Mullewa	**Recovery Team:**	Geraldton District Threatened Flora Recovery Team

Illustrations and/or further information: A. Brown, C. Thomson-Dans and N. Marchant (Eds) (1998) *Western Australia's Threatened Flora*, Department of Conservation and Land Management, Western Australia; S.D. Hopper *et al.* (1987) Haemodoraceae, *Flora of Australia* 45: 57-110, Australian Biological Resources Study, Canberra.

Current status: *Conostylis dielsii* subsp. *teres* was declared as Rare Flora in October 1996 under the *Wildlife Conservation Act 1950*. It currently meets World Conservation Union (IUCN) Red List category Vulnerable (IUCN 2000) under criteria B1ab(iii), as it is only known from a total of nine populations that occur over a 30km range, with decline in quality of habitat from weed invasion in four road reserve populations. *C dielsii* subsp. *teres* is listed as Endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Five relatively secure populations have been located since 1996. Four are within a Nature Reserve and one occurs within a wide (> 100m width) road reserve. The main threats to *C. dielsii* subsp. *teres* include edge effects, weeds, road, railway and firebreak maintenance, rabbits and inappropriate fire regimes.

Description: *Conostylis dielsii* subsp. *teres* is a tufted perennial herb, that grows to about 20cm tall, and has leaves 13 to 33 cm long and less than a mm wide. The leaf bases are densely hairy, while the upper part of the leaf is less hairy. *C. dielsii* subsp. *teres* has a dense inflorescence composed of many flowers, held on a 4-10 cm long stem. The individual flower stalks are short and each cream flower, 7.5 to 10 millimeters long, is tubular for a third to a half of its length then divides into six lobes. The flowers are covered with short, densely matted hairs. The petal lobes remain on the fruit and become claw-like, touching at the apex with gaps at the bases (Brown *et al.* 1998).

Habitat requirements: *Conostylis dielsii* subsp. *teres* is currently known from a range of approximately 30 km, to the north east of Dongara. It is found on white, pale yellow or grey sand with lateritic gravel, in heath, open scrub, low open heath and low open woodland, in upland areas with *Allocasuarina* species, *Banksia scabrella, Dryandra fraseri, Hibbertia hypericoides, Ecdeiocolea monostachya* and *Hakea* species.

Critical habitat and important populations: Populations 1, 2, 4 and 5 occur on Shire road reserves, but are in reasonably good condition. Populations 3, 6, 7 and 8 occur in a Nature Reserve, are not in decline and are subject to few threats. These populations are considered to be important. The critical habitat for *Conostylis dielsii* subsp. *teres* comprises the area of occupancy of important populations; similar habitat within 200 metres of important populations; corridors of remnant vegetation that link important populations and additional occurrences of similar habitat near important populations that do not currently contain the species but may have done so in the past and may be suitable for translocations.

Benefits to other species or ecological communities: *Conostylis micrantha* (Vulnerable under *Wildlife Conservation Act 1950*; Endangered under EPBC Act) occurs in association with Populations 1, 2, 6, 7, 8 and 9 of *C. dielsii* subsp. *teres*. *Leucopogon marginatus* (Endangered under *Wildlife Conservation Act 1950* and under EPBC Act) occurs in association with Populations 3, 6, 7 and 8 of *C.dielsii* subsp. *teres*. *Grevillea hirtella* (Priority 3) occurs in association with Populations 3, 4 and 7 of *C. dielsii* subsp. *teres*. *Grevillea erinaceae* (Priority 3) occurs in association with Population 7 of *C. dielsii* subsp *teres*. *Banksia scabrella* (Priority 4) occurs in association with Populations 3 and 4 of *C dielsii* subsp *teres*. Recovery actions such as weed and rabbit control and fire management strategies will help to protect these Rare and Priority Flora as well as *C. dielsii* subsp. *teres*, and the ecological community in which the populations are located.

International obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. However, as *Conostylis dielsii* subsp. *teres* is not specifically listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

Role and interests of indigenous people: The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of these populations. Implementation of recovery under this plan will include consideration of the role and interests of indigenous communities in the region, and this is discussed in the recovery actions.

Social and economic impact: Populations of *C. dielsii* subsp. *teres* occur on Shire road reserves and a Nature Reserve.

