Threatened Alpine Karst Flora

Sagina diemensis and Oreoporanthera petalifera

Flora Recovery Plan 2006 - 2010

Australian Government

Tasmania

ACKNOWLEDGMENTS

This Plan was prepared by Leanne Sherriff with advice from Wendy Potts (TSS, DPIW), Jon Marsden-Smedley (Fire Management Section, PWS), Eve Lazarus (TSS, DPIW), Louise Gilfedder (Non-Forest Vegetation Program, DPIW), Jayne Balmer (Vegetation Section, DPIW), Paul Black (TSS, DPIW), Justine Shaw (TSS, DPIW), Richard Schahinger (TSS, DPIW), Ian Houshold (Earth Sciences Section, DPIW), Phil Wyatt (Track Management Team, PWS) and Alex Buchanan (Tasmanian Herbarium). Edited by Wendy Potts, Eve Lazarus, and Justine Shaw (TSS). Cover produced by Gina Donelly (Graphic Services, ILS, DPIW). The Plan draws from the *Oreoporanthera petalifera* and *Sagina diemensis* draft listing statements and note sheets (Threatened Species Unit 2003). This Plan was prepared with support from the Australian Government Department of the Environment and Heritage.

Cover photo *Oreoporanthera petalifera* by Paul Black.

Citation: Threatened Species Section (2006). *Flora Recovery Plan: Threatened Alpine Karst Flora:* Oreoporanthera petalifera *and* Sagina diemensis *2006-2010.* Department of Primary Industries and Water, Hobart.

ISBN: 0 7246 6352 5

Abbreviations

DPIW	Tasmanian Department of Primary Industries and Water (formerly DPIWE - Department of Primary Industries, Water and Environment)
DTAE	Tasmanian Department of Tourism, Arts and Environment
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
NRM region	Natural Resource Management Region
PWS	Tasmanian Parks and Wildlife Service, DTAE
SAC	Scientific Advisory Committee
TSP Act	Tasmanian *Threatened Species Protection Act 1995*
TSS	Threatened Species Section, DPIW (formerly TSU - Threatened Species Unit)
RTBG	Royal Tasmanian Botanical Gardens
WHA	World Heritage Area

Taxonomy follows Buchanan (2005) except where otherwise noted.

The listing status of all threatened species referred to in this recovery plan were correct at the time of publication.

CONTENTS

SUMMARY

Current Species Status

The alpine karst plant community contains two threatened species, *Oreoporanthera petalifera* and *Sagina diemensis.*

Oreoporanthera petalifera

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* ..... Vulnerable
Tasmanian *Threatened Species Protection Act 1995* ..... rare

Oreoporanthera petalifera Orch. & J. Davies (1985), commonly known as hill oreoporanthera, is endemic to Tasmania. The species is known from only one population along the North East Ridge of Mt Anne within the Southwest National Park, part of the Tasmanian Wilderness World Heritage Area. The species is at risk from climate change, fire and stochastic events.

Sagina diemensis

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* ..... Critically Endangered
Tasmanian *Threatened Species Protection Act 1995* ..... endangered

Sagina diemensis L.G. Adams (1996), commonly known as pearlwort, is endemic to Tasmania and is known only from two small populations, both of which are located in the Southwest National Park.. One population co-occurs with *Oreoporanthera petalifera* on the North East Ridge of Mt Anne. The other population is located eight kilometres from the Mt Anne population beside the Weld River. *Sagina diemensis* is at risk from climate change, fire, trampling and stochastic events.

Habitat Requirements, Threats and Limiting Factors

Both species are known to occur only in dolomite areas. *Oreoporanthera petalifera* occurs only in high altitude, subalpine karst communities, while *Sagina diemensis* has been found co-occurring with *Oreoporanthera petalifera*, and also at a lower altitude site. Species known only from one or two small sites are vulnerable to extinction through stochastic events. Trampling by recreational users of the National Park may impact on both species, and potentially eliminate the Weld River population of *Sagina diemensis*.

Given the limited range of these species compared with the suitable habitat they could potentially inhabit, it is likely that they may occur as relict populations already impacted on by the effects of the changing global climate, and possibly by increased fire regimes resulting from human disturbance. The trend towards a warmer drier climate may therefore further threaten these species. Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases is listed as a key threatening process on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Overall Recovery Objective

To prevent *Oreoporanthera petalifera* and *Sagina diemensis* from declining further and/or becoming extinct, and to address threats to the populations of these species. This will require protecting, maintaining and monitoring known populations, establishing *ex situ* holdings and surveying suitable habitat for new populations.

Specific Objectives

1. Resurvey and protect the two populations of *Sagina diemensis* and the single known population of *Oreoporanthera petalifera.*

2. Maintain or increase the numbers, *in situ,* of both species.

3. Locate new populations of both species through survey work.

4. Establish representative *ex situ* holdings of both species.

Performance Criteria

1. Over the duration of the plan, no decline in the area occupied by known populations.

2. Surveys of potential habitat, identified by current vegetation and geological mapping projects, for new populations to be completed by end of year 2.

3. Specimens of each species (from all known populations) to be lodged with the Tasmanian Herbarium by the end of year 2.

4. By the end of year 3 establishment of *ex situ* stock plants of *Oreoporanthera petalifera* and *Sagina diemensis* at the RTBG. The stock plants should be propagated vegetatively and/or from seed from at least 10 plants per population, sampled from across the area occupied by each population.

