

**Approved NSW and National Recovery Plan**

# *Zieria obcordata* Recovery Plan



**February 2007**



**Australian Government**

Department of **Environment and Conservation** NSW



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**Department of Environment and Conservation Recovery Planning Program**

*Zieria obcordata*  
**Recovery Plan**

**Prepared in accordance with the New South Wales  
*Threatened Species Conservation Act 1995***

**February 2007**

## Acknowledgments

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This Recovery Plan was prepared by Melanie Bannerman, Department of Environment and Conservation (NSW) in consultation with the Royal Botanic Gardens, Sydney, the Australian National Botanic Gardens, Canberra and a number of botanical experts. Lesley Forward of the DEC prepared an early version of the plan and amendments were made to the draft by Geoff Robertson, Matt Cameron and Peter Christie of the DEC. Natural Heritage Trust funding was provided by the Australian Government to prepare this recovery plan.

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## Foreword

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The conservation of threatened species, populations and ecological communities is crucial for the maintenance of this State's unique biodiversity. In NSW, the *Threatened Species Conservation Act 1995* (TSC Act) provides the framework to conserve and recover threatened species, populations and ecological communities through the preparation and implementation of Recovery Plans.

The preparation and implementation of Recovery Plans are identified by both the National Strategy for the Conservation of Australia's Biological Diversity and the approved NSW Biodiversity Strategy as a key strategy for the conservation of threatened flora, fauna and invertebrates. The object of a Recovery Plan is to document the research and management actions required to promote the recovery of a threatened species, population or ecological community and to ensure its ongoing viability in nature.

This Recovery Plan describes our current understanding of *Zieria obcordata*, documents research and management actions undertaken to date and identifies actions required and parties responsible to ensure ongoing viability of the species in the wild.

The Department of Environment and Conservation (NSW) has prepared the *Zieria obcordata* Recovery Plan with the assistance of a number of people. I thank these people for their efforts to date and look forward to their continued contribution to the recovery of the species.



**BOB DEBUS MP**  
**Minister for the Environment**

## **Executive Summary**

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### **Introduction**

*Zieria obcordata* is endemic to New South Wales and is currently only known from two small populations near Wellington and Bathurst with a total number of approximately 220 individual plants. Both populations inhabit a very small area and occur entirely on private land. The species is a small, rounded shrub up to 50cm in height with distinctively aromatic, trifoliolate leaves and tiny pale pink or white flowers. Known and potential threats to the species include weed invasion, inappropriate fire or grazing regimes and clearing of habitat and/or other disturbances associated with development. With such a highly restricted distribution, the species is also at greater risk of extinction than if it was more widely distributed. Improper management or changes in habitat and unforeseen events such as disease, severe drought or wildfire may result in a significant loss of individuals and potentially lead to the extinction of the species in the wild.

### **Legislative Context**

The *Threatened Species Conservation Act 1995* (TSC Act) provides a legislative framework to protect and encourage the recovery of threatened species, populations and ecological communities in NSW. Under this legislation the Director-General of the Department of Environment and Conservation (DEC) has a responsibility to prepare Priority Action Statements or Recovery Plans for all species, populations and ecological communities listed as critically endangered, endangered or vulnerable on the TSC Act schedules. Similarly, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) enables the Commonwealth Minister for the Environment to require the preparation of a Recovery Plan for nationally listed species and communities or adopt plans prepared by others including those developed by State agencies. Both Acts include specific requirements for the matters to be addressed by Recovery Plans and the administrative process for preparing Recovery Plans.

### **Legal Status**

*Zieria obcordata* is listed as 'endangered' under both the New South Wales TSC Act and the Commonwealth EPBC Act.

### **Preparation of Plan**

This Recovery Plan has been prepared to satisfy both the requirements of the TSC Act and the EPBC Act and therefore will be the only Recovery Plan for the species. It is the intention of the Director-General of the DEC to forward the final version of this Recovery Plan to the Commonwealth Minister for the Environment for adoption, once it has been approved by the NSW Minister for the Environment.

This draft plan has been prepared with the assistance of interested parties with relevant expertise. Components within the plan do not necessarily represent the views nor the official positions of all the individuals or agencies consulted. The information in this Recovery Plan was accurate to the best of the knowledge of the DEC on the date it was approved.

## **Recovery Objectives**

The overall aims of this Recovery Plan are to prevent the decline of *Zieria obcordata*, to protect populations from threats and to ensure the long term viability of the species in the wild.

The specific objectives are to:

1. determine the species' full range, distribution and abundance and determine whether the species is currently in decline;
2. understand aspects of the species' biology and ecology that are crucial to the recovery effort, including its habitat and resource requirements and the reproductive viability of the wild populations;
3. determine the species response to fire and physical disturbances such as grazing or slashing;
4. establish an ex-situ conservation plan as insurance against extinction in the wild;
5. identify and mitigate, if possible, any threats to the species;
6. ensure that management of the sites on which the species currently occurs is appropriate and does not threaten its existence;
7. achieve a cooperative approach between the DEC and all stakeholders towards the conservation of the species;
8. promote community awareness and support for the conservation of the species.

## **Recovery Criteria**

The achievement of the Recovery Objectives will be assessed based on the following performance criteria:

1. all areas of potential habitat have been surveyed and all populations are mapped, benchmarked and regularly monitored;
2. no *Zieria obcordata* populations experience a significant and permanent decline in numbers and there is no loss of any known populations;
3. knowledge of the biology, ecology, habitat and resource requirements, reproductive viability and recruitment rates for the species exists and is used to guide management decisions;
4. the species response to various fire and physical disturbance regimes is known and the species is managed accordingly in response to these regimes;
5. an ex-situ seed bank exists that is representative of the full geographic range and diversity of the species and that can be used for future propagation if required;

6. the impact of stock and native herbivore grazing on *Z. obcordata* is known and, if required, all sites threatened by grazing are protected;
7. no areas of known habitat are burnt within a 10 year time frame or slashed for hazard reduction purposes;
8. Country Energy staff are aware of the *Z. obcordata* site located along the powerline easement on 'Crackerjack Rock' and no damage to the plants at this site occurs as a result of maintenance works along the easement;
9. Country Energy, Council, CMA and DEC Parks and Wildlife staff can adequately identify the species in the field and determine its locations using appropriate maps;
10. landholders and the DEC are working together for the conservation of the species with beneficial outcomes being achieved for both sides.

## **Recovery Actions**

Recovery actions will involve:

1. identifying, mapping and surveying all areas of potential habitat as well as mapping all known populations;
2. undertaking observational studies into reproduction, survivorship, longevity, recruitment and any possible threats or causes of mortality within the wild populations;
3. establishing and monitoring experimental plots to determine the species response to various fire, physical disturbance and grazing regimes and protecting populations from any of these regimes should an adverse effect be determined;
4. studying various aspects of the species' reproductive biology, life history and ecology;
5. recording and determining the species habitat and resource requirements;
6. collecting seed and establishing an ex-situ seedbank;
7. eradicating the threat of weed invasion at the Wellington population and assessing the degree of any further threat from weed invasion at all other known sites;
8. managing fire in accordance with the *Bushfire Environmental Assessment Code for NSW 2006* hazard reduction guidelines for *Z. obcordata*;
9. providing maps and training to Country Energy, Council and PWD staff in the identification of *Z. obcordata* so that they are able to locate and recognise the species when in the field and/or conducting maintenance or weed spraying activities;
10. liaising with local councils and landholders to seek long-term protection of all sites through various options;
11. educating and involving landholders, the community and other stakeholders in the conservation of the species.



## **Biodiversity Benefits**

The preparation and long term implementation of Recovery Plans for threatened species, populations and ecological communities contributes to, and highlights the importance of conserving all biodiversity. The conservation of biodiversity has a number of wider community benefits. These include:

- provision and maintenance of a range of ecosystem functions on which we and all other species depend;
- contributing to increased biological and ecological knowledge of species, communities, habitats and ecosystems;
- potential medical, economic, agricultural and industrial products; and
- cultural, aesthetic and spiritual values.

The conservation of *Z. obcordata* populations and the habitat in which it occurs will also benefit other species that share the same habitat and have similar biology. This Recovery Plan will increase public awareness of *Z. obcordata* and hence raise the profile of all threatened species. This, in turn, will lead to greater opportunities for the conservation of threatened species and increased protection of biodiversity.



**LISA CORBYN**  
**Director General**

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# 1 Introduction

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*Zieria obcordata* occurs only in Central West New South Wales, where a total of 220 individual plants are currently known from two populations near Wellington and Bathurst. The species is listed as endangered in New South Wales under the *Threatened Species Conservation Act 1995* and nationally under the *Environment Protection and Biodiversity Conservation Act 1999*.

The Wellington population is potentially threatened by the invasion of the exotic plant Tree of Heaven (*Ailanthus altissima*). The Bathurst population does not appear to be under any severe threat at present. However, with such a highly restricted distribution, the species is at greater risk of extinction than if it was more widely distributed. In addition, inappropriate management or changes in habitat and unforeseen events such as disease, severe drought or wildfire may result in a significant loss of individuals and potentially lead to the extinction of the species in the wild.

Both populations of *Z. obcordata* occur on private land. Therefore, all efforts to conserve the species must involve sympathetic management from the landholders. The intent of this Recovery Plan is to work cooperatively with landholders to protect *Z. obcordata* from threats and ensure its continued existence in the wild. Consultation has occurred with the relevant landholders throughout the development of this Plan and the DEC will continue to liaise with these landholders in the implementation of the recovery actions.

## 2 Legislative Context

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### 2.1 State and Commonwealth Acts

#### 2.1.1 *Threatened Species Conservation Act 1995*

*Zieria obcordata* is listed as ‘endangered’ on Schedule 1 Part 1 of the *Threatened Species Conservation Act 1995* (TSC Act). It is an offence to harm, pick or damage the habitat of a threatened species unless the damage is the result of activities which have been licensed under section 91 of the TSC Act or have otherwise gained approval under the *Environmental Planning and Assessment Act 1979*.

#### 2.1.2 *Environment Protection and Biodiversity Conservation Act 1999*

*Zieria obcordata* is also listed as ‘endangered’ under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This act protects nationally listed threatened species and ecological communities as well as threatened species that occur on Commonwealth land. It is an offence to undertake any actions that may harm, damage or pick a nationally listed threatened species without obtaining prior approval from the Commonwealth Minister for the Environment. As *Z. obcordata* is listed nationally under the EPBC Act, any person proposing to undertake actions likely to have a significant impact on the species should refer the action to the Commonwealth Minister for the Environment, who will then decide whether the action requires EPBC Act approval.