The Nature Reserve is under the joint care, control and management of the Conservation Commission and the Tree Society. The implementation of this interim recovery plan therefore has limited potential for social or economic impact, where populations occur on lands that are not specifically managed for conservation. Laying of poison oats for rabbit control will occur after liaison with managers of nearby properties. Recovery actions refer to continued liaison between stakeholders with regard to populations on shire road reserves.

Evaluation of the plan's performance: The Department of Conservation and Land Management will evaluate the performance of this IRP in conjunction with the Geraldton District Threatened Flora Recovery Team. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

Existing Recovery Actions: The following recovery actions have been or are currently being implemented:
Relevant land managers have been made aware of the location and threatened status of the subspecies.
Declared Rare Flora (DRF) markers are in place at all populations that are under threat from road maintenance activities.
The Botanic Gardens and Parks Authority (BGPA) currently hold a small amount of seed in their seed store.
Propagation from seed has been trialled by BGPA on one occasion, but without success.
Rabbit baiting was conducted at Populations 1, 2, 3, 6, and 9 in 1999. Follow-up baiting was undertaken at these populations in 2000.
Some control of grassy weeds has been undertaken at Populations 1 and 2.
Staff from CALM's Geraldton District and West Australian Threatened Species and Communities Unit (WATSCU) undertook surveys of suitable habitat and discovered new populations of the subspecies (Populations 4, 5, 6, 7, 8 and 9).
Staff from CALM's Geraldton District implement pre-suppression fire management strategies within the Nature Reserve that contains populations 3, 6, 7 and 8 of this subspecies.
9. Staff from CALM's Geraldton District regularly monitor populations of the subspecies.
The Geraldton District Threatened Flora Recovery Team (GDTFRT) is overseeing the implementation of this IRP.

IRP objective: The objective of this Interim Recovery Plan is to maintain or enhance viable *in situ* populations to ensure the long-term preservation of the subspecies in the wild.

Recovery criteria
Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more over the five year period of the plan.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the five year period of the plan.

Recovery actions
1. Coordinate recovery actions
2. Monitor populations
3. Conduct further surveys
4. Liaise with relevant land managers
5. Map critical habitat
6. Implement weed control when necessary
7. Implement rabbit control as necessary
8. Obtain biological and ecological information
9. Obtain information of fire response
10. Develop and implement a fire management strategy
11. Collect seed
12. Promote awareness
13. Review the need for further recovery actions

1. BACKGROUND

History

The earliest collection of *Conostylis dielsii* subsp. *teres* housed at the Western Australian Herbarium was made on 12 July 1970 by A M Ashby from an area 'near Irwin'. Clearing for agriculture around the Irwin River area began approximately 160 years ago when the town of Dongara was first established. Subsequent extensive clearing has resulted in a loss of most areas of suitable habitat for *C. dielsii* subsp. *teres*. The taxon was Declared to be Rare Flora under the *Wildlife Conservation Act 1950* in October 1996, after survey established the rarity of the subspecies. Nine populations are now known over a range of 30 km, and although several are small and threatened, four populations occur in the relative safety of a Class A Nature Reserve.

Description

Conostylis dielsii subsp. *teres* is named from the Latin *teres* (terete), in reference to the leaves that are cylindrical in cross-section.

Conostylis dielsii subsp. *teres* is a tufted perennial herb, which grows to about 20cm tall, and has leaves 13 to 33 centimeters long and less than a millimeter wide. The leaf bases are densely hairy, while the upper part of the leaf is less hairy. This conostylis has a dense inflorescence composed of many flowers, held on a 4-10 cm long stem. The individual flower stalks are short and each cream flower, 7.5 to 10 mm long, is tubular for a third to half of its length then divides into six lobes. The flowers are covered with short, densely matted hairs. The petal lobes remain on the fruit and become claw-like, touching at the apex with gaps at the bases (Brown *et al.* 1998).

Conostylis dielsii subsp. *teres* differs from the other subspecies *Conostylis dielsii* subsp. *dielsii* in that it has 13-33 cm long terete leaves and *Conostylis dielsii* subsp. *dielsii* has flat leaves that are 7-15.5 cm long.

