

INTERIM RECOVERY PLAN NO. 171

NORTHAMPTON MIDGET GREENHOOD (*PTEROSTYLIS* SP. NORTHAMPTON)

INTERIM RECOVERY PLAN

2004-2009

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Photograph: Andrew Brown

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FOREWORD

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

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

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

This Interim Recovery Plan replaces number 68 Northampton Midget Greenhood (*Pterostylis* sp. Northampton) (R. Phillimore *et al.* 2000).

This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be reviewed after five years and the need for a full Recovery Plan will be assessed.

This IRP was given regional approval on 22 June 2004 and was approved by the Director of Nature Conservation on 22 July 2004. The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate at July 2004.

ACKNOWLEDGMENTS

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

Andrew Batty	Research Scientist, Botanic Gardens and Parks Authority
Andrew Brown	Co-ordinator, Threatened Flora, CALM's WA Threatened Species & Communities Unit
Anthony Desmond	Regional Leader Nature Conservation, CALM's Midwest Region
Stephen Hopper	Director, Botanic Garden and Parks Authority
Sue Patrick	Senior Research Scientist, CALM's W.A. Herbarium
Phil Roberts	Wildlife Officer, CALM's Geraldton District

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

SUMMARY

Scientific Name:	<i>Pterostylis</i> sp. Northampton (S.D.Hopper 3349)	Common Name:	Northampton Midget Greenhood
Family:	Orchidaceae	Flowering Period:	August, early September
CALM Region:	Midwest	CALM District:	Geraldton
Shire:	Northampton	Recovery Team:	Geraldton District Threatened Flora and Communities Recovery Team

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; Hoffman, N. and Brown, A. (1998) *Orchids of South-west Australia*. Revised 2nd edition with supplement. University of Western Australia Press, Nedlands; Western Australian Herbarium (1998) FloraBase - Information on the Western Australian Flora. Department of Conservation and Land Management, Western Australia. <http://www.calm.wa.gov.au/science/>.

Current status: *Pterostylis* sp. Northampton was declared as Rare Flora in September 1987 under the Western Australian *Wildlife Conservation Act 1950* and ranked as Critically Endangered (CR) in September 1995. The taxon is also listed as Endangered under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). It currently meets World Conservation Union (IUCN) Red List Category 'CR' under criteria B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v); C2a(i,ii); and D (IUCN 2000) as populations are severely fragmented, and there is continuing decline in the extent and area occupied by populations, the number of plants and populations, and the quality of habitat. The main threats are hydrological changes, weed invasion, water erosion, road, track and firebreak maintenance activities, feral pigs, grazing, inappropriate fire regimes and chemical drift.

Critical habitat: The critical habitat for *Pterostylis* sp. Northampton comprises the area of occupancy of the known populations; similar habitat within 200 metres of known populations; remnant vegetation that links populations; additional nearby occurrences of similar habitat that do not currently contain the taxon but may have done so in the past and may be suitable for translocations; and the local catchment for the surface and possibly ground waters that provide the winter-wet habitat of the taxon.

Habitat critical to the survival of the species, and important populations: Given that this taxon is listed as Declared Rare Flora it is considered that all known habitat for wild and translocated populations is habitat critical.

Benefits to other species/ecological communities: The habitat of *Pterostylis* sp. Northampton also supports the Declared Rare Flora *Caladenia elegans* (Critically Endangered) and *Caladenia hoffmanii* subsp. *hoffmanii* (Endangered).

International Obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. *Pterostylis* sp. Northampton is not specifically listed under any other international agreement, so the implementation of other international environmental responsibilities is not affected by this plan.

Role and interests of indigenous people: According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, there are no listed sites in the vicinity of the taxon. Input and involvement will be sought from any indigenous groups that have an active interest in areas that are habitat for *Pterostylis* sp. Northampton, and this is discussed in the recovery actions.

Social and economic impacts: The implementation of this recovery plan has the potential to have some limited social and economic impact, as some populations are located on private property. Areas on private land that are considered to be 'habitat critical' may be regarded as having potential for uses other than conservation by landholders. Approaches that may minimise this potential impact could include covenants, management agreements or land acquisition, and this is discussed in the recovery actions.