### **2.1.3**            *National Parks and Wildlife Act 1974*

The *National Parks and Wildlife Act 1974* (NPW Act) provides for the reservation, protection and management of natural areas and the protection of native fauna and flora. It includes provisions for conservation agreements with other landholders and provisions for licensing of scientific investigation of threatened species. The NPW Act has been amended with regard to threatened species by the TSC Act. No known populations of *Z. obcordata* occur within a National Park or Nature Reserve. However any scientific investigation regarding the species must be licensed under the NPW Act.

### **2.1.4**            *Environmental Planning and Assessment Act 1979*

Land use and development in NSW is subject to evaluation in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act). Threatened species are to be taken into account by consent authorities when they are considering development applications under Part 4, and by determining authorities undertaking or approving activities under Part 5 of the Act. Under the *Crown Lands Act 1912*, the Department of Natural Resources may be the determining authority under the EP&A Act.

The TSC Act amendments to the environmental assessment provisions of the EP&A Act require that consent and determining authorities consider relevant Recovery Plans when exercising a decision making function under Parts 4 and 5 of the EP&A Act. When considering any activity that may affect *Zieria obcordata*, these authorities must consider the conservation strategy outlined in this plan.

### **2.1.5**            *Native Vegetation Act 2003*

The *Native Vegetation Act 2003* (NV Act) replaced the *Native Vegetation Conservation Act 1997* (NVC Act). The NV Act has the following objectives:

- (a) to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State,
  - (b) to prevent broadscale clearing unless it leads to better environmental outcomes,
  - (c) to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation,
  - (d) to improve the condition of existing native vegetation, particularly where it has high conservation value, and
  - (e) to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation,
- in accordance with the principles of ecologically sustainable development.

Under the NV Act, native vegetation must not be cleared except in accordance with a development consent or a property vegetation plan (PVP) approved by the Minister for Natural Resources in accordance with the Act. In determining whether to approve a PVP the Minister must have regard to Catchment Action Plans produced by Catchment Management Authorities. The Minister must not approve a PVP that proposes broadscale clearing of native vegetation unless the clearing will improve or maintain environmental outcomes.

## **2.2 Recovery Plan Preparation**

The TSC Act provides a legislative framework to protect and encourage the recovery of threatened species, populations and ecological communities in NSW. Under this legislation the Director-General of the Department of Environment and Conservation (DEC) has a responsibility to prepare Priority Action Statements or Recovery Plans for all species, populations and ecological communities listed as critically endangered, endangered or vulnerable on the TSC Act schedules. Similarly, the EPBC Act enables the Commonwealth Minister for the Environment to require the preparation of Recovery Plans for nationally listed species and communities or adopt plans prepared by others including those developed by State agencies. Both Acts include specific requirements for the matters to be addressed by Recovery Plans and the administrative process for preparing Recovery Plans.

This Recovery Plan has been prepared to satisfy both the requirements of the TSC Act and the EPBC Act and therefore will be the only Recovery Plan for the species. It is the intention of the Director-General of DEC to forward the final version of this Recovery Plan to the Commonwealth Minister of the Environment for adoption, once it has been approved by the NSW Minister for the Environment.

## **2.3 Recovery Plan Implementation**

The TSC Act requires that a public authority must take any appropriate measures available to implement actions included in a Recovery Plan for which they have agreed to be responsible. Public authorities and councils identified as responsible for the implementation of Recovery Plan actions are required by the TSC Act to report on measures taken to implement those actions. In addition, the Act specifies that public authorities must not make decisions that are inconsistent with the provisions of the Plan. Similarly, the EPBC Act specifies that a Commonwealth agency must not take any action that contravenes a Recovery Plan. The DEC, including the Parks and Wildlife Division and the Botanic Gardens Trust, is the only public authority responsible for the implementation of actions contained in this Recovery Plan.

## **2.4 Critical Habitat**

The TSC Act makes provision for the identification and declaration of Critical Habitat. Under this Act, Critical Habitat may be identified for any endangered species, population or ecological community occurring on NSW lands. Once declared, it becomes an offence to damage Critical Habitat (unless the action is exempted under the provisions of the TSC Act) and a Species Impact Statement is mandatory for all developments and activities proposed within declared Critical Habitat.

To date, Critical Habitat, as defined by the TSC Act, has not been declared for *Z. obcordata*. This Recovery Plan identifies habitat features of the locations where *Z. obcordata* currently occurs. However, it's unclear whether any of these features are decisive in allowing or constraining the long term dispersal, distribution, establishment and persistence of *Z. obcordata*. Accordingly, identification and nomination of Critical Habitat for *Z. obcordata* is not proposed as a recovery action in this Recovery Plan.

## 2.5 Environmental Assessment

The NSW EP&A Act requires that consent and determining authorities, and the Director-General of Department of Environment and Conservation as a concurrence authority, consider relevant Recovery Plans when exercising a decision-making function under Parts 4 and 5 of the EP&A Act. Decision-makers must consider known and potential habitat, biological and ecological factors and the regional significance of individual populations.

Local councils, the Department of Natural Resources and Rural Lands Protection Boards are the main public authorities that must consider *Zieria obcordata* while undertaking or approving activities on private or crown land.

Any other action not requiring approval under the EP&A Act, and which is likely to have a significant impact on *Z. obcordata*, will require a Section 91 Licence from the Director-General of DEC under the provisions of the TSC Act (except where there is provision in the TSC Act for such an action). A Section 91 Licence may be issued with or without conditions, or refused.

The EPBC Act regulates actions that may result in a significant impact on nationally listed threatened species and ecological communities. It is an offence to undertake any such actions in areas under State or Territory jurisdiction, as well as on Commonwealth-owned areas, without obtaining prior approval from the Commonwealth Environment Minister. As *Z. obcordata* is listed nationally under the EPBC Act, any person proposing to undertake actions likely to have a significant impact on this species should refer the action to the Commonwealth Minister for the Environment for consideration. The Minister will then decide whether the action requires EPBC Act approval.

Administrative guidelines are available from the Department of the Environment, Water, Heritage and the Arts to assist proponents in determining whether their action is likely to have a significant impact. In cases where the action does not require EPBC Act approval, but will result in the death or injury of any *Z. obcordata*, and the species is in or on a Commonwealth area, a permit issued by the Commonwealth Minister under the EPBC Act will be required.

The Environment Minister can also delegate the role of assessment and approval to other Commonwealth Ministers under a Ministerial Declaration and to the States and Territories under bilateral agreements.

## 3 Current Conservation Status

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*Zieria obcordata* is listed as ‘endangered’ under the New South Wales *Threatened Species Conservation Act 1995* (TSC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The species is also listed as ‘endangered’ under the International Union for the Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Plants. This status is based upon the ROTAP (Rare or Threatened Australian Plants) codes, which assess the conservation status of Australia’s flora from a national perspective. *Zieria obcordata* was assigned the code ‘3E’, where the ‘3’ indicates that the geographic range in Australia is greater than 100km and the ‘E’ indicates that the species is considered endangered and at serious risk of extinction in the wild within 10-20 years (Briggs and Leigh 1996). The EPBC Act list of threatened plants has now superseded the use of ROTAP codes as an indication of the national threat status.



## 4 Description and Taxonomy

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### 4.1 Description

*Zieria obcordata* A. Cunn. (Rutaceae) was originally described by Cunningham in Field (1825). The specific epithet refers to the characteristic obcordate (two-lobed, heart-shaped) apex of the central leaflet (Porteners 2000) (Figure 2).

*Zieria obcordata* is a distinctively aromatic, multi-stemmed, dense, rounded, perennial shrub up to 40-50 cm in height with a somewhat prostrate or sprawling habit (Briggs and Leigh 1990, herbarium records in Mackay and Gross 2000) (Figure 1). Branches are generally hairy with opposite and trifoliolate leaves that appear whorled along the branches. The leaves are small, hairy and comprised of three smaller leaflets with the upper surfaces covered in numerous small warts. The central leaflet is flattish, broad-oval to wedge-shaped, 3 - 10 mm long and 1.3 – 5.0 mm wide with a blunt, or notched and heart-shaped tip. Secondary leaflets are similar but only about two-thirds the size and the leaf stalk or petiole is 1.5 – 3.0 mm long. The inflorescences (clusters of individual flowers) generally consist of 1 to 3 pale pink or white flowers arranged singly or in small clusters in the leaf axils. Each flower is about 5 - 6 mm across and consists of four tiny petals that are each 2.0 - 2.5 mm long. The sepals are triangular, generally warty and hairy and about 1 mm long. The fruit is a hairy capsule about 5 mm across which is deeply divided into four chambers with each chamber containing one or rarely two ellipsoid seeds about 2 mm long (Armstrong 1991a, 1991b, 2002, Armstrong and Harden 2002, Briggs and Leigh 1990). A more detailed taxonomic description and key for the species can be found in Armstrong and Harden (2002).



**Figure 1:** *Zieria obcordata* shrub (Photo: G. Robertson).



**Figure 2:** *Zieria obcordata* characteristic flowers and leaves (Photo: G. Robertson).

## 4.2 Taxonomic Significance

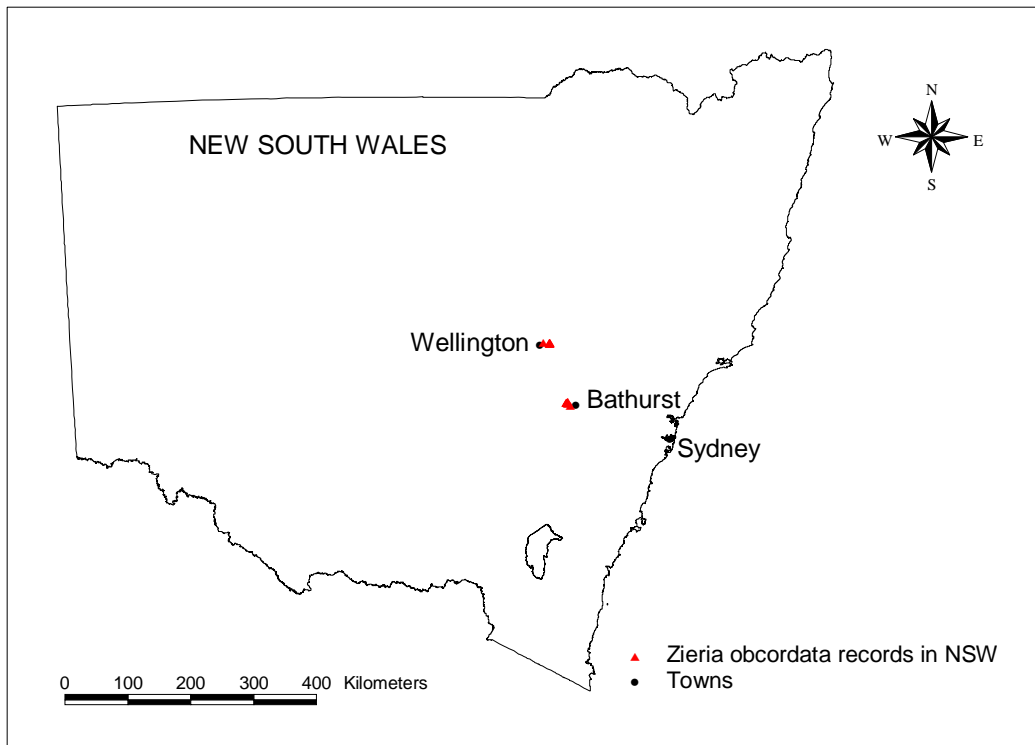
There are 44 species of *Zieria* world wide, with 43 of these species being endemic to Australia and 35 of them occurring in New South Wales. Of these 35 species, 15 are currently listed as ‘Endangered’, 2 as ‘Vulnerable’ and 1 as an ‘Endangered Population’ in NSW alone under the TSC Act, which represents a very high proportion of the genus. In addition, 17 of these 18 species listed in NSW are also listed as nationally threatened under the EPBC Act. This high proportion of threatened species in the genus is reflected in the fact that there is a high proportion of *Zieria* species with very restricted distributions and therefore potentially a high susceptibility to threatening processes. The conservation, management and improved understanding of *Z. obcordata* may assist in guiding recovery efforts for other threatened *Zieria* species in NSW and Australia.