Conostylis dielsii subsp. *teres is s*imilar to *C. teretiuscula*, but the species differ in the leaf indumentum (hair covering) and the placentation (arrangement of the ovaries).

Distribution and habitat

C. dielsii subsp. *teres* occurs in an area north east of Dongara, over a range of approximately 30 km. A total of approximately 1,637 plants are known from nine populations that occur on Shire road reserves and a Nature Reserve. It is found on white, pale yellow or grey sand with lateritic gravel, in heath, open scrub, low open heath and low open woodland, in upland areas, and is quite inconspicuous when not in flower. Associated species include *Allocasuarina* species, *Hibbertia hypericoides, Dryandra fraseri, Banksia scabrella, Ecdeiocolea monostachya* and *Hakea* species.

Biology and ecology

The genus *Conostylis* contains 45 species, all of which are endemic to the south-west of Western Australia. A number of species are grown as ornamentals and *C. dielsii* subsp. *teres* has the potential to be of horticultural significance.

The genus *Conostylis* is comprised of a mixture of insect and bird-pollinated species (Hopper *et al*. 1987). The pollinators of *C. dielsii* subsp. *teres* are as yet unknown.

C. dielsii subsp. *teres* was observed in an area burnt 2-3 years previously, and this suggests that it regenerates successfully after fire. It is likely that it regenerates from subterranean regenerative buds emerging from horizontal rhizomes (Gill 1981) and that soil-stored seed germinates following summer fire, as in other species of *Conostylis*.

Threats

Conostylis dielsii subsp. *teres* was declared as Rare Flora on 1st October 1996 under the *Wildlife Conservation Act 1950*. It currently meets World Conservation Union (IUCN) rank Vulnerable (VU) under criteria B1ab (iii) as it is only known from nine populations that occur over a range of 30km, with decline in the quality of the habitat at four road reserve populations from weed invasion. *C. dielsii subsp. teres* is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Four populations have been discovered within a Nature Reserve since 1996, and these are subject to low levels of threat. Low levels of weed invasion, low level of rabbit activity, and implementation of a fire management strategy all contribute to the health of these populations. The main threats to populations occurring on Shire road reserves are edge effects, weeds, road and firebreak maintenance, rabbits and inappropriate fire regimes.

- **Edge effects** influence the four populations that are restricted to narrow road reserves. The habitat of these populations have high perimeter to area ratios (Populations 1, 2, 5 and 9). Another road reserve population (Population 4) is currently only minimally impacted as it occurs within a wide road reserve (>100m width). In populations where the road reserve is narrow, virtually the whole corridor is subject to edge effects from management of the adjacent land (Lynch 1987). Effects include the proximity of a weed seed source, increased wind speed, fertiliser and herbicide spray drift and runoff, modified hydrology, and altered disturbance regimes, including fire. The fragmentation of the corridors, combined with edge effects, results in the habitat being subject to high levels of stress and periodic acute disturbances.

- **Weed levels** are high in narrow road reserve populations (Populations 1, 2, 5 and 9), and occur at a lower level in populations near reserve boundaries or on wide road reserves (Populations 4, 7 and 8). Weed invasion occurs as a result of edge effects such as increased nutrient levels (fertiliser runoff, rabbit droppings) and soil disturbance (rabbits, earthworks). Weed species include [*] *Avena fatua* (wild oats), **Ehrharta longiflora* (annual veldt grass), other introduced annual grass species, **Arctotheca calendula* (cape weed) and **Brassica tournefortii* (wild turnip). At populations where the level of weed infestation is low, there is potential for weeds to invade further in the event of a disturbance such as fire.

  C *dielsii* subsp. *teres* is both directly and indirectly affected by weeds due to:
  - direct competition, inhibiting the growth of *C. dielsii* subsp. *teres* and displacing it.
  - a decrease in the diversity of native species in the habitat of *C. dielsii* subsp. *teres.*
  - altered nutrient cycling.
  - a change in soil acidity.
  - increased fire hazard due to easy ignition of high fuel loads that are produced annually, and the formation of a continuous fuel bed that permits fires to spread quickly.

- **Road, firebreak and fence maintenance** threatens all road reserve populations. Firebreak and fence maintenance threatens populations at the boundaries of private property. Firebreak maintenance within the Nature Reserve that contains this subspecies is not currently considered a threat as threatened flora locations are considered in planning for fire management. Threats to road reserve populations include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation.