Evaluation of the Plans Performance: CALM, in conjunction with the Recovery Team will evaluate the performance of this IRP. The plan is to be reviewed within five years of its implementation.

Habitat requirements: *Pterostylis* sp. Northampton grows on wet clay flats among low dense shrubs and annual under taller scattered *Hakea*, *Melaleuca* and *Acacia*, north-west of Northampton.

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

1. Land managers have been notified of the location and threatened status of the taxon.
2. Declared Rare Flora (DRF) markers have been installed at Populations 1a and 2.
3. Dashboard stickers and posters that describe the significance of DRF markers have been produced and distributed.

4. An A4 sized poster, that provides a description of the species and information about threats and recovery actions, has been developed for *Pterostylis* sp. Northampton.
5. Populations 1b and 3 have been fenced to prevent grazing by feral pigs, kangaroos and sheep, and to help prevent illegal clearing.
6. In 1989, the Agriculture Protection Board conducted a 1080 baiting program throughout Northampton in an attempt to control feral pigs.
7. A 10 x 10 metre monitoring quadrat was established at Population 2 in August 1990 by CALM staff.
8. Works have been undertaken to manage drainage/erosion problems on the road reserve at Population 2.
9. Weed control was conducted at Populations 2 and 4 in April/May 2000, 2001, and 2003 by Geraldton District staff.
10. Native seedlings were planted in 2001, 2002 and 2003 at Populations 2 and 4 of *Pterostylis* sp. Northampton by CALM District staff, students and members of the Northampton Regional Herbarium group.
11. Seed was collected by staff of the Botanic Gardens and Parks Authority (BGPA) in 1998 and 1999 and stored in liquid nitrogen. Fungal isolates were obtained in 1998 and 1999 but failed to germinate seed. Most of the seed collected in 1998 and 1999 were used in germination trials. Further seed was collected in 2003 and is currently stored in liquid nitrogen at BGPA.
12. Soil from Populations 1, 2, 3, and 4 was collected in March 2004 by CALM District staff and sent to BGPA for mycorrhizal association studies.
13. The Geraldton Region Threatened Flora and Communities Recovery Team (GDTFCRT) is overseeing the implementation of this IRP and will include information on progress in their annual report to CALM's Corporate Executive and funding bodies.
14. Staff from CALM's Geraldton District regularly monitor populations of this taxon.

IRP Objective: The objective of this Interim Recovery Plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the taxon in the wild.

Recovery criteria

Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more over the period of the plan's adoption under the EPBC Act.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the period of the plan's adoption under the EPBC Act.

Recovery actions

1. Coordinate recovery actions.
2. Map critical habitat.
3. Undertake weed control.
4. Drainage strategy for Population 2.
5. Fence Population 5 and rehabilitate habitat.
6. Conduct further surveys.
7. Control fauna that impact the species.
8. Liaise with land managers.
9. Seek long-term protection of habitat.
10. Weed barriers, and rehabilitate buffer at Population 4.
11. Collect seed and fungal material.
12. Develop and implement a fire management strategy.
13. Monitor populations.
14. Monitor salinity and groundwater levels.
15. Obtain biological and ecological information.
16. Promote awareness.
17. Develop and implement a translocation proposal.
18. Review the need for a full Recovery Plan.

1. BACKGROUND

History

Pterostylis sp. Northampton was discovered in 1978 by Stan Finck, a Victorian orchid enthusiast. The original locations are now recorded as Populations 1 and 2. No further populations were located until 1990, when A. Brown discovered another population on an unnamed road north of Population 1, but this area was mostly cleared in 1994. Population 4 was located in 1996 on a Shire reserve in Northampton, also by A. Brown. The species is currently known from five populations totalling approximately 44 plants. No plants were recorded in two of the populations during the most recent monitoring period.

An Interim Recovery Plan was developed for the species in 2000 (Phillimore *et al.* 2000). Information accumulated since that plan was completed has been incorporated into this plan and this document now replaces Phillimore *et al.* (2000).

Description

Pterostylis sp. Northampton (S.D.Hopper 3349) is a small tuberous herb 5-10 centimetres tall. The flower spike emerges from a basal rosette of leaves and bears between two and twenty pale green 'greenhood' flowers, each of which are approximately 5 by 5 mm in size (Hoffman and Brown 1998). Flowering occurs over a period of approximately three weeks from August to early September, with seed maturing between October and November. Plants are found in clumps or as solitary individuals. As is usual with the genus *Pterostylis*, plants become dormant after fruiting. Underground tuberoles continue the life cycle after an annual period of dormancy.