## 5 Distribution

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### 5.1 Current and Historic Distribution

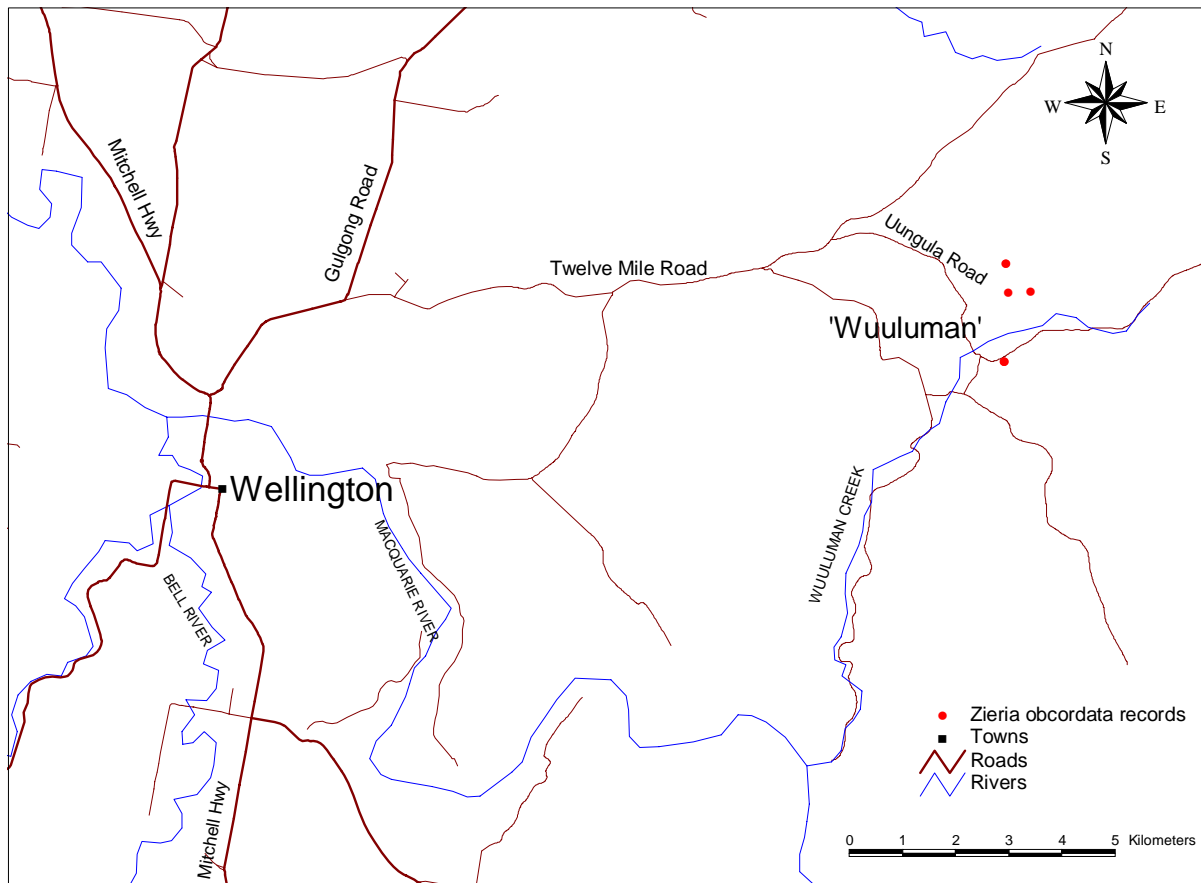
*Zieria obcordata* is endemic to NSW and has a very restricted distribution with a known geographic range of approximately 110km. All records, both historic and recent, occur from only two separate localities within Central West NSW. These include the general area around the Wuuluman locality, approximately 15km east of Wellington in the Central West Slopes Botanical Division of NSW and the general area around the Rock Forest locality, approximately 15km north west of Bathurst in the Central Tablelands Botanical Division of NSW (Figure 3).



**Figure 3:** Currently known range of *Zieria obcordata* in New South Wales.

*Wuuluman locality (Wellington)*

The species was first collected by Alan Cunningham in 1822 at “Hills on Macquarie River” (Mackay and Gross 2000). Due to this very broad description the precise locality of the type specimen cannot be re-located (Briggs and Leigh 1990). The collection may have been from (or near) the current known location near Wellington or from another site not yet found. Following Cunningham’s collection the species was again collected in 1947 by Althofer at a locality east of Wellington, then again in 1978 by both Coveny and Armstrong in separate collections from the Wellington site (Mackay and Gross 2000). The currently known population, referred to in this plan as the Wellington population, occurs at a single site on private property off the Uungula Road, Wuuluman (Figure 4).



**Figure 4:** Currently known *Zieria obcordata* records near Wellington (1947 – 2006).

#### *Rock Forest locality (Bathurst)*

*Zieria obcordata* was also collected by Ingram in 1963 from a location west of Bathurst, followed by another collection made by Johnstone in 1994 near Crackerjack Rock just north west of Bathurst (Mackay and Gross 2000). The currently known population, referred to in this plan as the Bathurst population, occurs on four separate sites on private properties in close proximity to each other along Ophir and Pine Ridge Roads, Rock Forest. One site occurs directly beneath an electricity transmission line on the edge of the transmission line access track, one occurs within a fenced area around a residential dwelling, one is within a fenced area at the rear of a rural residential property and the fourth site occurs on a currently undeveloped block. Two additional sites are also known to have occurred in the locality (L. Cole, pers. comm, Briggs and Leigh 1990), however, neither have been relocated in recent years despite targeted searches.

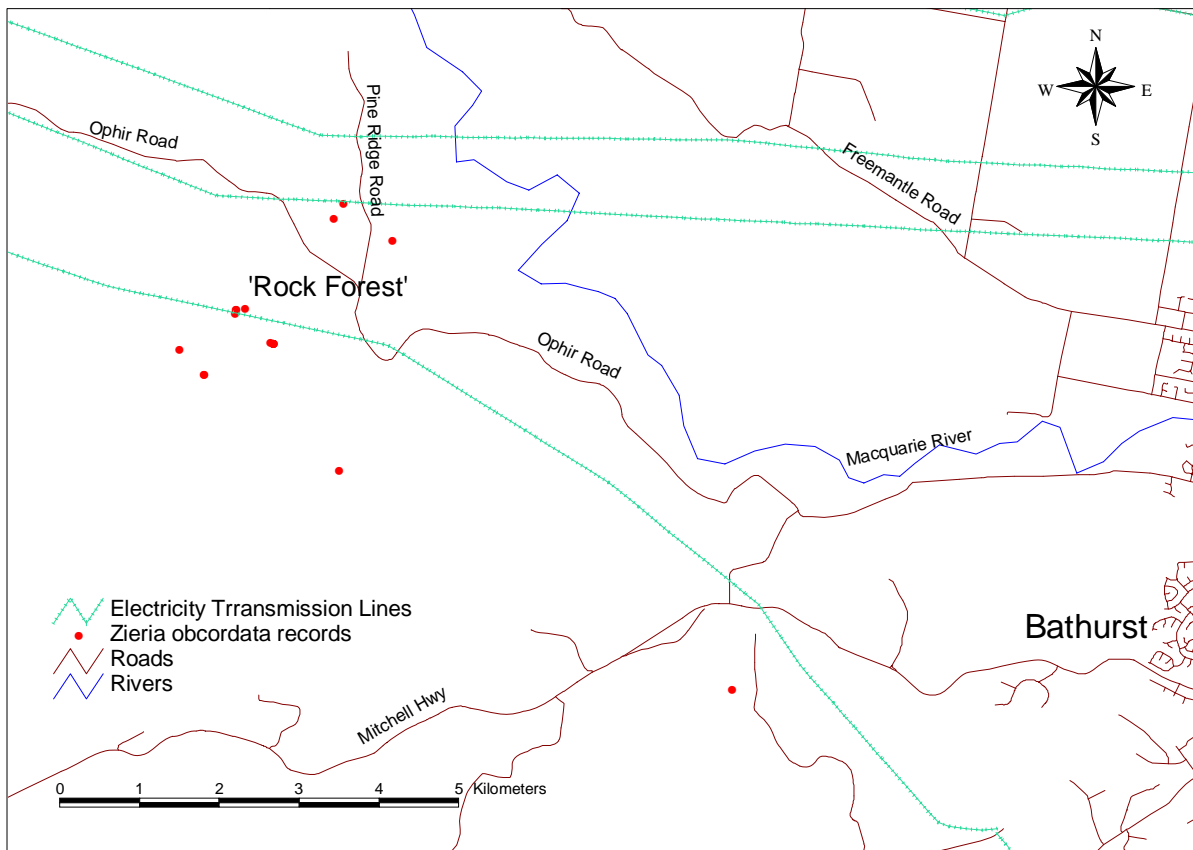


Figure 5: Currently known *Zieria obcordata* records near Bathurst (1963 – 2006).

## 5.2 Tenure

Both currently known populations of *Z. obcordata* occur entirely on privately owned land within the Wellington Council Local Government Area and the Bathurst Regional Council Local Government Area and the Central West Catchment Management Authority area.

## 6 Habitat

### 6.1 Physical Site Characteristics

*Zieria obcordata* grows (predominantly) on gentle to moderately steep, west- to north-facing slopes of low hills or ridges, in undulating terrain of low hills (Figure 6) (Briggs and Leigh 1990). The elevation of the sites ranges from 520m to 920m (Wellington 520-540m, Bathurst sites 740-920m). Individual site elevations are included in Table 1 (Section 7.2). All sites have granite boulders, outcrops, and/or exposed granite. Individual plants typically occur either around the base of the granite boulders, in crevices between the boulders, or nearby (Figure 7).