- **Rabbits** have a high level of impact on several road reserve populations (Populations 1, 2, 5 and 9). Rabbits do not appear to graze adult plants except in very bad seasons. However, the sandy soils of *Conostylis dielsii* subsp. *teres* habitat are susceptible to disturbance from warrens and diggings. Rabbits also encourage weed invasion through soil disturbance, addition of nutrients to soil, and introduction of weed seeds.

- **Inappropriate fire regimes** during the reproductive phase (ie. flowering, pollination, seed growth and seed dispersal) of *Conostylis dielsii* subsp. *teres* may impact seedling recruitment. High fire frequency may also lead to habitat degradation due to depletion of the soil seed bank and a temporary increase in the availability of nutrients for weed establishment (Panetta and Hopkins 1991). Appropriate occasional summer fire may be an important part of the life cycle of this subspecies and be necessary for regeneration. The role of fire in facilitating weed invasion needs to be considered as part of fire

[*] asterisk designates an introduced (non-native) species

management planning, however, particularly for populations that occur close to reserve boundaries that adjoin cleared farmland, where monitoring and weed control will be necessary following any wildfire or prescribed burn.

- **Access for oil drilling** is a potential threat to Population 1 and 2, as an oil company has operations on the adjacent private property and machinery and vehicles use access tracks within the road verge near *Conostylis dielsii* subsp. *teres* plants. Vehicles deviating from access tracks have the potential to cause direct damage to *C. dielsii* subsp. *teres* plants and also cause damage to the habitat.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1. East of Dongara	Shire Road Reserve	1996 340+ 2000 5+ 2004 36	Healthy (1996) Moderate (2000) Moderate (2004)	Weeds, road, fence and firebreak maintenance, rabbits, inappropriate fire.
2. East of Dongara	Shire Road Reserve	2000 2003 235+ 2004 200+	Moderate (2000) Healthy (2003) Moderate (2004)	Weeds, road maintenance, rabbits, inappropriate fire.
3. East of Dongara	Nature Reserve	1996 11 2000 30+ 2003 250+ 2004 250+	Healthy (1996) Healthy (2000) Healthy (2003) Healthy (2004)	Inappropriate fire, rabbits.
4. East of Dongara	Shire Road Reserve	2000 35 2003 42 2004 100+	Healthy (2000) Healthy (2003) Healthy (2004)	Weeds, road maintenance, rabbits, inappropriate fire.
5. East of Dongara	Shire Road Reserve	2000 38 2003 10 2004 21	Healthy (2000) Moderate (2003) Moderate (2004)	Road, fence and firebreak maintenance, weeds, rabbits, inappropriate fire.
6. East of Dongara	Nature Reserve	2000 50+ 2003 2004 1000+	Healthy (2000) Healthy (2003) Healthy (2004)	Inappropriate fire, rabbits.
7. East of Dongara	Nature Reserve	2000 30+ 2001 30+ 2004 30+	Healthy (2000) Healthy (2001) Healthy (2004)	Inappropriate fire, rabbits.
8. East of Dongara	Nature Reserve	2000 273+ 2003 not counted 2004 not counted	Healthy (2000) Healthy (2003) Healthy (2004)	Firebreak maintenance, inappropriate fire
9. East of Dongara	Shire Road Reserve	2003 2	Poor (2003)	Road, fence and firebreak maintenance, rabbits, weeds, inappropriate fire.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Any on-ground works (clearing, firebreaks, roadworks etc) in the immediate vicinity of *Conostylis dielsii* subsp. *teres* will require assessment. On-ground works should not be approved unless the proponents can demonstrate that they will not have an impact on the subspecies, or on its habitat or potential habitat.

Critical habitat and important populations

Populations 1, 2, 4 and 5 occur on Shire road reserves, but are in reasonably good condition. Populations 3, 6, 7 and 8 occur in a Nature Reserve, are not in decline and are subject to few threats. These populations are considered to be important.