5. Increase the level of seedling recruitment of both species following application of altered soil disturbance levels or other regimes as determined by monitoring.

6. Determine from monitoring programs the threat posed by trampling to either species by the end of year 1. If it emerges from this work that trampling is a serious threat to the survival of either species then a defined walking track, with suitable erosion controls should be established to minimize damage to fragile or at risk areas along North East Ridge.

7. Follow the guidelines for fuel reduction burning in the Sandfly Creek buttongrass moorland as described in Parks and Wildlife Service (2004), and ensure that Southwest National Park and the WHA are maintained as fuel stove only areas.

8. Establishment of a Recovery Team when funding is procured to implement this plan or parts thereof.

9. Update listing statement and spatial and population data as required and circulate this information to the wider botanical community and general public in the appropriate form i.e., update TSS databases and DPIW's Natural Values Atlas, circulate updated information to the Tasmanian Flora Network and update the DPIW threatened species website as necessary, provide data to relevant State and Commonwealth agencies, and include threatened species sites on LIST (Land Information Systems Tasmania).

10. Annual requests made to volunteer networks (e.g., Wildcare, Threatened Species Network) to encourage active involvement in the Recovery process.

11. Maintenance of the TSS database (ie: new populations, population decline and threshold conditions) to trigger management intervention.

12. Update the Recovery Plan by the end of year 5 or when new information becomes available.

Actions Needed

1. Verify that known populations are extant, and conduct a census of populations.
2. Determine the effect of trampling on population size, and if necessary protect populations.
3. Monitoring for improved understanding of population dynamics and threats, habitat management and seedling recruitment.
4. Survey for new populations.
5. Establish a representative *ex situ* holdings of both species at the RTBG.
6. Establish a mechanism with community input to ensure ongoing long-term management and intervention when required.

Estimated Cost of Recovery

Actions	Cost estimate	Timeframe	NRM region
1. Survey and census of known populations	$20,000	year 1– year 2	South
2. Protect populations	$20,000	year 1– year 5	South
3. Monitoring	$8,000	year 1– year 3	South
4. Survey for new populations	$10,000	year 1– year 3	South
5. Establishment of *ex situ* holdings	$10,000	year 1– year 4	South
6. Long-term management	$13,000	year 1– year 5	Statewide
Total	**$81,000**		

BACKGROUND INFORMATION

Oreoporanthera petalifera

Description

Oreoporanthera petalifera is a spreading, perennial herb with annual stems that die back to a slightly woody base in winter. The stems are 20–30 cm long and about 1 mm in diameter. Leaves are opposite, lance-shaped, subglossy above, 6–7 mm long by 1–1.7 mm wide, with the leaf margins recurved almost to the midrib. Plants are dioecious, with unisexual flowers borne singly in the axils of the upper leaves. The five sepals are greenish-white, oblong, and 1.6–2.2 mm long, while the five white to hyaline petals are lanceolate and up to 0.6 mm long. The fruit is globular, 1.2 by 2 mm, 6-seeded, dehiscing explosively; seeds are pale orange-brown and smooth (Orchard & Davies 1985).

Taxonomic Status

Oreoporanthera petalifera belongs to the family Euphorbiaceae (Buchanan 2005). Until the discovery of *Oreoporanthera petalifera* in Tasmania in 1985 the genus *Oreoporanthera* was thought to be endemic to New Zealand; *Oreoporanthera alpina* is found in subalpine communities on mountains between 1000 and 1800 m in altitude in the northwestern corner of the South Island.

Distribution and Habitat

Oreoporanthera petalifera is endemic to southwestern Tasmania. The species is known only from the dolomite ridge that runs north and north east of Mt Anne in the Southwest National Park, where it has been described as being locally abundant (Orchard & Davies 1985). *Oreoporanthera petalifera* occurs most commonly in the altitude range 950–1060 m, though plants have been recorded as low as 680 m above sea level. The annual rainfall of the area is c. 1750 mm. The known linear range of the species is about 2 km, the extent of occurrence 2.2 km^2, and the area of occupancy c. 5–10 ha.

Oreoporanthera petalifera occurs in two habitats within its alpine karst environment at Mt Anne. The first is associated with cracks and crevices in exposed dolomite outcrops within low shrubberies; component species may include *Richea scoparia*, *Persoonia gunnii*, *Richea sprengelioides*, *Agastachys odorata*, *Lomatia polymorpha*, *Tasmannia lanceolata* and the Liliaceous *Astelia alpina* (pineapple grass). *Oreoporanthera petalifera* grows in shallow well-drained soils derived from solution pockets in the dolomite; soils are stony, medium to fine grained, light-grey clayey sand with organic fragments, and are slightly to moderately alkaline (pH 7.4). The species may spread over rocks and adjacent plants, forming mats up to 20 or 30 cm in diameter, and typically occupies less than 1% of any given rock outcrop (unpublished data, Threatened Species Section, DPIW).