Soil types recorded at the sites are generally sandy &/or gravelly loams amongst granite boulders. They have been variously described as shallow sandy loam, and brown to dark brown, sometimes shallow, gravelly loams, with a substrate of outcropping, or extensively exposed, granite (sometimes pink) (Briggs and Leigh 1990). The soils at two of the sites have

also been described as skeletal (Johnstone, herbarium records in Mackay and Gross 2000, G. Robertson, pers. comm.).



**Figure 6:** *Zieria obcordata* habitat at 'Bulbudgerree' (Photo: G. Robertson).



**Figure 7:** Typical microhabitat of *Zieria obcordata* - growing amongst granite boulders (Photo: M. Bannerman).

## 6.2 Vegetation

*Zieria obcordata* occurs in a variety of vegetation types that can broadly be described as Eucalypt woodland with a low, open, shrubby understorey on moderately rocky slopes or rocky hillsides (Armstrong and Harden 2002, Briggs and Leigh 1990). Some habitats have also been described as shrublands dominated by species of *Acacia* (Armstrong 1991a, Armstrong and Harden 2002).

### *Wellington Population*

At the Wellington population Rough-barked Angophora (*Angophora floribunda*) and Hickory Wattle (*Acacia implexa*) are dominant in the overstorey with some Kurrajongs (*Brachychiton populneus*) present. The understorey is dominated mainly by Weeping Boree (*Acacia vestita*), Wonga Vine (*Pandorea pandorana*) and Hopbush (*Dodonaea* sp.) with many small herbs including Nodding Blue Lily (*Stypandra glauca*), *Lepidosperma laterale* and a groundcover of native grasses and Rock Ferns (*Cheilanthes* spp.) occurring throughout.

The Wellington population also contains very few weed species with the exception of the exotic Tree of Heaven (*Ailanthus altissima*), which commonly occurs throughout the habitat and surrounding landscape and which may pose a threat to *Z. obcordata* if left unmanaged.

### *Bathurst Population*

Some of the more common overstorey species in the Bathurst population include Bundy (*Eucalyptus goniocalyx*) and Black Cypress (*Callitris endlicheri*). Two of the four currently known sites that make up the Bathurst population have been cleared in the past and therefore have no overstorey. However, past records and the surrounding vegetation suggest that Bundy, Black Cypress and Red Stringybark (*E. macrorhyncha*) were present prior to clearing (G. Robertson, pers. comm.). All of the sites have a shrubby understorey containing predominantly Weeping Boree (*Acacia vestita*) and Hopbush (*Dodonaea* sp.) with a groundcover of native grasses and Rock Ferns (*Cheilanthes* spp.). In addition, a number of small shrubs and herbs including Fringe Myrtle (*Calytrix tetragona*), Slender Westringia (*Westringia eremicola*), Nodding Blue Lily (*Stypandra glauca*), *Brachyloma daphnoides* and *Lepidosperma laterale* are common to most of the sites.

One of the two historic Bathurst sites that was recently re-visited also contains predominantly Bundy, Black Cypress and Red Stringybark in the overstorey. Understorey species are also similar to the currently inhabited sites. However, the structure of the vegetation in the understorey differs considerably to that of the other sites. The midstorey is denser, there is very little understorey and the groundcover, although grassy, contains considerably more ground litter than the currently inhabited sites. Further investigation is required to determine whether vegetation structure and density is a limiting factor in the regeneration of *Z. obcordata* at previous known sites.

Very few weeds are present at the Bathurst sites. Those that do occur include Blackberry (*Rubus fruticosus*), Quaking Grass (*Briza maxima*), Saffron Thistle (*Carthamus lanatus*), Heliotrope (*Heliotropium amplexicaule*) and Flatweed or Catsear (*Hypochaeris radicata*) (G. Robertson, pers. comm. and L. Cole, pers. comm.).

## 6.3 Climate

### *Wellington*

Wellington has a climate characterised by cool, wet winters and hot summers with variable rain. In winter the average daily minimum and maximum temperatures are 3.4°C and 14.1°C, with an average rainfall of 136 mm over three months (median 123 mm) and an average number of 11 frost days per year. In summer the average daily minimum and maximum temperatures are 17.5°C and 31.2°C, with an average rainfall of 175 mm over three months (median 147 mm). The average annual rainfall is 618 mm. These records are based on the equivalent of 37-58 years of data collected from Wellington Research Centre, approximately 13km WNW of the Wellington population, at an elevation of 390m compared with the population which occurs at 520-560m (Bureau of Meteorology website: [http://www.bom.gov.au/climate/averages/tables/cw\\_065035.shtml](http://www.bom.gov.au/climate/averages/tables/cw_065035.shtml)).

### *Bathurst*

Bathurst is characterised by cold winters and mild, wet summers. In winter the average daily minimum and maximum temperatures are 0.5°C and 11.2°C, with an average rainfall of 142 mm over three months (median 124 mm) and an average number of 59 frost days per year. In summer the average daily minimum and maximum temperatures are 13.3°C and 27.8°C, with an average rainfall of 187 mm over three months (median 160 mm). The average annual rainfall is 631 mm. These records are based on the equivalent of 38-96 years of data collected from Bathurst Agricultural Station, approximately 13km ESE of the Bathurst population, at an elevation of 713m compared with the population which occurs at 740-920m (Bureau of Meteorology website: [http://www.bom.gov.au/climate/averages/tables/cw\\_063005.shtml](http://www.bom.gov.au/climate/averages/tables/cw_063005.shtml)).

It should be noted that the weather stations where these averages have been recorded are located approximately 13km from the comparative populations and are at lower elevations than the populations. Hence, these averages are merely an estimate for the populations and it is recognised that slight variations may occur in temperature, rainfall and number of frost days per year at each site.

## 7 Biology and Ecology

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### 7.1 Reproductive Biology

The flowering period for *Z. obcordata* occurs in spring (Armstrong 1991a, Armstrong and Harden 2002, Briggs and Leigh 1990). However, phenological data collected from herbarium specimens indicate that plants can flower from September through to March. Surveys conducted in 2002 found the plants flowering from September to November with very few plants flowering in late November. Additionally, specimens with fruits have only been collected from September to November (Mackay and Gross 2000).

Armstrong (1991b, in Mackay and Gross 2000) also reports that the species possesses functional pollen but is genetically self-incompatible, thus requiring outcross pollen to set seed. Both populations at present contain sufficient plant numbers for cross-pollination to occur within each population and the Bathurst sites occur closely enough to enable cross-



pollination to occur between sites. Both populations, however, are geographically separated to the extent that it is unlikely that cross-pollination occurs between the two populations.

No formal studies have yet been conducted on pollination in this species, although native bees, hover flies and bush flies have been observed on *Z. obcordata* plants and flowers, suggesting that these may be pollinators (G. Robertson, pers. comm., Thompson 1999).

Very little else is known about the reproductive biology and ecology of *Z. obcordata* and further research is required in these areas to better understand the species and its ecological requirements.

## 7.2 Population Size and Demography

At present, the two currently known populations comprise a total of 221 individual live plants covering a combined area of approximately 1.7 hectares. Both populations appear to fluctuate in numbers over time, although whether this is due to climatic responses, survey variation or some other factor is currently not known. Table 1 overpage shows the recorded number of plants made at various times by various people or agencies, as well as elevation and estimated area of occupation for each known site in both populations.

The Wellington population has been regularly visited since 1988. At that time no seedlings were observed but the population contained approximately 100 mature healthy plants over 0.5ha (Briggs and Leigh 1990). In 1996, a visit by the Department of Land and Water Conservation recorded 49 plants, which included both mature and immature plants (D. Shelly, pers. comm.). The DEC visit to the site in September 2002 recorded 77 healthy mature and immature plants covering an area of approximately 1ha.

Different people have visited various sites in the Bathurst population at different times. The four inhabited sites revisited in 2002 by the DEC contained both mature and immature plants. No plants were found at the fifth site and the sixth site, visited by Mr Cole in 2001, contained 1 mature plant at that time but which had died by 2005.

**Table 1: Recorded number of *Zieria obcordata* plants at all known sites 1988 – 2006, elevation and estimated area of occupation at each site.**

Population	Site	Elev (m)	1988 B&L	1996 DLWC	2000 NPWS	2001 Cole	2002 DEC <sup>^</sup>	2005 Cole	Area (ha)
Wellington	Bulbudgeriee	540	100	49			77		1
Bathurst	CJ Rock house	790					10		0.05
Bathurst	CJ Rock ETL	740	12				49		0.25
Bathurst	CJ Rock N slope*		30				0		0.05
Bathurst	Pine Ridge Road	805					27		0.1
Bathurst	Ophir Road	760			44		58		0.25
Bathurst	The Rocks*	920				1		0	0
	<b>TOTALS</b>						<b>221</b>		<b>1.7</b>

\* Previously known *Z. obcordata* sites.

<sup>^</sup> Search conducted with the assistance of Miss J. Stevenson and various property owners.

Survey personnel: B&L = Briggs and Leigh, DLWC = Department of Land and Water Conservation, NPWS = National Parks & Wildlife Service, Cole = Mr L. Cole, DEC = Department of Environment and Conservation.

## 8 Management Issues

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### 8.1 Threats and Reasons for Decline

*Zieria obcordata* is a naturally rare species, characterised by extremely low population numbers across a highly restricted geographic range. As Mackay and Gross (1998) suggest with *Zieria ingramii*, speculation about the species decline before adequate records were maintained is merely conjectural. The same may be true for *Z. obcordata* and it is unknown whether the species is currently declining. Not enough is known about the life history and biology of the species to determine whether recent disappearances at previously known sites are localised extinctions at this stage or whether a viable seedbank exists in the soil at these locations. Nevertheless, the species is rare with approximately 220 known individual plants currently recorded. With such critically low numbers, it is vital that known and potential threats and causes of decline are identified and if possible, mitigated.

#### 8.1.1 Weed Invasion and Management

Although few weeds have been found in both populations, the infestation of the exotic Tree of Heaven (*Ailanthus altissima*) at Wellington poses a potential threat to the population. This species suckers vigorously from roots and has a tendency to expand over considerable areas in a short period of time (Cunningham *et al* 1992). Many medium to large trees and numerous small suckers of the Tree of Heaven occur in and around core habitat of the Wellington population. This species is likely to overtake the rocky outcrop on which *Z. obcordata* occurs and out-compete numerous native species, including *Z. obcordata*. Efforts to eradicate the species from the population have begun (see Section 9) but further follow-up work will be required to ensure that re-infestations do not occur.