Pterostylis sp. Northampton has affinities with *P. cycnocephala* which occurs in eastern Australia and *P. mutica* (midget greenhood). *P. mutica* is found in semi-arid zones near Southern Cross and extends across the southern edge of the Nullarbor Plain into eastern Australia. *P. sp. Northampton* differs from *P. mutica* in that it is paler in colour, has forward-projecting labellum appendages and wavy-margined leaves (Hoffman and Brown 1998).

Distribution and habitat

Pterostylis sp. Northampton is known from five populations growing in open *Melaleuca uncinata* and *Hakea recurva* low scrub over low heath in winter-wet clay soils over laterite north-west of Northampton. Plants occur in open, well lit, moist areas and flower in lower numbers when the density of the vegetation increases (Brown *et al.* 1998).

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

Given that this taxon is listed as Declared Rare Flora it is considered that all known habitat is habitat critical. In addition all populations, including translocated populations, are considered important to the survival of the taxon. Recovery actions include survey for further populations that may lead to the identification of additional critical habitat.

Benefits to other species/ecological communities

The Critically Endangered *Caladenia elegans* occurs in the habitat of all populations of *Pterostylis* sp. Northampton, and the Endangered *Caladenia hoffmanii* subsp. *hoffmanii* occurs with Population 1. Recovery actions implemented to improve the quality or security of the habitat of this species, such as weed control and rehabilitation, will be of benefit to the other threatened species that occur with *P. sp. Northampton*.

International Obligations

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

Role and interests of indigenous people

According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, there are no listed sites in the vicinity of the taxon. Input and involvement will be sought from any indigenous groups that have an active interest in areas that are habitat for *Pterostylis* sp. Northampton, and this is discussed in the recovery actions.

Social and economic impacts

The implementation of this recovery plan has the potential to have some limited social and economic impact, as some populations are located on private property (Populations 1b, 3 and 5). Areas on private land that are considered to be 'habitat critical' may be regarded as having potential for uses other than conservation by landholders. Approaches that may minimise this potential impact could include covenants, management agreements or land acquisition and this is discussed in the recovery actions.

Evaluation of the Plan's Performance

CALM, in conjunction with the Geraldton District Threatened Flora and Communities Recovery Team will evaluate the performance of this Interim Recovery Plan. The plan is to be reviewed within five years of its implementation. Any changes to management or recovery actions will be documented accordingly.

Critical habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or listed threatened ecological community. Habitat is defined as the biophysical medium or media occupied (continuously, periodically or occasionally) by an organism or group of organisms or once occupied (continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind have the potential to be reintroduced (*Environment Protection and Biodiversity Conservation Act 1999*).

The critical habitat for *Pterostylis* sp. Northampton comprises:

- the area of occupancy of known populations;
- areas of similar habitat within 200 metres of known populations, ie. in open *Melaleuca uncinata* and *Hakea recurva* low scrub over low heath in winter-wet clay soils over laterite (these provide potential habitat for natural range extension);
- remnant vegetation that surrounds or links populations (this is necessary to allow pollinators to move between populations);
- additional occurrences of similar habitat that do not currently contain the taxon but may have done so in the past (these represent possible translocation sites); and
- the local catchment for the surface and possibly ground waters that provide the winter-wet habitat of the taxon (the taxon occurs on wet clay flats whose occurrence depends on the maintenance of local hydrology).

Biology and ecology

Very little is known about the biology or ecology of the species, and further research is required. Orchids have specific requirements for both pollination and germination. Pollination in most species of *Pterostylis* is thought to involve small Diptera, commonly known as fungus gnats (Stoutamire 1982). The insects may be attracted to the plant by sex pheromones emitted by the orchid. The orchid does not produce nectar. Once at the flower, insects are trapped by a hinged labellum and can only escape through a small opening at the top of the column. If an insect has come into contact with pollen while visiting another plant, it then transfers pollen to the next plant visited, resulting in fertilisation. Observations suggest that for *P.* sp. Northampton most flowering individuals are pollinated naturally and set seed (personal communication A. Batty¹).