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

The critical habitat for *Conostylis dielsii* subsp. *teres* comprises:

- the area of occupancy of important populations;
- areas of similar habitat within 200 metres of important populations, i.e. white, pale yellow or grey sand with lateritic gravel, in heath, open scrub, low open heath and low open woodland, in upland areas (these provide potential habitat for natural range extension);
- areas of remnant vegetation that link important populations (these are necessary to allow pollinators to move between populations); and
- additional occurrences of similar habitat on conservation estate near important populations that do not currently contain the species but may have done so in the past (these represent possible translocation sites).

Benefits to other species or ecological communities

Conostylis micrantha (Vulnerable under *Wildlife Conservation Act 1950*; Endangered under EPBC Act) occurs in association with Populations 1, 2, 6, 7 and 8 of *C. dielsii* subsp *teres*. *Leucopogon marginatus* (Endangered under *Wildlife Conservation Act 1950* and under EPBC Act) occurs in association with Populations 3, 6, 7 and 8 of *C. dielsii* subsp. *teres*. *Grevillea hirtella* (Priority 3) occurs in association with Populations 3, 4 and 7 of *C. dielsii* subsp. *teres*. *Grevillea erinaceae* (Priority 3) occurs in association with Population 7 of *C. dielsii* subsp. *teres*. *Banksia scabrella* (Priority 4) occurs in association with Populations 3 and 4 of *C. dielsii* subsp. *teres*. Recovery actions such as weed and rabbit control and fire management strategies will assist in protecting these Declared Rare and Priority species as well as *C. dielsii* subsp. *teres*, and the ecological community in which the populations are located.

International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. However, as *Conostylis dielsii* subsp. *teres* is not specifically listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

Role and interests of indigenous people

The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of these populations. Implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region, and this is discussed in the recovery actions.

Social and economic impacts

Populations of *Conostylis dielsii* subsp. *teres* occur on Shire road reserves, and a Nature Reserve that is under the joint care, control and management of the Conservation Commission and the Tree Society. The implementation of this interim recovery plan therefore has limited potential for social or economic impact where populations occur on lands not specifically managed for conservation. Laying of poison oats for rabbit control will occur after liaison with managers of nearby private property. Recovery actions refer to continued liaison between stakeholders with regard to populations on Shire road reserves.

Evaluation of the plan's performance

CALM will evaluate the performance of this IRP in conjunction with the Geraldton District Threatened Flora Recovery Team. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

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

Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more within the five year period of the plan.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more within the five year period of the plan.

3. RECOVERY ACTIONS

Existing recovery actions

The Shire of Irwin and the Shire of Mullewa have been informed of the presence of *Conostylis dielsii* subsp. *teres* on road reserves that they manage. The notification details the Declared Rare status of *C. dielsii* subsp. *teres* and the associated legal obligations. On-site liaison has also occurred between staff from CALM's Geraldton District and Shire works supervisors for both Irwin and Mullewa. Managers of land that adjoins road reserve populations have also been sent similar notifications. An oil company operating on property adjacent to Population 1 and 2 has been sent a similar notification, as it was considered there might be some likelihood of the company moving machinery or vehicles through the area. On-site liaison has also occurred between representatives from CALM and the oil company.

Declared Rare Flora (DRF) markers have been installed at all populations that occur on road reserves or near Nature Reserve firebreaks. These markers alert road maintenance workers and reserve operations officers to the presence of each population, and enable them to take appropriate care.

BGPA hold a small amount of *Conostylis dielsii* subsp *teres* seed. BGPA undertook one trial to propagate *C dielsii* subsp. *teres* from seed, but this was unsuccessful (C. Naughton[1] personal communication).

Staff from CALM's Geraldton District conducted rabbit baiting with 1080 oats at Populations 1, 2, 3, 6 and 9 in 1999, in an attempt to reduce rabbit numbers and their impact on the habitat at those sites. Further baiting was undertaken at these populations in 2000. During subsequent years monitoring determined that rabbit activity was low and baiting has not been necessary, although monitoring during 2004 indicated that rabbit numbers are again increasing at some populations.

Rabbits do not appear to graze the *Conostylis dielsii* subsp. *teres* plants unless alternative food sources are very scarce, but the rabbit warrens and diggings lead to soil disturbance that impacts the habitat and plants. These disturbed areas are then colonised by weeds.