The second habitat is associated with overhanging rocks and the mossy, shaded walls of sinkholes; here *Oreoporanthera petalifera* exhibits an etiolated form and soils may be in excess of 20 cm (Gilfedder 1989). The grass *Poa labillardierei* generally dominates the vegetation in such situations. Associated species may include the grasses *Poa gunnii*, *Poa hiemata* and *Rytidosperma fortunae-hibernae*, the sedges *Carpha alpina* and *Carex archeri*, the herbs *Oreomyrrhis gunnii*, *Senecio pectinatus* var. *pectinatus* and *Dichosciadium ranunculaceum*, and the ferns *Cystopteris tasmanica*, *Grammitis poeppigiana* and *Asplenium trichomanes* subsp. *quadrivalens* (Gilfedder 1989).

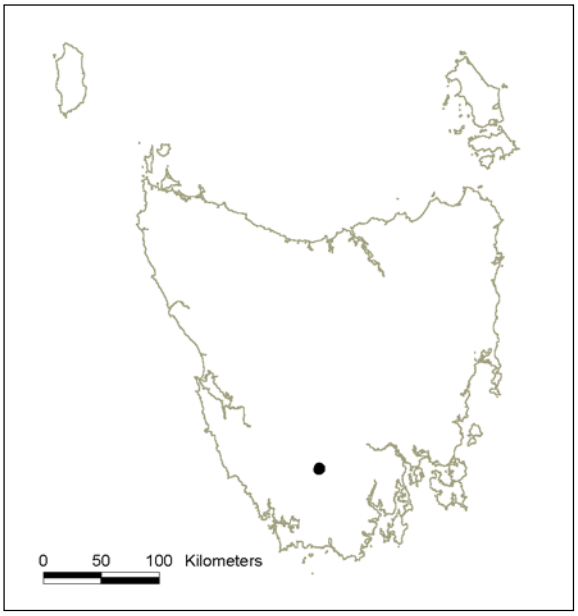

Figure 1. Distribution of *Oreoporanthera petalifera* in Tasmania.

Population Estimate

A number of targeted searches for *Oreoporanthera petalifera* have been undertaken in Tasmania's Southwest since the species was described in 1985, the focus being limestone or dolomite outcrops at altitudes above 600 m. Gilfedder (1989) has reported the results of surveys in the following areas: Mt Ronald Cross, Tim Shea, Mt Gell and Mt Bobs, as well as Weld Arch along the Weld River. DPIW personnel conducted subsequent extension surveys along the North East Ridge of Mt Anne in November 2003, and also in January and March 2005 (unpublished data held by the Threatened Species Section, DPIW). The 2005 surveys recorded c. 2,000 patches, the majority with an area of less than 100 cm^2; each patch may contain one to many plants.

Given the level of past survey efforts and the species' specialised habitat, the likelihood of *Oreoporanthera petalifera* populations being discovered outside the known area of suitable habitat at Mt Anne is considered to be low. However, the area of occupancy and the population size cited above should be considered as approximate only, as about half the species' suitable habitat remains to be surveyed; the total number of patches is considered likely to be c. 5,000.

Location Tenure	**NRM**	**1:25,000 mapsheet**	**Year last seen**	**Area occupied (ha)**	**Number of plants***	**Specific threats**
North East Ridge, Mt Anne Southwest National Park	South	Anne	2005	5–10	5,000+	Climate change; fire; trampling; stochastic events.

(* refers to the number of patches: each patch may contain more than 1 plant)

Life History and Ecology

Oreoporanthera petalifera flowers from December to February, while fruit has been seen in June (Orchard & Davies 1985). The species has been observed to reproduce vegetatively via runners rooting at the nodes, but otherwise little is known of its reproductive biology. It is likely that *Oreoporanthera petalifera* is a fire-sensitive species, having evolved in a high altitude environment that is relatively free from fire (Gilfedder 1989).

Sagina diemensis

Description

Sagina diemensis is a cushion-forming perennial herb that is covered with glandular, oily hairs. It has a permanent non-flowering leaf rosette that arises from a woody base. Trailing, flexible stems up to 10 cm long arise from the base. The stems may form roots where they touch the ground. The leaves are slightly fleshy, stalkless, and linear with a pointed tip that can be short and sharp. They are between 2 to 25 mm long and are usually covered with glandular hairs that are oily and rough to the touch. The leaf margins are narrow, thin, dry and translucent (Adams 1996).

The small flowers (up to 10 mm) have four white petals, and are surrounded by leaf-like sepals that are tinged purple on the outside as the buds open. The stamens are very prominent. The fruit is an oval capsule between 2.5 to 2.75 mm long. The seeds are kidney-shaped, dark reddish-brown, and approximately 6 mm long.

Sagina diemensis is readily distinguished from other *Sagina* species by its persistent basal leaf-rosette, its usually strongly glandular-hairy foliage and inflorescence, the saccate base of the sepals, and the relatively conspicuous white corolla (Adams 1996).

Taxonomic Status

Sagina diemensis was first collected in Tasmania in 1982 and formally described more than a decade later (Adams 1996). It belongs to the family Caryophyllaceae. Four other species of *Sagina* are found in Tasmania, three of which are introduced (Buchanan 2005). None of the introduced *Sagina* species are found in the same area as *Sagina diemensis* (Buchanan 2006, pers. comm.), while the native *Sagina namadgi* is found mainly in coastal areas.

Distribution and Habitat

Sagina diemensis is endemic to southwestern Tasmania (Adams 1996). It is known only from the North East Ridge at Mt Anne and the headwaters of the Weld River in the Southwest National Park (part of the Tasmanian Wilderness World Heritage Area). The linear range of the species is 9 km.