¹ Andrew Batty, Research Scientist, Botanic Gardens and Parks Authority

Germination and successful establishment of most native orchids is reliant upon a soil-borne fungal symbiont. The specific nature of the mycorrhiza has not been identified for *Pterostylis* sp. Northampton. Typically *Pterostylis* spp. are some of the easiest West Australian orchids to germinate. However, the fungi isolated to date from *P.* sp. Northampton appears to be atypical and fails to result in seed germination. Further research is required (such as baiting for other fungal isolates from field soil) to resolve this problem (personal communication A. Batty).

Threats

Pterostylis sp. Northampton was declared as Rare Flora in September 1987 under the Western Australian *Wildlife Conservation Act 1950* and ranked as Critically Endangered (CR) in September 1995. The taxon is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It currently meets World Conservation Union (IUCN) Red List Category 'CR' under criteria B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v); C2a(i,ii) and D (IUCN 2000) as populations are severely fragmented and there is continuing decline in the extent and area occupied by populations, in the number of plants and populations, and in the quality of habitat. The main threats are hydrological changes, weed invasion, water erosion, road, track and firebreak maintenance activities, feral pigs, grazing, inappropriate fire regimes and chemical drift.

- **Weed invasion** is a major threat to all populations. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase the fire hazard due to the easy ignition of high fuel loads, which are produced annually by many weed species.
- **Hydrological change including salinisation** may be impacting the taxon. Salinisation can occur as a consequence of evaporation of increased levels of surface water resulting in salt residues on the soil. The Northampton area has also been identified in a dryland salinity assessment as an area being at medium risk based on groundwater depth and soil system (Short and McConell 2001). Salinity may be causing an impact on the taxon and leading to degradation of its habitat (personal communication A. Batty). If not addressed, this decline may continue in the medium to long term.
- **Water erosion** in a drainage channel at Population 2 is directly affecting *Pterostylis* sp. Northampton plants and their habitat. The site may originally have been a natural drainage line, but road building and land clearing have resulted in large volumes of runoff into the road reserve that contains Population 2. A drainage culvert and constructed levy bank in an adjacent paddock on the south side of the road have served to further direct the water into the road reserve. This has resulted in the erosion of large sections of the road reserve, creating wide channels up to five metres in width adjacent to the road. Parallel erosion channels have begun to form in the centre of the road reserve. The water flowing from adjacent land is also channelling seeds of pasture grasses, fertilisers and silt into the habitat of the orchid, causing weed infestation and a coverage of silt. A monitoring site established at that site in 1990 has become densely infested with weeds, and no orchids were observed within the plot in 1994. Similarly, on the north side of the road at Population 2, a spoon drain directs water, silt and weed seeds into the road reserve. Despite some works that have occurred in an attempt to stem the water flow (see existing recovery actions), overall the drainage situation is not good with water still flowing through the area too quickly rather than soaking in to the soil.
- **Road, track and firebreak maintenance activities** threaten the *Pterostylis* sp. Northampton and its habitat. Threats include actions such as grading road reserves, road widening (in particular Population 1), spraying of chemicals, constructing drainage channels and mowing the roadside vegetation to improve visibility. In particular on the north side of the road reserve in a section of the habitat of Population 2, firebreaks have been cleared on both sides of the boundary fence. These disturbance events also often encourage weed invasion into adjacent habitat, as well as causing damage to actual plants.
- **Feral pig** activity has been observed in most populations. As well as grazing the orchids themselves, pigs can destroy the underground tubers of the orchid and also affect the growth of symbiotic fungi that are essential for germination and for providing starches for the plant (Hoffman and Brown 1998).