Preliminary weed control trials were carried out at Populations 1 and 2, where *Conostylis dielsii* subsp. *teres* occurs with *C. micrantha*. The effect of the grass-specific herbicide Fusilade was tested on a treatment plot compared to a control plot. The Fusilade achieved good grass weed control and had some effect on native grass species, including some death of *Austrostipa elegantissima* (Obbens 1997).

Grass weeds at Population 1 were sprayed with Fusilade by Geraldton District staff in 2000. Some broadleaf weeds were also present although a broadscale herbicide was not used due to the risk of damage to *Conostylis dielsii* subsp. *teres* and associated native vegetation.

Displays at wildflower shows have included pictures and information on this subspecies to promote flora conservation in the hope that this may result in the discovery of new populations, increased community awareness and better protection for the subspecies where it occurs on Shire road reserves.

[1] Carly Naughton, Horticulturalist, Botanic Garden and Parks Authority

Staff from CALM's Geraldton District and WA Threatened Species and Communities Unit (WATSCU) have undertaken surveys of suitable habitat and recorded new populations of this subspecies (Populations 4, 5, 6, 7, 8 and 9).

Staff from CALM's Geraldton District regularly monitor all populations of this subspecies.

The Geraldton District Threatened Flora Recovery Team (GDTFRT) is overseeing the implementation of this IRP.

Future recovery actions

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

1. Coordinate recovery actions

The Geraldton District Threatened Flora Recovery Team will coordinate recovery actions for *Conostylis dielsii* subsp. *teres* and other Declared Rare Flora in their District. They will include information on progress in their annual report to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (Geraldton District) through the GDTFRT
Cost: $1,300 per year

2. Monitor populations

Annual monitoring of factors such as habitat degradation (including weed invasion, rabbit activity, road, firebreak or fenceline maintenance), population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation is essential. The visibility of DRF markers will also be monitored to ensure they remain effective, and have not faded or been covered by vegetation growth. In the event of a fire any burnt populations will be monitored for regeneration and level of weed invasion, and data recorded to increase knowledge of the biology of this species.

Action: Monitor populations
Responsibility: CALM (Geraldton District) through the GDTFRT
Cost: $1,100 per year

3. Conduct further surveys

Further surveys by CALM staff, and where possible community volunteers, will be conducted during the flowering period of the subspecies (July-August). Several of the *Conostylis dielsii* subsp. *teres* populations that occur in a Nature Reserve have only been partially surveyed (populations 3, 6, 7 and 8). More extensive survey of these populations is a priority to determine the total number of individuals, their distribution and to enable monitoring to more accurately determine any decline or extension. There are also large areas of appropriate habitat within this reserve, where additional populations may be located, and these areas therefore require survey. Records of areas surveyed will be sent to Wildlife Branch and retained at the district, even if *C. dielsii* subsp. *teres* is not located.

Action: Conduct further surveys
Responsibility: CALM (Geraldton District) through the GDTFRT
Cost: $1,200 per year in the first, third and fifth years

4. Liaise with relevant land managers

Staff from CALM's Geraldton District will continue to liaise with relevant land managers to ensure that populations are not accidentally damaged or destroyed. This will include liaison with the oil company operating near Population 1. CALM District fire operations staff will continue to consult flora conservation staff with regard to fire management strategies within the Nature Reserve where *Conostylis dielsii* subsp. *teres* occurs, and in relation to the implications of trials to obtain information on fire response and appropriate fire regime for the subspecies.

Action: Liaise with relevant land managers
Responsibility: CALM (Geraldton District) through the GDTFRT
Cost: $1,500 per year

5. Map critical habitat

It is a requirement of the EPBC Act that spatial data relating to critical habitat be determined. Although critical habitat is described in Section 1, the areas as described have not yet been mapped and that will be redressed under this action. If any additional populations are located, then critical habitat will also be determined and mapped for these locations.

Action: Map critical habitat
Responsibility: CALM (Geraldton District, WATSCU) through the GDTFRT
Cost: $2,000 in the first year

6. Implement weed control

The habitat of Populations 1, 2, 5 and 9 has high levels of weed infestations and Populations 4, 7 and 8 have minor weed infestations at the edge of the populations. Weeds present include [*]*Avena fatua* (wild oats) and **Arctotheca calendula* (cape weed), which tend to become more dense as areas become more degraded. As *Conostylis dielsii* subsp. *teres* is a relatively small perennial herb (up to 20cm tall), the health of existing plants and recruitment of new plants are likely to be affected by weed invasion.