The previously known site at ‘The Rocks’ is reported to be subject to considerable weed invasion, particularly from Blackberry (*Rubus fruticosus*) and Blue Heliotrope (*Heliotropium amplexicaule*) (L. Cole, pers. comm.). Other weeds observed at both the Wellington and Bathurst populations do not currently occur in large numbers and are therefore unlikely to pose a threat to *Z. obcordata* at this stage. However, monitoring should be undertaken on a regular basis to ensure that future significant and potentially threatening infestations do not occur and to regularly re-assess this potential threat.

In addition to weed invasion, the actual management and removal of the weeds may also pose a threat to *Z. obcordata* if conducted inappropriately. Broadscale weed spraying would pose a significant threat to *Z. obcordata* and should not be conducted in or around areas of known or potential habitat. Spot spraying or ‘cut and paint’ techniques are preferable herbicide application methods as they are less likely to affect non-target species, including *Z. obcordata*. Even if these methods are used, however, *Z. obcordata* plants may still be inadvertently harmed or destroyed through overspraying, trampling or accidental removal as a result of mis-identification.

#### 8.1.2 Inappropriate Management

Very little is currently known about *Z. obcordata* with regard to its ecological requirements and response to disturbances and threatening processes. As a consequence, this lack of knowledge may lead to inappropriate management of the species or the environment in which

it inhabits, which may potentially threaten the survival of the species. Some of the possible management practices that, if conducted inappropriately, could potentially threaten *Z. obcordata* are outlined below.

*Fire Management* - the response of *Z. obcordata* to fire is currently unknown. High frequency fire is listed as a Key Threatening Process and may disrupt the life cycle of *Z. obcordata* or alter the vegetation structure and composition of *Z. obcordata* habitat such that the species can no longer survive. On the other hand, fire may be a critical factor in the germination of *Z. obcordata* seeds, as it is for many other *Zieria* species, or it may play an important role in maintaining the appropriate structure and density of vegetation in *Z. obcordata* habitat. This suggests that the absence of fire could potentially be detrimental to the species. Determining the response of *Z. obcordata* to fire is considered to be a high priority for the species. However, in the interim, high frequency fires and, alternatively, the long term absence of fires should be avoided in areas of potential *Z. obcordata* habitat as a precautionary measure until such time as the impact of fire on the species is better understood. Slashing, as an alternative fire management tool, may also pose a threat to *Z. obcordata*, particularly through physical damage to plants. Slashing should therefore be avoided in areas where *Z. obcordata* is known to occur. The *Bushfire Environmental Assessment Code for NSW* (NSW RFS 2006) hazard reduction guidelines for *Z. obcordata* support the above fire management recommendations. The Code states that hazard reduction fires be conducted no more than once every 10 years for *Z. obcordata* and that no slashing, trittering or tree removal be conducted for hazard reduction purposes within 100m of a known *Z. obcordata* location.

*Grazing Management* - there is no conclusive evidence to show that browsing by either domestic stock and/or native herbivores has a significant impact on *Z. obcordata* populations. Clear evidence shows that the species is palatable to herbivores (Briggs and Leigh 1990, D. Shelly, pers. comm.). However, the extent and severity of browsing on *Z. obcordata* is unknown. Excessive grazing by domestic stock or native herbivores as well as trampling caused by hooved stock has the potential to threaten the species. Monitoring of the wild population should occur to determine if grazing poses a significant threat to the species. In the meantime a precautionary approach with regards to browsing should be taken, with excessive browsing on *Z. obcordata* being avoided where possible.

*Track Maintenance* – as one of the Bathurst sites occurs directly beneath an electricity transmission line on the edge of the transmission line access track, maintenance works or clearing along the track may pose a threat to *Z. obcordata* through direct physical damage to or loss of plants. Maintenance of the area along the track where *Z. obcordata* occurs should be undertaken with extreme care so as not to damage or destroy any *Z. obcordata* plants.

*Weed Management* – see 8.1.1 above.

### **8.1.3 Development and Altered Land Uses**

Development activities for rural residential purposes, particularly around the Bathurst population, are a potential threat to *Z. obcordata*. Various stages of development activities, including site preparation, construction and final land use all have the potential to impact upon *Z. obcordata*. Experiences with other species (including another *Zieria* species) in similar situations has exposed some of the potential direct and indirect threats (J. Briggs, pers. comm. and G. Robertson, pers. comm.). Some of these threats and their impacts are listed below.

Site preparation impacts may include direct loss or damage to plants and loss of habitat through clearing and soil stockpiling, soil compaction from heavy plant and vehicles and changes to the availability of resources such as water and light due to altered topography and vegetation.

Construction impacts may include physical damage or trampling of plants from building activities such as movement around the site of builders and vehicles and dumping of building rubble onto plants.

Final land use impacts may include increased shade from buildings or introduced plants, trampling from people and introduced animals, competition for resources from introduced weeds and other exotic plant species, predation by introduced invertebrate pests, possible introduction of pathogens (fungi or viruses) via introduced plants, changes to water availability due to altered topography and landscaping, altered soil chemistry from garden fertilisers, potential drift or direct application of insecticides or herbicides (which could affect both the plants and pollinators). These impacts should all be carefully considered and avoided where possible, when land uses are altered in areas of known or potential habitat.

Both *Z. obcordata* populations occur in rural areas. The potential for these areas to be subdivided and developed for rural residential purposes has already been demonstrated around the Bathurst population, where a single property containing *Z. obcordata* was subdivided into four separate lots for residential purposes. In doing so, the developer was required to establish a positive covenant on the lot containing the plants to provide for their protection (Section 9.5 provides further details regarding protective covenants). Further development around either population in the future may pose a threat to these populations and should be very carefully assessed with regards to the impacts on *Z. obcordata*.

#### **8.1.4 Environmental Stochasticity**

*Z. obcordata* is a highly restricted and rare species, with only two currently known populations within a geographic range of 110km. With such a highly restricted distribution the chances that one or all of the populations are destroyed by a single catastrophic event are greater than if the species was more widely distributed. Stochastic processes such as severe drought, wildfire or the introduction of a pest or disease pose a significant threat to the survival of these populations, with the possibility of a single event causing the extinction of the species.

### **8.2 Social and Economic Issues**

#### **8.2.1 Economic Considerations**

The properties that support the presently known populations of this species are privately owned and currently used for stock grazing or have been in the recent past. Due to the rocky nature of the sites, the poor soils, and the moderate to moderately steep slopes, it is unlikely they would be further developed for stock grazing or agriculture. Hence, protection of the species at these sites from current and/or increased grazing pressure is unlikely to impose any significant social or economic consequences on the landholders, especially considering the relatively small area they occupy.

Rural-residential development is a potential threat, particularly for agriculturally poor sites that are close to towns with expanding populations. As the *Z. obcordata* populations are only small in area, it is possible that negotiations regarding any potential developments may enable plans to be adjusted and adequate buffer zones around populations established and enforced, as was the case at a site near Bathurst. Given that the areas in consideration are small, and usually occur in very rocky sites (including exposed bedrock), such compromises are likely to have only minor economic consequences on proposed developments.

In addition, the direct costs of achieving the objectives of this Recovery Plan will be minimal and borne by the DEC.

### **8.2.2 Social Considerations**

Social benefits that may result from the implementation of this Recovery Plan include increased public awareness and understanding of threatened species and the threats that affect them as well as the benefits associated with the maintenance of biodiversity and sustainable ecosystems. In addition, landholders that become involved in recovery actions for the species will gain a sense of ‘ownership’ of these actions and pride in the knowledge that they have been involved in the conservation of a nationally threatened species for both current and future generations.

## **8.3 Biodiversity Benefits**

The preparation and long term implementation of Recovery Plans for threatened species, populations and ecological communities contributes to, and highlights the importance of conserving all biodiversity. The conservation of biodiversity has a number of wider community benefits. These include:

- provision and maintenance of a range of ecosystem functions on which we and all other species depend;
- contributing to increased biological and ecological knowledge of species, communities, habitats and ecosystems;
- potential medical, economic, agricultural and industrial products; and
- cultural, aesthetic and spiritual values.

The conservation of *Z. obcordata* populations and the habitat in which it occurs will also benefit other species that share the same habitat and have similar biology. This Recovery Plan will increase public awareness of *Z. obcordata* and hence raise the profile of all threatened species. This, in turn, will lead to greater opportunities for the conservation of threatened species and increased protection of biodiversity.

## **8.4 Roles and Interests of Indigenous Communities**

*Zieria obcordata* was used by Aboriginal people of the area for its medicinal properties. In particular, the leaves of the plant were used for the treatment of headaches. The medicinal properties of the plant are enhanced by the presence of companion plants that also occur in

the habitat of *Z. obcordata* (B. Allen, pers. comm.). Specific detail regarding the use of *Z. obcordata* by Aboriginal people is considered sensitive in nature and has not been provided.

## **9 Previous Actions Undertaken**

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### **9.1 Previous Surveys**

In 1988 Briggs and Leigh (1990) checked all known records of *Zieria obcordata* in the field and searched for the species in other areas of potential habitat. They confirmed and assessed the Wellington population and the two known sites of the Bathurst population at the time. Similar granite outcrops in the vicinity of Wellington and Bathurst were also searched but with no success. All the areas that were searched had been subjected to domestic stock grazing and much of the native understorey was destroyed (Briggs and Leigh 1990).

In 1996, the Department of Land and Water Conservation conducted a visit to the Wellington population, confirming the presence of 49 plants, including seedlings (D. Shelly pers. comm.). In the 5 years following, individual sites in the Bathurst population were opportunistically searched either by individuals (L. Cole and J. Stevenson) or by DEC staff.

In 2002, all known sites, with the exception of the site known as ‘The Rocks’, were revisited by DEC staff to confirm their continued existence. Five of the six sites were re-located, which included the four currently known sites that make up the Bathurst population and the single site of the Wellington population. The only site that was unable to be found was the site recorded in 1988 by Briggs and Leigh known as ‘Crackerjack Rock north slope’. Opportunistic searches in the Bathurst and Wellington areas were also conducted at the same time. Searches were conducted on foot in areas of suitable habitat around known or historic records as well as by road in search of further potential habitat between Rock Forest and Wellington. A total of 22 person hours were spent searching suitable habitat and 103 km of road based searches were conducted. No further populations were discovered despite the existence of suitable ungrazed remnants in parts of the landscape.

### **9.2 Collections and Cultivation**

#### *Herbarium Specimens*

*Zieria obcordata* is represented by 21 herbarium specimens in four Australian herbaria. Eight specimens are held in the Australian National Herbarium, Canberra; eight specimens are held in the Royal Botanic Gardens, Sydney; four specimens are held in the Melbourne Royal Botanic Gardens and one specimen is held in the Brisbane Botanic Gardens Mt Coot-tha, Brisbane (Council of Heads of Australasian Herbaria 2006).