At the North East Ridge at Mt Anne *Sagina diemensis* grows within cracks and crevices in exposed dolomite outcrops, along with species such as *Austrodanthonia diemenica*, *Oreomyrrhis gunnii* and *Oreoporanthera petalifera* (Adams 1996). The species grows in shallow well-drained soils derived from solution pockets in the dolomite; soils are stony, medium to fine grained, light-grey clayey sand with organic fragments, and are slightly to moderately alkaline (pH 7.4) (unpublished data, Threatened Species Section, DPIWE). The recorded altitude range is 970–1050 m. Surrounding low subalpine shrubberies contain species like *Richea scoparia*, *Persoonia gunnii*, *Richea sprengelioides*, *Agastachys odorata*, *Lomatia polymorpha*, *Tasmannia lanceolata* and *Astelia alpina*.

At Weld River *Sagina diemensis* has been recorded from sparsely vegetated dolomite rock ledges above the flood zone. Associated species include *Galium australe*, *Senecio leptocarpus*, *Australina pusilla*, *Carex brevifolius*, *Cardamine* sp. and *Poa* sp. (Balmer & Lambourne 2005). Soils are only a few millimetres thick. Nearby slopes are densely vegetated with thick carpets of mosses, ferns and rainforest. The altitude is 340 m asl. Both areas are subject to an annual rainfall of c. 1750 mm.

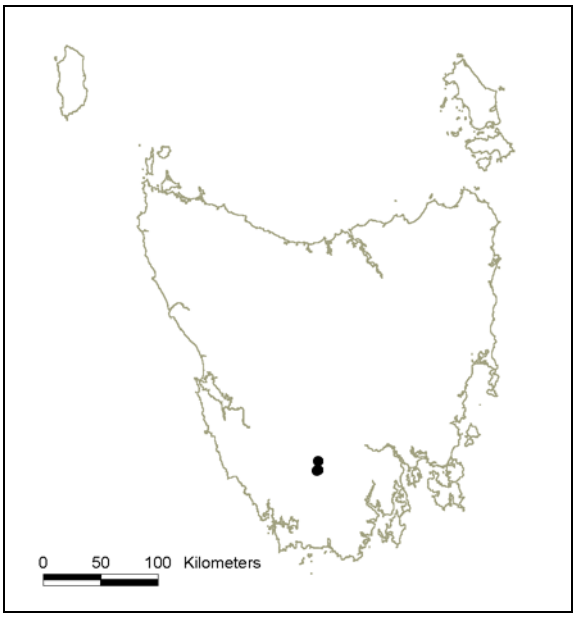

Figure 2. Distribution of *Sagina diemensis* in Tasmania.

Population Estimate

A number of targeted searches for *Sagina diemensis* have been undertaken in Tasmania's Southwest since the taxon was first collected in 1982 (Gilfedder 1989), the focus being limestone or dolomite outcrops at altitudes above 600 m (viz., North East Ridge of Mt Anne, Mt Ronald Cross, Tim Shea, Mt Gell and Mt Bobs). DPIW personnel conducted detailed extension surveys of about half the available habitat at Mt Anne in 2005, as well as the known site along the Weld River (Balmer & Lambourne 2005; unpublished data, Threatened Species Section, DPIW). These surveys recorded 24 mature plants at Mt Anne over a linear distance of 1 km, while 10 mature and c. 90 immature plants were recorded from two sites about 10 m apart at Weld River.

Past survey efforts for the species have been limited by the remoteness and restricted nature of potential dolomite habitat in Tasmania's southwest, as well as the diminutive nature of the species. About half the species' suitable habitat at Mt Anne remains to be surveyed, while several areas of potential habit outside the species' known extent of occurrence have yet to be surveyed (Balmer & Lambourne 2005). The likelihood of additional subpopulations being found is considered to be reasonable, given a well-resourced and targeted survey effort. Based on the area of unsurveyed suitable habitat at Mt Anne, the total number of mature individuals at that site alone is likely to be at least 50 - 100.

	Location Tenure	**NRM**	**1:25 000 mapsheet**	**Year last and (first) seen**	**Area Occupied (ha)**	**Number of plants**	**Specific threats**
1	**North East Ridge, Mt Anne** Southwest National Park	South	Anne	2005 (1982)	< 0.1	24	Climate change; fire; trampling; stochastic events.
2	**Weld River Arch** Southwest National Park	South	Bowes	2005 (1988)	0.0001	c. 10	Trampling; stochastic events.

Life History and Ecology

Sagina diemensis flowers from January to March (Adams 1996). No other information on the reproductive biology of this species is known. Plants have been observed fruiting, but the levels and requirements for the recruitment of seedlings are unknown.

It is likely that *Sagina diemensis* is a fire-sensitive species, having evolved in a high altitude environment that is relatively free from fire (Gilfedder 1989).

Threats, Limiting Factors and Management Issues

Having only one large or two small populations means that both *Oreoporanthera petalifera* and *Sagina diemensis* are extremely vulnerable to extinction through chance events (this is known as stochastic risk). Any local event, such as wildfire, flood or landslip, may effect an entire population. Therefore all the threats to both *Sagina diemensis* and *Oreoporanthera petalifera* could potentially result in their extinction. Both *Oreoporanthera petalifera* and *Sagina diemensis* are also at risk from climate change.