Weed control is required at Populations 1, 2, 5 and 9 to improve habitat condition. Weed control will include spot spraying with herbicide during the appropriate weed growth phase. Low concentrations will be used to minimise the impact on native vegetation. Minor weed infestations at Populations 4, 7 and 8 require monitoring and implementation of appropriate control should weeds begin encroaching further into *Conostylis dielsii* subsp *teres* populations. This is of particular importance in the event of a disturbance such as fire, when prompt control will be required. The outcome of all weed control measures will be monitored and results documented to enable effective follow-up measures where necessary.

Action: Implement weed control
Responsibility: CALM (Geraldton District) through the GDTFRT; relevant land managers
Cost: $1,000 per year

7. Implement rabbit control as necessary

The level of threat posed by rabbits varies from year to year with climatic conditions and rabbit numbers. Baiting using 1080 oats will be undertaken in cooperation with adjoining property owners when monitoring indicates that the threat from rabbits is high. Baiting will be done during summer when bait uptake is highest due to scarcity of food and water.

Action: Implement rabbit control as necessary
Responsibility: CALM (Geraldton District) through the GDTFRT; relevant land managers
Cost: $700 in first, third and fifth years

8. Obtain biological and ecological information

[*] asterisk designates an introduced (non-native) species

Improved knowledge of the biology and ecology of *Conostylis dielsii* subsp. *teres* will provide a scientific basis for its management in the wild. An understanding of the following is necessary for effective management:

1. the role of competition, rainfall, and grazing in germination and recruitment.
2. the reproductive strategies, phenology and seasonal growth of the species.

Action: Obtain biological and ecological information
Responsibility: CALM (Science Division, Geraldton Districts) through the Recovery Team
Cost: $12,000 per year in second, third and fourth years

9. Obtain information on fire response

Too frequent fire may impact on soil seed banks and recruitment and lead to habitat degradation, although occasional summer fire may be an important part of the life cycle and necessary for regeneration. Implementation of an appropriate fire management strategy in the reserve that contains populations of *Conostyils dielsii* subsp. *teres* is essential to help protect conservation values. Experimental trials to gain information on the most appropriate fire regime for this subspecies and also other threatened and Priority flora within the reserve, are therefore essential to ensure management strategies are beneficial rather than detrimental to these values.

Trials will involve small-scale prescribed burning plots followed by monitoring details of fire response of *Conostylis dielsii* subsp. *teres*, other threatened and Priority flora and associated habitat, as well as any negative impacts such as level of weed invasion and the species involved. Monitoring results will be used to determine future directions in the fire management strategies.

Action: Obtain biological and ecological information
Responsibility: CALM (Geraldton District) through the GDTFRT
Cost: $2,500 in first year and 1,500 in subsequent years.

10. Develop and implement a fire management strategy

As the most appropriate fire regime for *Conostylis dielsii* subsp. *teres* and its habitat is currently unknown, current fire management objectives include prevention of fire from impacting DRF populations. Once adequate information is obtained through fire response trials, a fire management strategy will be developed in consultation with land managers, and this will recommend fire control measures, and fire intensity, timing and frequency.

Action: Develop and implement a fire management strategy
Responsibility: CALM (Geraldton District) and relevant land managers through the GDTFRT
Cost: $2,500 in first year, and $1,700 in subsequent years

11. Collect seed

It is necessary to store germplasm as a genetic resource, ready for use in translocations and as an *ex situ* genetic 'blueprint' of the subspecies. The germplasm stored will include seed and tissue culture material. Some seed has been collected by BGPA, but additional collections are required from all populations to maintain adequate representation of the genetic diversity of this species.

Action: Collect seed
Responsibility: CALM (TFSC, Geraldton District) through the GDTFRT
Cost: $2,400 in the first, third and fifth years

12. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of this subspecies 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, including a description of the plant, its habitat, threats, recovery actions and photos. This will be distributed to the public through CALM's Geraldton District office and at the office and library of the Shires of Irwin and Mullewa. Such information distribution may lead to the discovery of new populations.