#### *Live Specimens*

*Z. obcordata* is very difficult to maintain in cultivation (Briggs and Leigh 1990) and previous attempts to establish plants ex-situ have either failed or resulted in very low survival rates. At present, a total of nine live plants are in the Australian National Botanic Gardens, Canberra (CANB Herbarium Records 2006) following numerous attempts over the past 25 years to establish ex-situ populations. In 1978 the Royal Botanic Gardens, Sydney took cuttings from the Wellington population for cultivation. By 1988, only one of these cuttings had survived

at the Australian National Botanic Gardens in Canberra. None had survived in Sydney (J. Armstrong, pers. comm. in Briggs and Leigh 1990).

Cuttings were again taken from both the Wellington and Bathurst locations in 1988 and sent to Canberra (Briggs and Leigh 1990). These cuttings had a strike rate of 20%, with only 10% survivorship and very slow growth rates. The best growth was achieved with plants in a very sandy well-drained soil. Eight plants cloned from three parent plants from the Wellington site were still alive in 1990 (Briggs and Leigh 1990) and are presumed to be eight of the nine plants that currently survive at the ANBG in Canberra (Pedersen, pers. comm.). The ninth plant is presumed to be either the single plant surviving from 1978 or another cutting taken in 1988 from Wellington.

Other attempts to cultivate plants have proved unsuccessful. One plant from the Bathurst population and four from Wellington were established in pots at CSIRO Division of Plant Industry in Canberra in 1988, however, none survived. Attempts to establish specimens at Burrendong Arboretum in Wellington also failed (J. Briggs, pers. comm.). Cuttings taken from four plants in the Bathurst population in 1994 and established in pots at Mt Annan Botanic Gardens in western Sydney did not survive beyond 1999. All currently surviving plants have originated from the Wellington population with no plants surviving from the Bathurst population.

The cultivation difficulties encountered with this species highlight the necessity for it to be conserved in its natural habitat (Briggs and Leigh, 1990). Past attempts to establish ex-situ populations have been largely unsuccessful and further attempts are likely to be extremely difficult. Therefore, all efforts to conserve the species in-situ are considered to be of highest priority, with attempts to establish an ex-situ seed bank considered a more appropriate action than cultivating an ex-situ population.

#### *Seed Storage*

To date, no seeds have been collected from either of the *Z. obcordata* populations for the purposes of storage. However, discussions with Mt Annan Botanic Gardens are ongoing regarding the collection and storage of *Z. obcordata* seeds for the purposes of establishing an ex-situ seedbank. The seeds collected will contribute to the NSW Seedbank as well as the SeedQuest Project with the Royal Botanic Gardens, Kew. SeedQuest is an international collaborative plant conservation initiative established by the RBG, Kew, of which the NSW Botanic Gardens Trust is a partner. The aim of SeedQuest is to have 10% of the world's flora held as seed collections by 2010. The NSW Seedbank and the associated seed research unit at Mt Annan Botanic Gardens will play an important role in the collection and storage of seed for SeedQuest. Further information regarding SeedQuest can be obtained direct from the NSW Botanic Gardens Trust.

#### *Germination Studies*

Germination trials specifically for *Z. obcordata* have not been conducted. However, Mt Annan Botanic Gardens are currently investigating the germination requirements of three common *Zieria* species with the hope of extrapolating the techniques used to some of the rarer and threatened *Zieria* species including *Z. obcordata* (R. Johnstone, pers. comm.).

### **9.3 Weed Management**

The exotic Tree of Heaven (*Ailanthus altissima*) in the Wellington population poses a potential threat to the population. Efforts to eradicate the introduced species from the population and its habitat have begun. Conservation Volunteers Australia provided a team of volunteers to remove the Tree of Heaven from *Z. obcordata* habitat. The team consisted of 6 people and worked for a week in October 2004, using the ‘cut and paint’ technique with Roundup to remove as much of the introduced species as possible from core habitat.

### **9.4 Fencing**

Two of the four sites in the Bathurst population are fenced off from domestic stock and native herbivores. One was opportunistically fenced due to the site being in close proximity to a residence and therefore enclosed within the yard fence associated with the residence. The other site was fenced in accordance with a covenant over the parcel of land involved, which required that a fence be erected around the site.

The remaining sites in the Bathurst population are unfenced, although attempts have been made to prevent herbivores browsing on a couple of plants by erecting chicken wire around individual plants. Fencing was also partially erected around the Wellington population in the past but has not been completed. Consequently native herbivores and domestic stock (sheep) continue to graze on the site.

### **9.5 Protective Covenant**

Under section 88B of the *Conveyancing Act* 1919 a covenant may be created over a parcel of land, requiring the property owner to either undertake (positive covenant) or refrain from undertaking (restrictive covenant) certain activities or land uses. A covenant is placed on the title of the land and therefore remains in perpetuity. In the case of one of the Bathurst sites where *Z. obcordata* occurs, a decision in the Land & Environment Court was made to protect the site via a positive covenant over the parcel of land on which the site was located. The covenant specifies that a fence and signs marked “Restricted Area” must be erected and maintained around the site. It also states that no stock are to enter the fenced area and that no activities are to be carried out in or near the site that will impact on the health and wellbeing of the species. Such activities include spraying, picking of the species, grazing within the area and any activity that is likely to modify the nutrient or moisture content of the area. It is the responsibility of the Bathurst Regional Council and the landholder to ensure that the specifications of the covenant are adhered to. Both the council and the landholder are aware of their responsibilities and consultation with the DEC will occur, if necessary, regarding any concerns with the adequacy of the covenant.

### **9.6 Information Brochure**

An information brochure for *Z. obcordata* was produced in 2002 and distributed to relevant landholders and stakeholders. The brochure provides general information regarding the conservation status and description of the species and its habitat, as well as an indication of its current distribution, known threats and management actions. The brochure requires updating and should be more widely distributed to landholders surrounding the currently



known populations as well as the general community. A copy of the information brochure is provided in Appendix 1.

## **10 Species Ability to Recover**

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*Z. obcordata* is currently known to occur only in two small populations within a very limited range. Neither of the populations exist within a conservation reserve and the ecology of the species is poorly understood, particularly with regard to the effects of threats on the species.

Nevertheless, both populations at present appear to be viable. There are a variety of size classes in each population and plants have recently been observed flowering and producing fruit. In addition, the known and obvious threats to the species can be readily managed which should enhance the species chances of survival and continuance in the wild.

Therefore, provided the recovery actions are implemented and a precautionary approach is taken to management of the species, the chances of *Z. obcordata* continuing in the wild are promising.

## **11 Recovery Objectives and Performance Criteria**

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### **Recovery Objectives**

The overall aims of this Recovery Plan are to prevent the decline of *Zieria obcordata*, to protect populations from threats and to ensure the long term viability of the species in the wild.

The specific objectives are to:

1. determine the species' full range, distribution and abundance and determine whether the species is currently in decline;
2. understand aspects of the species' biology and ecology that are crucial to the recovery effort, including its habitat and resource requirements and the reproductive viability of the wild populations;
3. determine the species response to fire and physical disturbances such as grazing or slashing;
4. establish an ex-situ conservation plan as insurance against extinction in the wild;
5. identify and mitigate, if possible, any threats to the species;
6. ensure that management of the sites on which the species currently occurs is appropriate and does not threaten its existence;
7. achieve a cooperative approach between the DEC and all stakeholders towards the conservation of the species;
8. promote community awareness and support for the conservation of the species.

## Recovery Criteria

The achievement of the Recovery Objectives will be assessed based on the following performance criteria:

1. all areas of potential habitat have been surveyed and all populations are mapped, benchmarked and regularly monitored;
2. no *Zieria obcordata* populations experience a significant and permanent decline in numbers and there is no loss of any known populations;
3. knowledge of the biology, ecology, habitat and resource requirements, reproductive viability and recruitment rates for the species exists and is used to guide management decisions;
4. the species response to various fire and physical disturbance regimes is known and the species is managed accordingly in response to these regimes;
5. an ex-situ seed bank exists that is representative of the full geographic range and diversity of the species and that can be used for future propagation if required;
6. the impact of stock and native herbivore grazing on *Z. obcordata* is known and, if required, all sites threatened by grazing are protected;
7. no areas of known habitat are burnt within a 10 year time frame or slashed for hazard reduction purposes;
8. Country Energy staff are aware of the *Z. obcordata* site located along the powerline easement on 'Crackerjack Rock' and no damage to the plants at this site occurs as a result of maintenance works along the easement;
9. Country Energy, Council, CMA and DEC Parks and Wildlife staff can adequately identify the species in the field and determine its locations using appropriate maps;
10. landholders and the DEC are working together for the conservation of the species with beneficial outcomes being achieved for both sides.

## 12 Recovery Actions

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### 12.1 Action 1 – Survey, Data Collection and Analysis

Areas of potential habitat will be identified and mapped and targeted surveys for *Z. obcordata* will be undertaken in these areas with the permission of relevant landholders. Previously known sites will also be revisited. Surveys will be conducted in spring when the species is likely to be flowering and therefore more easily detected and specimens from newly located populations will be lodged with a suitable herbarium. In undertaking surveys for new populations of *Z. obcordata*, the DEC will seek to involve the community and stakeholders in the survey effort.

At the time of surveys, population and habitat characteristics will also be recorded including population size and demographics, vegetation structure and composition, topography, substrate composition and potential threats. Soil samples will be collected and tested for various elements (organic carbon, phosphorous, aluminium levels, etc) that may assist in determining critical habitat components for the species. The data collected will be used to assist in determining which factors, if any, are most strongly related to the distribution and abundance of the species.

The DEC will also inform all relevant landholders and councils of any new distributional data and ensure that all relevant databases are updated within three months following the surveys, so that informed habitat management decisions can be made.

**Outcome:**

Surveys will assist in determining the full range and distribution of *Z. obcordata* and the data collected during these surveys will assist in providing a better understanding of habitat preferences and threats to the species.

**Agency responsible for implementation:**

Department of Environment and Conservation

## **12.2 Action 2 – Monitoring**

*Zieria obcordata* populations as well as individual plants will be monitored to determine population dynamics and the impacts of threatening processes and management regimes on the species. Base-line data will be collected and observational monitoring will be conducted annually to determine whether plants are reproducing (flowering, fruiting) as well as to determine survivorship, longevity, recruitment and any possible threats or causes of mortality within populations.

In addition, the impact of domestic stock and native herbivore grazing on plants will be regularly monitored to determine whether grazing is adversely affecting the species. Experimental monitoring plots may also be established and particular habitat management regimes applied including fire and physical disturbance (slashing or grading), in order to determine the responses of the species to such regimes. Monitoring will be conducted with the permission and assistance of all relevant landholders and results will be distributed on a regular basis to keep landholders informed of the outcomes.

**Outcome:**

Trends in mortality and recruitment over time will be better understood and any decline in population numbers will be detected. The experimental plots will assist in determining the response of the species to particular management regimes and in guiding future recovery efforts.