Wildfire in dry periods is considered to pose the biggest threat to the unique plant communities of the North East Ridge of Mt. Anne. It is likely that both *Oreoporanthera petalifera* and *Sagina diemensis* are fire sensitive species, having evolved in a high altitude environment that is relatively free from fire. Their ability to re-establish after fire is unknown. Many threatened plants and communities, including *Oreoporanthera petalifera* and *Sagina diemensis*, could be eliminated from the Mt Anne area by the effects of a single wildfire.

A route has been marked by caving parties along the complete length of the North East Ridge of Mt. Anne. The current condition of the track indicates it receives a small amount of use compared to other tracks on the Mt Anne massif. Trampling in those sections of the track where the route follows the rocky crest of the dolomite ridge may eliminate a small amount of *Oreoporanthera petalifera*. However, the population size is considerable and therefore, it is unlikely that the entire population would be threatened by the trampling associated with recreational visitors unless the visitation rate increases substantially. One plant of *Sagina diemensis* could be eliminated by the effects of trampling as it resides in the middle of a ridgeline where one would naturally walk. The majority of the other plants are protected in cracks within the dolomite outcrops that are difficult for people to walk on or near.

Sagina diemensis plants at the Weld River Arch are in areas that may be subjected to walker trampling, although the presence of plants in good condition suggests that they have survived trampling impacts to date (Balmer & Lambourne 2005). Most plants observed in 2005 were immature, perhaps reflecting a high mortality rate and low survivorship. Visitor numbers to the Weld River Arch fluctuate but are, at least in recent years, quite low (between 8 and 51) (Balmer & Lambourne 2005).

The small size of the *Oreoporanthera petalifera* and *Sagina diemensis* populations means that both species are vulnerable to extinction through stochastic events.

In order to develop future recovery strategies, investigations into the ecology, life history and recruitment triggers of these threatened plants are vital to determine the species' population biology. In addition, successful *in situ* conservation will be based on understanding more about the alpine karst ecosystem and the response of the species to environmental processes.

Reservation Status

The only known population of *Oreoporanthera petalifera* and both known populations of *Sagina diemensis* are wholly reserved within the Southwest National Park, part of the Tasmanian Wilderness World Heritage Area (Parks and Wildlife Service 1999).

Reasons for Listing and Critical Habitat

Oreoporanthera petalifera

Oreoporanthera petalifera is currently listed as rare on the Tasmanian *Threatened Species Protection Act 1995*. The species may, however, qualify for listing as vulnerable at the State level using the guidelines for the listing of species (SAC 1995):

Rule B1. The area of occupancy estimated to be less than 2000 km^2 and 1) the species is known from less than 10 locations and 2) there is a continuing decline projected in the area, extent and/or quality of habitat.

A continuing decline is projected from climate change and fire risk.

Oreoporanthera petalifera is currently listed as Vulnerable on the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.

Sagina diemensis

Sagina diemensis is listed as endangered at the State level using the guidelines for the listing of species on the Tasmanian *Threatened Species Protection Act 1995* (SAC 1995):

Rule B. The extent of occurrence is estimated to be less than 5000 km^2, or area of occupancy estimated to be less than 500 km^2 and 1) it is known from less than 5 locations and 2) there is a continuing decline observed, inferred or projected in the (a) extent of occurrence, (b) area of occupancy and (c) area, extent and/or quality of habitat.

A continuing decline is inferred from climate change and fire risk.

Rule C. The total population size is estimated to number fewer than 2,500 mature individuals and 2) a continuing decline is observed, inferred or projected in numbers of mature individuals and population structure as (a) no population is estimated to contain more than 250 mature individuals.

Rule D. The total population size is estimated to number fewer than 250 mature individuals.

Sagina diemensis is listed as Critically Endangered on the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.

Sagina diemensis meets the following IUCN Red List guidelines (IUCN 2001):

Rule C. The total population size is estimated to number fewer than 250 mature individuals and 2) a continuing decline is observed, inferred or projected in numbers of mature individuals and (a) population structure as (i) no sub-population is estimated to contain more than 50 mature individuals.

A continuing decline is inferred from climate change and fire risk.

Habitat considered critical to the survival of both these species comprises the high altitude dolomite-karst community of North East Ridge, and also at the Weld Arch on Weld River for *Sagina diemensis*. Neither species has been located from other high altitude karst communities in southwestern Tasmania. However these areas may still be important for the survival of these species, and for the continued survival of alpine karst communities.

Existing Conservation Measures

The population of *Oreoporanthera petalifera* and both populations of *Sagina diemensis* are reserved within Southwest National Park, part of the Tasmanian Wilderness World Heritage Area. Permanent plots were established by DPIW personnel at several sites along the North East Ridge at Mt Anne in January and March 2005 to monitor the species' population dynamics.

RECOVERY PLAN

Recovery Objectives, Performance Criteria and Actions Needed

The **overall objective** of the Recovery Plan is to prevent *Oreoporanthera petalifera* and *Sagina diemensis* from declining further and/or becoming extinct, and to address threats to the populations of these species. This will require protecting, maintaining and monitoring known populations, establishing *ex situ* holdings and surveying suitable habitat for new populations.