Action: Promote awareness
Responsibility: CALM (Geraldton District) through the GDTFRT
Cost: $1,700 in first year, and $1,100 per year in subsequent years

13. Review the need for further recovery actions

At the end of the fourth year of its five-year term this Interim Recovery Plan will be reviewed and the need for further recovery actions will be assessed.

Action: Review the need for further recovery actions
Responsibility: CALM (WATSCU, Geraldton District) through the GDTFRT
Cost: $1,000 in the fifth year

4. TERM OF PLAN

This Interim Recovery Plan will operate from January 2005 to December 2009 but will remain in force until withdrawn or replaced. If the subspecies is still Declared Rare Flora after five years, the need for further recovery actions will be determined.

5. REFERENCES

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6. TAXONOMIC DESCRIPTION

Excerpt from: Hopper**,** S.D., Purdie, R.W., George, A.S. and Patrick, S.J. (1987). Conostylis. *Flora of Australia* 45: 57, 92-94. Australian Biological Resources Study, Canberra.

Conostylis dielsii W*. Fitzg., J.Proc.Mueller. Bot. Soc. W. Australia* 1:82 (1903)

Tufts to 15 cm diam., shortly rhizomatous. Leaves terete or flat, 7-33 cm long, 0.8-1.8 mm wide, green glabrous except base woolly with simple white hairs. Inflorescence a dense cyme or capitate, many-flowered; scape 4-10 cm long, equal to or slightly exceeding leaves, bearing usually a +/- median leaf-like bract 6-15 mm long, with a smaller bract subtending inflorescence. Perianth 7.5-10 mm long, creamy yellow, closely tomentose with branched hairs outside, glabrous or slightly hairy inside; lobes 4-6 mm long, claw-like fruit. Stamens uniseriate; filaments short; anthers 2.5-4 mm long. Style 6-8.5 mm long, shorter than or +/- equal to stamens; placenta dilated with several reflexed ovules.

Characterised by the flat or terete leaves that are woolly at the base and glabrous above, by the uniseriate stamens and the few ovules. Occurs between Mingenew, Walkaway and the Arrowsmith R., WA. There are 2 subspecies.

Leaves flat, 7-15.5 cm long **subsp. *dielsii***

Leaves terete, 13-33 cm long **subsp. *teres***

Subsp. *teres*
Leaves terete, 13-33 cm long, less than 1 mm wide. Scape 1-14.5 cm long.

Restricted to uplands inland from Walkaway, WA. Grows in sand in heath and low open woodland. Flowers July-August.

Similar to *C. teretiuscula*, differing in the leaf indumentum and the placentation.

Named from the Latin *teres* (terete), in reference to the leaves.

SUMMARY OF RECOVERY ACTIONS AND COSTS

Recovery Action	Year 1			Year 2			Year 3			Year 4			Year 5		
	CALM	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**
Coordinate recovery actions	800	500		800	500		800	500		800	500		800	500	
Monitor populations	800		300	800		300	800		300	800		300	800		300
Conduct further surveys	500	400	300				500	400	300				500	400	300
Liaise with land managers	800		700	800		700	800		700	800		700	800		700
Map critical habitat	1,500		500												
Implement weed control	600		400	600		400	600		400	600		400	600		400
Implement rabbit control, if req'd	400		300				400		300				400		300
Obtain biological and ecological information				5000		7000	5000		7000	5000		7000			
Obtain info on fire response	1,500		1000	1,000		500	1,000		500	1,000		500	1,000		500
Develop and implement a fire management strategy	1,200	900	400	900	300	500	900	300	500	900	300	500	900	300	500
Collect seed	1,000		1,400				1,000		1,400				1,000		1,400
Promote awareness	1,100		600	1,100			1,100			1,100			1,100		
Review the need for further recovery actions													400	600	
Total	10,200	1,800	5,900	11,000	800	9,400	12,900	1,200	11,400	11,000	800	9,400	8,300	1,800	4,400
Yearly Total		**17,900**			**21,200**			**25,500**			**21,200**			**14,500**	

Ext. = External funding (funding to be sought), Other = funds contributed by in-kind contribution and BGPA.

Total CALM:	$53,400
Total Other:	$6,400
Total External Funding:	$40,500
Total Costs:	**$100,30**