**Agency responsible for implementation:**

Department of Environment and Conservation

### 12.3 Action 3 – Weed Management

The Tree of Heaven (*Ailanthus altissima*) poses a potential threat to the Wellington population. Efforts to eradicate the species from the population have begun (see Section 9) but further follow-up work will be required to ensure that re-infestations do not occur. In addition, all *Z. obcordata* populations will be regularly monitored so that any future significant and potentially threatening infestations are detected and managed.

Weed management should be conducted in a sensitive manner to ensure that no *Z. obcordata* plants are inadvertently harmed or destroyed. All groups or individuals who plan to conduct weed management in and around *Z. obcordata* habitat should be trained in identification of the species and should plan to undertake works using the most appropriate methods that will have the least impact on *Z. obcordata*. Broad-scale weed spraying should be avoided in areas where *Z. obcordata* is known or likely to occur. Spot spraying or ‘cut and paint’ techniques are preferable herbicide application methods as they are less likely to affect non-target species, including *Z. obcordata*. Even if these methods are used, extreme caution should be undertaken to ensure that no *Z. obcordata* plants are inadvertently harmed or destroyed through overspraying, trampling or accidental removal.

#### **Outcome:**

The threat to the Wellington population of *Z. obcordata* from the exotic Tree of Heaven (*Ailanthus altissima*) will be eradicated and any future threat of weed invasion to any *Z. obcordata* population will be detected early and managed using the most appropriate and sensitive techniques.

#### **Agency responsible for implementation:**

Department of Environment and Conservation

### 12.4 Action 4 – Research

There has been limited study of the life history attributes of the genus *Zieria* (Armstrong 2002, Auld 2001). Further research is required particularly in the areas of population ecology and reproductive biology. Specific areas of research that are required for *Z. obcordata* include:

- determining factors that influence flowering;
- determining pollination vectors;
- understanding seed set and seed dispersal methods;
- determining the viability of seeds and soil seed bank dynamics including the period of time required to establish an adequate soil seed bank;
- investigating seedling survival and germination requirements (including the continuation of investigations by Mt Annan Botanic Gardens);
- determining plant longevity, mortality and recruitment rates;
- determining the susceptibility of the species to pathogens and pests;
- identifying habitat and resource requirements (eg. specific nutrients, amount of water required/drought tolerance, amount of shade/light and photoperiod, soil components, temperature and climatic variables, vegetation structure and composition);

- investigating possible competition for resources from other plant species and whether vegetation structure and density is a limiting factor in the regeneration of *Z. obcordata* at previously known sites.

The DEC will encourage the involvement of various research institutes, universities and Botanic Gardens in conducting this research. Some of the monitoring conducted under Action 2 will also assist in contributing to these research questions.

**Outcome:**

The overall knowledge and understanding of the species' ecology will be improved, which, in turn, will guide conservation and management actions and benefit the species in the long term. Specific outcomes will be an improved understanding of the reproductive biology of the species, knowledge of the susceptibility of *Z. obcordata* to disease, pests and competition or predation from other species and an improved understanding of the species habitat and resource requirements.

**Agency responsible for implementation:**

Department of Environment and Conservation

**12.5 Action 5 – Establish an Ex-situ Seed Bank**

*Z. obcordata* occurs in very low numbers and has a very restricted distribution, which places the species at a greater risk of extinction than if it was more widely distributed. It is therefore considered prudent to establish a viable and representative ex-situ seed bank as insurance against potential losses in the wild. Mt Annan Botanic Gardens will establish an ex-situ seed bank with seeds collected from both populations and any other extant populations that may be located. In order to establish a representative and viable ex-situ seed bank, at least several hundred viable seeds collected from as great a range of plants as possible would be required although several thousand seeds would be preferred (R. Johnstone, pers. comm.). The aim will be to establish a viable and representative ex-situ seed bank within five years of commencement of the Recovery Plan.

**Outcome:**

A representative and viable ex-situ seed bank will be established, which will assist in providing stock for possible future reintroduction of the species, should the species become extinct in the wild.

**Agency responsible for implementation:**

Department of Environment and Conservation

**12.6 Action 6 – Precautionary Management**

Since all currently known *Z. obcordata* populations occur entirely on private property, a precautionary approach to the management of these properties is crucial to the continued survival of the species. In particular, the management of domestic stock, fire, weeds and tracks in areas of known or potential habitat should be undertaken with extreme caution so as

not to adversely affect *Z. obcordata*. To assist landholders, land managers and determining authorities in planning management and development activities, maps showing the location of all known *Z. obcordata* sites will be provided to all relevant landholders, Wellington Council and Bathurst Regional Council, Country Energy, Central West Catchment Management Authority and the DEC Parks & Wildlife Division staff. In addition, the DEC will provide advice and training in the identification of *Z. obcordata*, to all relevant people to ensure that they can adequately locate and recognise the species during management activities, approval processes or site inspections.

Fire management should be conducted in accordance with the *Bushfire Environmental Assessment Code for NSW* (RFS 2006) hazard reduction guidelines for *Z. obcordata*. The code states that fire should be conducted no more than once every 10 years and no slashing, trittering or tree removal within 100m of known *Z. obcordata* plants should occur.

Road and track maintenance should avoid areas where *Z. obcordata* is known to occur. The maps will show the location and extent of roadside sites so that landholders and Country Energy staff are aware of these sites when planning track maintenance. In addition, the DEC will liaise with landholders and Country Energy staff to identify and resolve any issues that may arise regarding roadside maintenance and *Z. obcordata*.

Domestic stock and native herbivores continue to graze in some areas of *Z. obcordata* habitat and will not be restricted at this stage, although excessive grazing should be avoided where possible. The DEC will liaise with landholders to ensure that grazing is carefully monitored and any possible adverse affects are identified. Should it be determined that domestic stock and/or native herbivores are adversely affecting *Z. obcordata*, then they should be excluded from all affected sites. This may include the erection of fences around the populations and/or individual plants. Options to protect these populations will be discussed with the relevant landholders.

**Outcome:**

*Z. obcordata* will be protected from inappropriate management regimes that may threaten the species until such time as the species response to particular regimes is better understood.

**Agency responsible for implementation:**

Department of Environment and Conservation

## **12.7 Action 7 – Long Term Protection of Sites**

Although all present landholders are supportive of the protection of *Z. obcordata* on their properties, long-term protection of the populations should be sought in order to protect populations in the future, should ownership and/or land use of any properties change. The options of long term security of the sites will be discussed and encouraged with the relevant landholders. The DEC recognises that a range of options may be used to achieve protection of populations on private land and that the suitability of these options will depend on the circumstances and preferences of individual landholders.

Long-term protection may be achieved through Voluntary Conservation Agreements (VCAs). These are agreements between the Minister for the Environment and the property owners

about the management of a particular parcel of land or portion thereof. One advantage of a VCA is that the portion of land under the agreement receives an exemption from Council rates. Having a VCA may also assist in attracting funding for the management of the portion of land under the agreement. The DEC's Parks & Wildlife Division and Environment Protection and Regulation Division will work cooperatively in the negotiation of VCAs with any interested landholders. Alternatively, covenants may be placed on the properties to provide protective measures for the populations, as has been done with one site in Bathurst already (see Section 9.5). Both VCAs and covenants are placed on the title of the land and are therefore in force in perpetuity and are legally binding.

Future potential purchasers or developers should also be alerted to the presence of the species on a property and any VCA or covenant applying to that property with regard to the species. This may be achieved through the inclusion of the information on a Planning Certificate issued under the provisions of Section 149 of the *Environmental Planning and Assessment Act 1979*. The DEC will discuss with relevant councils the inclusion of the species on Section 149 Planning Certificates for the relevant properties and will advise Councils of any VCAs that are established on these properties.

**Outcome:**

Long term protection measures are established for *Z. obcordata* populations.

**Agency responsible for implementation:**

Department of Environment and Conservation

## **12.8 Action 8 – Landholder and Community Involvement**

It is important that landholders and the community be made aware of the significance of threatened species and their habitats and their role in the maintenance of biodiversity. The DEC has liaised and will continue to liaise with relevant landholders and other interested individuals regarding the conservation and management of *Z. obcordata* on their properties. An information leaflet for *Z. obcordata* has already been designed and distributed to landholders and will be more widely distributed to the general community and other stakeholders to raise public awareness of the species across its range. Should any further *Z. obcordata* populations be located, the DEC will liaise with the landholders to determine appropriate management and conservation of the populations. Furthermore, all relevant landholders will be consulted on all aspects of the management and monitoring of the species on their properties.

**Outcome:**

Community awareness of and support for the conservation and protection of *Z. obcordata* will be enhanced and interested landholders and individuals will be involved in the conservation of the populations on their properties and in the decision making regarding the species.

**Agency responsible for implementation:**

Department of Environment and Conservation

## **12.9 Action 9 - Recovery Plan Coordination**

Effective coordination of this plan is essential to ensure its implementation is conducted in a timely, cost-effective and efficient manner. Coordination of this plan will involve liaison with other recovery programs to ensure that actions do not adversely impact upon other threatened species. Coordination will also involve effective liaison with relevant government agencies, including the Australian Government Department of the Environment, Water, Heritage and the Arts as well as botanical experts, landholders and other stakeholders.

### **Outcome:**

The Recovery Plan will be implemented in an efficient and coordinated manner to achieve the stated objectives.

### **Agency responsible for implementation:**

Department of Environment and Conservation

## **13 Alternative Management Strategies**

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### **13.1 No Management Action Taken**

An alternative strategy for the management of *Z. obcordata* is to undertake no management action for the species. This species is endemic to NSW, has extremely low population numbers and a very restricted distribution and is listed both statewide and nationally as endangered. In addition, no currently known *Z. obcordata* populations occur within a conservation reserve. If no management action is undertaken to protect this species, it is possible that the species will become extinct. Therefore, no management action is considered not to be an appropriate strategy.

### **13.2 Establish an Ex-situ Population**

In order to provide insurance against the loss of *Z. obcordata* in the wild, this Recovery Plan aims to undertake ex-situ conservation of the species. The establishment of an ex-situ population could be attempted. However, the difficulties in the past of maintaining an ex-situ population of *Z. obcordata* suggest that these attempts would probably be unsuccessful. Therefore the establishment of an ex-situ population is not considered appropriate. An ex-situ seed bank has been proposed instead.

### **13.3 Nomination of Critical Habitat**

The nomination of Critical Habitat for *Z. obcordata* would provide additional protection for the species by protecting habitat that is critical for its survival. This Recovery Plan identifies habitat features of the locations where *Z. obcordata* is currently known and previously occurred. However, it is not clear which, if any, of these features are decisive in allowing or constraining the long term dispersal, distribution, establishment and persistence of *Z. obcordata*. Accordingly, identification and nomination of Critical Habitat for *Z. obcordata* are considered inappropriate at this stage and are not proposed as recovery actions in this Recovery Plan.