Specific objectives are:

1. Resurvey and protect the two populations of *Sagina diemensis* and the single known population of *Oreoporanthera petalifera.*

2. Maintain or increase the numbers, *in situ,* of both species.

3. Locate new populations of both species through survey work.

4. Establish representative *ex situ* holdings of both species.

The **criteria** for achieving the objectives constitute a quantifiable decrease in the risk of extinction over 5 years of Recovery Plan implementation. They are:

1. Over the duration of the plan, no decline in the area occupied by known populations. ***Specific objectives 1 and 2***

2. Surveys of potential habitat, identified by current vegetation and geological mapping projects, for new populations to be completed by end of year 2. ***Specific objective 3***

3. Specimens of each species (from all known populations) to be lodged with the Tasmanian Herbarium by the end of year 2. ***Specific objective 1***

4. By the end of year 4 establishment of *ex situ* stock plants of *Oreoporanthera petalifera* and *Sagina diemensis* at the RTBG. The stock plants should be propagated vegetatively and/or from seed from at least 10 plants per population, sampled from across the area occupied by each population. ***Specific objective 4***

5. Increase the level of seedling recruitment of both species following application of altered soil disturbance levels or other regimes as determined by monitoring. ***Specific objective 2***

6. Determine from monitoring programs the threat posed by trampling to either species by end of year 2. If it emerges from this work that trampling is a serious threat to the survival of either species then a defined walking track, with suitable erosion controls should be established in fragile or at risk areas along North East Ridge. ***Specific objectives 1 and 2***

7. Follow the guidelines for fuel reduction burning in the Sandfly Creek buttongrass moorland as described in Parks and Wildlife Service (2004), and ensure that Southwest National Park and the WHA are maintained as fuel stove only areas. ***Specific objective 1***

8. Establishment of a Recovery Team when funding is procured to implement this plan or parts thereof. ***Specific objectives 1 - 4***

9. Update listing statement and spatial and population data as required and circulate this information to the wider botanical community and general public in the appropriate form i.e., update TSS databases, circulate updated information to the Tasmanian Flora Network and update the DPIW threatened species website as necessary, provide data to relevant State and Commonwealth agencies, and include threatened species sites on LIST (Land Information Systems Tasmania). ***Specific objectives 1 and 3***

10. Annual requests made to volunteer networks (e.g., Wildcare, Threatened Species Network) to encourage active involvement in the Recovery process. ***Specific objectives 1 - 4***

11. Maintenance of the TSS database (ie: new populations, population decline and threshold conditions) to trigger management intervention. ***Specific objectives 1 - 3***

12. Update the Recovery Plan by the end of year 5 or when new information becomes available. ***Specific objectives 1 - 3***

The **actions** required for achieving the objectives are:

1. Verify that known populations are extant, and conduct a census of populations. ***Specific objective 1***

2. Determine the effect of trampling on population size, and if necessary protect populations. ***Specific objectives 1 and 2***

3. Monitoring for improved understanding of population dynamics and threats, habitat management and seedling recruitment. ***Specific objective 2***

4. Survey for new populations. ***Specific objective 3***

5. Establish a representative *ex situ* holdings of both species at the RTBG. ***Specific objective 4***

6. Establish a mechanism with community input to ensure ongoing long-term management and intervention when required. ***Specific objectives 1 and 2***

Strategy for Recovery and Progress Evaluation

The Alpine Karst Flora Recovery Plan will run for 5 years and is based on strategies to increase the number of populations, maintain or increase numbers of individuals and habitat quality and manage populations in the long term. This will be achieved by determination of disturbance requirements, survey and monitoring, establishment of representative *ex situ* holdings of *Oreoporanthera petalifera* and *Sagina diemensis*, habitat management and provision for long term management.

This plan has been prepared in consultation with various representatives of the Threatened Species Section, the Vegetation Section of the Biodiversity Conservation Branch of the Department of Primary Industries and Water, the Fire Management Section of the Department of Tourism, Arts and Environment, the Tasmanian Herbarium, the Tasmanian Flora Network, and a network of professional botanists and active volunteers concerned with threatened flora issues in Tasmania. A Recovery Team will be established once funding to implement this plan or parts of the plan is secured.

Each year following establishment, the Recovery Team will monitor and evaluate progress against recovery criteria outlined in this plan and report to relevant sponsor organisations. Significant developments will be communicated to the general public through Listing Statement updates, relevant newsletters and reports.

This plan is consistent with the aims of the *Threatened Species Strategy for Tasmania* (DPIWE 2000) and *Tasmania's Nature Conservation Strategy 2002 - 2006* (DPIWE 2002).

Affected Interests and Social and Economic Impacts

Oreoporanthera petalifera and *Sagina diemensis* have legal protection as listed threatened species at the State and Commonwealth level. These species occur on World Heritage reserved land that is maintained for its natural values.

The Aboriginal community is currently being consulted to determine whether there are any Aboriginal issues or interests identified in this Recovery Plan. If no role is identified for indigenous communities in the recovery of this species, opportunities may exist through cultural interpretation and awareness of this species.

The implementation of this Recovery Plan is unlikely to cause significant adverse social and economic impacts.

Biodiversity Benefits

Biodiversity benefits are maintenance of diversity in rare ecosystems that are threatened with further reduction in size and diversity, and the prevention of both *Oreoporanthera petalifera* and *Sagina diemensis* from becoming extinct. The North East Ridge area, where *Oreoporanthera petalifera* and *Sagina diemensis* are found, is characterised by two rare plant communities. An unusual, species-rich grassland community dominated by *Poa labillardierei* is found on the steep slopes of the karst formations, while King Billy Pine (*Athrotaxis selaginoides*) dominated subalpine rainforest communities extend up into the karst areas. The North East Ridge at Mt Anne is considered to be one of the two most outstanding localities for this community in Tasmania (Kirkpatrick 1997).

RECOVERY ACTIONS

1. Survey and census of known populations

Surveys conducted in January 2005 relocated populations of *Oreoporanthera petalifera* at North East Ridge and *Sagina diemensis* at the North East Ridge and the Weld River Arch. These surveys were not extensive due to the difficult terrain and further surveys of the North East Ridge will be required to determine the total area of occupancy and population of *Oreoporanthera petalifera* and *Sagina diemensis* at this location. The survey should include an estimate of the number of plants and information including population demographics and number of the seedlings. January - February is the best time of the year to relocate *Oreoporanthera petalifera* and *Sagina diemensis* as both species are in flower and favourable weather patterns may occur.

Further detailed population census of *Oreoporanthera petalifera* and *Sagina diemensis* are necessary, as the surveys conducted in January 2005 only covered approximately a half of the potential habitat at the North East Ridge. Information on population demographic and dynamics is critical for determining the health of the population.

Costs for this action include travel, data collection and co-ordination costs. The travel costs are likely to be significant as the populations of both species are remote, and will require helicopter hire or a two day return hike to access. Volunteer input will be sought as appropriate. Co-ordination responsibility rests with DPIW.

Cost estimate	Timeframe
$20,000	year 1– year 2

2. Protection of populations

Although the populations of *Sagina diemensis* and *Oreoporanthera petalifera* are protected within the Southwest National Park and the Tasmanian Wilderness World Heritage Area they may be threatened by human-induced or natural impacts such as wild fire, trampling and loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.

To prevent the inadvertent destruction or decline of the alpine karst communities through wildfire, the guidelines for fuel reduction burning in the Sandfly Creek buttongrass moorland should be followed as described in the TWWHATFMP. It is also important to ensure that the Southwest National Park and the WHA are maintained as fuel stove only areas.

The effect that trampling from bushwalkers is having on both species should be assessed. If trampling is having a negative impact on either species, it may be necessary to establish a defined walking route along North East Ridge. The emphasis of this work should be to prevent trampling from impacting either species. Where it is not possible to re-route tracks to avoid impacting populations of *Oreoporanthera petalifera* and *Sagina diemensis*, then it may be necessary to undertake trampling control measures across fragile or at risk areas.

The population of *Sagina diemensis* at the Weld River Arch is at risk from trampling by bushwalkers. Any monitoring program should be established in conjunction with the Parks and Wildlife Track Management Team to determine the level of impact on populations. In addition a prioritised works program should be developed to implement any recommendations for threat abatement. This may well include re-routing of tracks, placement of barriers or preparation and distribution of educational material, which should be done in conjunction Parks & Wildlife Track Management Team.

Costs for this action include monitoring the effects of trampling, which will incur expenses such as travel, data collection and handling and program co-ordination. The travel costs are likely to be significant as the populations of both species are remote, and will require helicopter hire or a two day return hike to access. Volunteer input will be sought where appropriate. Co-ordination responsibility rests with DPIW.

If track work is necessary to protect the populations of *Oreoporanthera petalifera* and *Sagina diemensis* the costs

will include labour, materials, and travel. The costs for this action will rest with the Tasmanian Parks and Wildlife Service, and co-ordination will rest with both DPIW and DTAE.

.	**Cost estimate**	**Timeframe**
Monitoring	$10,000	year 1– year 5
Track work	$10,000	year 1– year 5

3. Monitoring

Monitoring known populations of *Oreoporanthera petalifera* and *Sagina diemensis* is required to determine management requirements. Nothing is known about seed dispersal or germination, the conditions associated with recruitment events, or population dynamics and structure of either species. Monitoring of populations is necessary to better understand the population dynamics of both species and the regimes required for seedling recruitment. Monitoring will also indicate whether intervention may be effective in improving seedling recruitment. The overall objective of the monitoring program is to determine how the viability of populations of *Oreoporanthera petalifera* and *Sagina diemensis* can be improved.

Permanent monitoring plots at the site were established when the first search was conducted post discovery of the species. The status of these plots requires review, as they were initially difficult to establish due to the nature of the dolomite outcrops.

Costs for this action include travel, data collection and handling, and program co-ordination. Volunteer input will be sought where appropriate. Co-ordination responsibility rests with DPIW.

Cost estimate	**Timeframe**
$8,000	year 1– year 3

4. Survey for new populations

While the probability of discovering a new population of *Oreoporanthera petalifera* is low due to the limited occurrence of suitable habitat and previous targeted surveys for the species, the Tasmanian Vegetation Mapping Program in DPIW may identify new areas that warrant searches.