## **14 Preparation Details**

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This Recovery Plan was prepared by Melanie Bannerman, Threatened Species Officer of the Department of Environment and Conservation. Establishment of a Recovery Team for this species was not considered to be a priority or an efficient use of resources. However a number of botanical experts and authorities were consulted during the preparation of the plan. These included Geoff Robertson and John Briggs of the DEC, Darren Shelly of the Department of Natural Resources, Richard Johnston at Mt Annan Botanic Gardens and a number of other staff of the Royal Botanic Gardens, Sydney and the Australian National Botanic Gardens, Canberra. Lesley Forward of the DEC prepared an early version of the plan, amendments were made to the draft by Geoff Robertson, Matt Cameron and Peter Christie of the DEC and an initial review of the biology and ecology of the species was prepared by David Mackay and Caroline Gross.

### **14.1 Date of last Amendment**

No amendments have been made to date.

### **14.2 Review Date**

This Recovery Plan and the conservation status of *Zieria obcordata* will be reviewed by the DEC within five years of the date of publication. In evaluating the success or otherwise of the Recovery Plan, the DEC will liaise with other relevant stakeholders including the Australian Government Department of the Environment, Water, Heritage and the Arts, Wellington Council and Bathurst Regional Council, Central West CMA, Country Energy, relevant botanical experts and interested stakeholders and the landholders of the properties where *Z. obcordata* occurs.



**Table 2: Costing Table**

Action No:	Description	Priority	Estimated Cost/yr					Total Cost	Responsible party/funding source	In-kind	Cash
			Year 1	Year 2	Year 3	Year 4	Year 5				
12.1	Survey and Data Collection	1	\$10,000					<b>\$10,000</b>	DEC		<b>\$10,000</b>
	Data Analysis	1	\$5,000					<b>\$5,000</b>	DEC		<b>\$5,000</b>
12.2	Monitoring:										
	i. collect baseline data	1	\$3,300					<b>\$3,300</b>	DEC	<b>\$3,300</b>	
	ii. ongoing monitoring	1		\$1,500	\$1,500	\$1,500	\$1,500	<b>\$6,000</b>	DEC	<b>\$6,000</b>	
	iii. experimental plots	2		\$7,800				<b>\$7,800</b>	DEC	<b>\$1,800</b>	<b>\$6,000</b>
12.3	Weed Management	2		\$2,800		\$2,800		<b>\$5,600</b>	DEC	<b>\$600</b>	<b>\$5,000</b>
12.4	Research	1		\$5,000	\$5,000	\$5,000	\$5,000	<b>\$20,000</b>	DEC	<b>\$10,000</b>	<b>\$10,000</b>
12.5	Ex-situ Conservation:										
	i. seed collection	1		\$3,600				<b>\$3,600</b>	DEC	<b>\$3,600</b>	
	ii. storage	1		\$1,500	\$1,500	\$1,500	\$1,500	<b>\$6,000</b>	DEC	<b>\$6,000</b>	
12.6	Precautionary Management:										
	i. maps & ID training	2	\$1,300					<b>\$1,300</b>	DEC	<b>\$900</b>	<b>\$400</b>
	ii. fire management	2	Ψ	Ψ	Ψ	Ψ	Ψ	<b>Ψ</b>	DEC	<b>Ψ</b>	
	iii. track maintenance	1	Ψ	Ψ	Ψ	Ψ	Ψ	<b>Ψ</b>	DEC	<b>Ψ</b>	
	iv. grazing management	2	Ψ	Ψ	Ψ	^\$2,000	^\$2,000	<b>^\$4,000</b>	DEC		<b>^\$4,000</b>
12.7	Long Term Protection:										
	i. discuss with landholders	1	Ψ	Ψ	Ψ	Ψ	Ψ	<b>Ψ</b>	DEC	<b>Ψ</b>	
	ii. negotiate VCAs if req'd	1			^\$3,000	^\$3,000		<b>^\$6,000</b>	DEC	<b>^\$6,000</b>	
	iii. discuss with Councils	2	Ψ	\$300	Ψ	Ψ	Ψ	<b>\$300</b>	DEC	<b>\$300</b>	
12.8	Landholder Involvement										
	i. update & distribute leaflet	2	\$1,800					<b>\$1,800</b>	DEC	<b>\$300</b>	<b>\$1,500</b>
	ii. liaise with landholders	1		\$300	\$300	\$300	\$300	<b>\$1,200</b>	DEC	<b>\$1,200</b>	
12.9	Recovery Plan Coordination	2	\$300	\$300	\$300	\$300	\$1,800	<b>\$3,000</b>	DEC	<b>\$3,000</b>	
<b>Total</b>			\$21,700	\$23,100	\$11,600	\$16,400	\$12,100	<b>\$84,900</b>		<b>\$43,000</b>	<b>\$41,900</b>

Priority ratings are: 1- Action critical to meeting plan objectives, 2- Action contributing to meeting plan objectives.

'In-Kind' Funds represent salary component of permanent staff and current resources.

'Cash' Funds represent the salary component for temporary staff and other costs such as the purchasing of survey and laboratory equipment.

^ Funds only required if investigation identifies a threat from browsing.

Ψ No direct cost as action is liaison.

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- Armstrong, J.A. 1991b. *Studies on pollination and systematics in the Australian Rutaceae*. Unpublished PhD thesis. University of New South Wales.
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- Mackay, D. and Gross, C.L. 2000. *A review of the biology and ecology of Zieria obcordata* Cunn., *Homoranthus darwinioides* (Maiden & E. Bêche) Cheel, *Lepidium monoplocoides* F. Muell. and *Austrostipa wakoolica* (Vickery, S.W.L. Jacobs & J. Everett) S.W.L. Jacobs & J. Everett. Unpublished report to NSW National Parks and Wildlife Service.

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### THREATENED SPECIES INFORMATION

# *Zieria obcordata* Cunn.

#### Conservation status

*Zieria obcordata* is listed as an **endangered species** on Schedule 1 of the New South Wales *Threatened Species Conservation Act 1995* (TSC Act). It is also listed as **endangered** on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

#### Description

*Z. obcordata* (Rutaceae) is a multi-stemmed, rounded perennial shrub up to 0.5m in height, sometimes tending towards a prostrate or sprawling habit. Being of the Rutaceae family, the species is distinctively aromatic. The plant has generally hairy branches. Leaves are small, opposite, hairy and comprised of three leaflets with the upper surfaces covered in numerous small warts. The central leaflet is 3-10mm long, 1.3-5.0mm wide, flattish with an obcordate, two-lobed, heart-shaped apex from which the species gets its name. Secondary leaflets are similar but only two-thirds the size. The leaf petiole is 1.5-3.0mm long. Inflorescences are shorter than the leaves. The stalk is hairy. Flowers are 5-6mm across with tiny white or pale pink petals. Flowers are arranged singly or in small clusters in the leaf axils. Sepals are triangular, hairy and approximately 1mm long. The fruit is a hairy capsule 5mm across, which is deeply divided into four chambers. Each of the chambers contains one or rarely two elliptical seeds about 2mm long (Armstrong, 1991; Briggs and Leigh, 1990).

#### Distribution

*Z. obcordata* is endemic to NSW and has a disjunct distribution. The species occurs in four small populations around Bathurst and Wellington, in the Evans and Wellington Local Government Areas. All populations exist on private land. These populations occur within the Central West Catchment Management Board area.

#### Recorded occurrences in conservation reserves

*Z. obcordata* has not been recorded within any conservation reserves.



*Zieria obcordata* plant  
G. Robertson



*Zieria obcordata* habitat  
G. Robertson

#### Habitat

*Z. obcordata* occurs on gentle to moderately steep, west to north facing slopes of low hills and ridges, between the altitudes of 500 and 830m ASL. All sites are characterised by

granite outcrops and the plants commonly occur around the base of the granite boulders, in crevices between the boulders or nearby. The species occurs in a variety of

vegetation types that can be broadly described as Eucalyptus-Callitris woodlands with open, low shrub Acacia understoreys (Briggs and Leigh, 1990). These habitats are commonly grazed by domestic stock and native herbivores.

### Ecology

*Z. obcordata* is known to flower in spring (Sept – Oct) (Armstrong, 1991; Briggs and Leigh, 1990), although a single plant near Bathurst has been observed flowering as early as August. Specimens with fruit have been collected from September to November, indicating that the fruiting period for this species occurs throughout spring (Mackay & Gross, 2000). Very little is known about the ecology and reproductive biology of the species except that the species possesses functional pollen and is genetically self-incompatible, thus requiring pollen from other individuals to set seed. No formal studies have been conducted on pollination in this species. However, native bees and flies have been observed on *Z. obcordata* plants, suggesting that these may be pollinators. Longevity of the species is unknown, although specimens held in the Australian National Botanic Gardens, Canberra have survived for 10 – 14 years and possibly 24 years for one specimen.

### Threats

There are no Key Threatening Processes that are relevant to *Z. obcordata*.

#### For further information or to report any new sightings of *Z. obcordata* contact:

NSW National Parks and Wildlife Service Western Directorate Threatened Species Unit, PO Box 2111, Dubbo NSW 2830 or telephone 6883 5342.

### References

- Armstrong, J.A. (1991) *Zieria*. In, Harden, G.J. (ed.) *Flora of New South Wales. Volume 2*. New South Wales University Press, Sydney.
- Briggs, J.D. and Leigh, J.H. (1990) *Delineation of Important Habitats of Threatened Plant Species in South-eastern New South Wales*. Research report to the Australian Heritage Commission. CSIRO, Canberra.
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Other threats to *Z. obcordata* however include:

- heavy browsing by domestic stock and possibly native herbivores;
- broad scale or targeted clearing of native vegetation;
- adverse impacts from development activities, including physical disturbance, introduction of weeds, invertebrate pests or pathogens, runoff or altered water regimes, drift or direct application of pesticides; and
- weed invasion.

Further loss of individual plants is likely to impact on the fecundity and genetic integrity of populations of *Z. obcordata* and ultimately their long-term viability, due to reduced population numbers and opportunities for successful recruitment.

### Management

Management of *Z. obcordata* should attempt to:

- protect populations and minimise habitat loss and/or degradation from direct or indirect human disturbance;
- protect populations from browsing pressure; and
- control the invasion of weeds.

### Recovery Plans

A Recovery Plan is currently being prepared for *Zieria obcordata*.

#### IMPORTANT DISCLAIMER

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## ADDENDUM

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### *Zieria obcordata* Recovery Plan

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

#### **Recovery Actions**

Action 4 – Research is amended by adding to the list of specific areas of research that are required for *Z. obcordata*

- determining grazing impacts on the species (including through enclosure studies in grazed areas)

and

- determining the response of the species to fire



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