There have not been surveys targeted specifically at locating new populations of *Sagina diemensis*, although the species was looked for in some of the *Oreoporanthera petalifera* search sites. Targeted investigations for *Sagina diemensis* in dolomite karst areas should be undertaken. It is likely that other populations may be found as the plant itself is small and cryptic and has possibly been overlooked in the past. *Sagina diemensis* was officially described in 1996 and may occur in both high and lower altitude dolomite areas. This species was not located during a dedicated search at Weld Arch, but a specimen was collected from this site a few years later. In order to improve the chance of finding populations, the timing of surveys will need to occur in January to February when both species are in flower.

Surveys for *Sagina diemensis* should be conducted in the Karst areas in the vicinity of the 'Bone Cavern', Lake Timk, and the Riveaux and Mt Picton Karst areas.

Expenses for this action include travel and survey costs. Due to the remote nature of the North East Ridge site, the travel costs are likely to be significant. Volunteer input will be sought where appropriate. Co-ordination responsibility rests with DPIW.

Cost estimate	**Timeframe**
$10,000	year 1– year 3

5. Establishment of *ex situ* holdings

Due to the stochastic risk posed by having only a single population of *Oreoporanthera petalifera* and two small populations of *Sagina diemensis* (the current status of both the latter populations unknown) it is important to establish representative *ex situ* holdings. The *ex situ* holdings should be held and maintained in a secure location such as the RTBG, so that if the wild populations are damaged or destroyed then plants or propagation material would be available to re-establish both species in the wild. Maintaining *ex situ* holdings will help to ensure the long-term survival of *Oreoporanthera petalifera* and *Sagina diemensis.*

Before a program to produce *ex situ* plants can commence, more information on the germination requirements of seeds is needed from the monitoring program (covered by Action 5 of this plan). To maintain genetic diversity of the species it is preferable to produce *ex situ* plants through collection of seed from wild plants. However, as it may take some time to obtain the information necessary to successfully germinate seeds and grow seedlings, *ex situ* plants may first need to be produced via propagation from vegetative material collected from the wild.

To maintain the genetic diversity in the *ex situ* population necessary for the health and long-term viability of a species, vegetative material and seeds should be collected from as many plants as possible (without significantly impacting upon populations), spread out over the entire range of each population. If any seed bank projects are undertaken on Tasmanian native flora then seed of both *Oreoporanthera petalifera* and *Sagina diemensis* should be included.

The collection of propagation material from wild populations will require a permit issued under provisions of the TSP Act.

Expenses for this action include collection of vegetative propagation material and seeds from the wild for stock plant production, *ex situ* plant maintenance and ongoing production of plants from stock plants and seed, and project co-ordination. Propagation will be conducted by the RTBG or a specialist nursery, and the populations should be maintained at the RTBG. Volunteer input will be sought where appropriate. Studying the germination and propagation requirements of both species may be suitable honours or post-graduate projects for University students. Co-ordination responsibility rests with DPIW.

Cost estimate	Timeframe
$10,000	year 1– year 4

6. Long term management

The effective long-term management of *Oreoporanthera petalifera* and *Sagina diemensis* involves collation and interpretation of data pertaining to them and dissemination to stakeholders in the appropriate form. This is necessary to base management advice, allocation of resources and assessment of the impact of management on the best available information at any time. This action is also required to encourage and allow community participation in, and ownership of, the Recovery Plan implementation process.

Ongoing data and data interpretation requirements as new information becomes available are:

- entry of spatial information into TSS and DPIW and Parks and Wildlife Service GIS systems
- collation of additional information required to assess the conservation status such as population and threat data and inclusion in a TSS database
- regular reassessment of conservation status, storage of revised assessments in a TSS database and preparation of nominations for a change in the conservation status for State and Commonwealth legislation as required
- entry into TSS database (ie: new populations, population decline and threshold conditions) and regular assessment of the database to determine whether management intervention is required
- lodgement of specimens of all populations with the Tasmanian Herbarium in case of future taxonomic treatments

Requirements for the dissemination of information are:

- update Listing Statement every five years or as new information becomes available and circulate to libraries, the wider botanical community (including the Tasmanian Flora Network) and include on the TSS website to give access to the general public
- update the Recovery Plan every five years, submit for adoption by the Commonwealth, and circulate to libraries, the wider botanical community (including the Tasmanian Flora Network) and include on the TSS and Environment Australia websites to give access to the general public
- liaise with and provide written updates and spatial data to Parks and Wildlife Service District, Planning, Tracks and Fire Management sections
- circulate spatial information to different users in the appropriate form i.e., include polygon or point data as appropriate in the TSS GIS system and DPIW's Natural Values Atlas, provide data to relevant State and Commonwealth agencies, include polygon or point data as appropriate on LIST (Land Information Systems Tasmania; an internet site with access controlled by password)

Mechanisms to facilitate community participation and ownership are:

- establish a Recovery Team when funding is procured to implement this plan or parts thereof
- make requests to volunteer networks (e.g., Wildcare, Threatened Species Network) to participate in specific recovery actions at least 6 weeks in advance (general requests for participation usually generate little interest)
- request participation in recovery actions by the wider botanical community through the Tasmanian Flora Network
- when necessary, organise managers to access populations and permits from the TSS for the collection of propagation material or herbarium specimens

Costs for this action include those associated with maintenance of databases and websites, updates and circulation of literature, requests for participation in the Recovery Team and recovery actions including provision of training and supervision when necessary and other co-ordination costs. Responsibility rests with DPIW.

Cost estimate	Timeframe
$13,000	year 1– year 5

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