- **Grazing** by brown caterpillars, kangaroos (*Macropus fuliginosus*) and rabbits (*Oryctolagus cuniculus*) has impacted upon most populations. In addition, disturbance of soil by rabbit warren construction, increased nutrient levels from their droppings and the introduction of weeds impact on the habitat of the species. Grazing may impact on the establishment of *Pterostylis* sp. Northampton seedlings thereby limiting natural recruitment. In recent years, the impact of rabbits has declined due to rabbit baiting by many landholders, and the introduction of the calici virus.
- **Inappropriate fire regimes** may affect the viability of populations. Undergrowth can get excessively dense and orchids can be out-competed if an area is too long unburnt. However, fire that occurs when the orchid has above-ground growth will prevent seed set and possibly kill the tuber through a lack of opportunity to build up starch reserves. Most orchid species emerge from the soil by mid April and dehisce their seed by late November. The orchids become dormant when climatic conditions are typically hot and dry. The optimum time for fire in orchid populations is therefore from December to March. Burning at this time of year, is, however, associated with risks of fire becoming uncontrolled and risking lives and property. In addition to the detrimental effects of inappropriate fire regimes on the vegetative stages of the species, a proliferation of weeds often follows burning, partly due to a temporary increase in the availability of nutrients (Panetta and Hopkins 1991).
- **Chemical drift** from herbicide and fertiliser application on adjacent farmland have the potential to impact the species' growth and survival.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1a. W of Northampton	Shire Road Reserve	1992 10* 1994 60+* 1995 40+* 1997 40+ 1999 35+* 2000 4 2001 (1)* 2003 17	Moderate	Weeds, road maintenance, chemical drift, hydrological changes, pigs, inappropriate fire regimes, grazing
1b. W of Northampton	Private property	1992 10* 1994 60+* 1995 40+* 1997 20+ 1999 35+* 2000 15 2001 (1)* 2003 25	Healthy	Weeds, chemical drift, hydrological changes, pigs, inappropriate fire regimes
2. W of Northampton	Shire Road Reserve	1992 5 1994 70+ 1996 100+ 1997 15 1999 0 2000 19 2001 25 (25) 2003 (4)	Poor	Weeds, water erosion, chemical drift, road and firebreak maintenance, hydrological changes, pigs, inappropriate fire regimes, grazing
3. W of Northampton	Private property	1990 12 1994 1 1999 0 2000 5 (1) 2001 4 2002 2	Poor	Weeds, grazing, pigs, inappropriate fire regimes, hydrological changes
4. W of Northampton	Shire recreation reserve	1996 29 2000 0 2001 0 2002 0	Healthy	Weeds, chemical drift, inappropriate fire regimes, hydrological changes, pigs, grazing
5. W of Northampton	Private Property	2001 4 2002 (1) 2003 0	Moderate	Weeds, pigs, hydrological changes, inappropriate fire regimes

* = total for subpopulations combined.
Numbers in brackets = number of seedlings.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of the populations or within the defined critical habitat of *Pterostylis* sp. Northampton require assessment. No developments should be approved unless the proponents can demonstrate that they will have no significant impact on the taxon, its habitat or potential habitat, or the local surface or ground water hydrology.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

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

Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more over the period of the plan's adoption under the EPBC Act.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the period of the plan's adoption under the EPBC Act.

3. RECOVERY ACTIONS

Existing recovery actions

Land managers have been notified of the location and threatened status of the taxon. The notification details the Declared Rare status of *Pterostylis* sp. Northampton and the legal responsibility to protect it.

Declared Rare Flora (DRF) markers have been installed at Populations 1a and 2. These serve to alert people working in the vicinity to the presence of DRF, and the need to avoid work that may damage plants or their habitat. Dashboard stickers and posters that describe the significance of DRF markers have also been produced and distributed.

An A4 sized poster, that provides a description of the species and information about threats and recovery actions, has been developed for *Pterostylis* sp. Northampton. These posters have been distributed to the local community in the hope that this will result in the discovery of new populations.

Populations 1b and 3 have been fenced to prevent grazing by feral pigs, kangaroos and sheep.

In 1989, the Agriculture Protection Board (APB) conducted a 1080 baiting program throughout Northampton in an attempt to control feral pigs. By 1991, pigs had reinvaded the area, and in August 1994 recent pig diggings were observed near the populations of *Pterostylis* sp. Northampton. In summer 2001/2002, baiting was undertaken by Agriculture WA at Population 4. Liaison between staff of CALM Geraldton District and Agriculture WA is continuing with regard to pig control.

A 10m by 10m monitoring plot was established near Population 2 in 1990 by CALM staff. Although the plot now contains no *Pterostylis* sp. Northampton plants, monitoring data are indicative of the increased levels of weed invasion and general decline in condition of the site.

Works to manage drainage/erosion problems on the road reserve at Population 2 of *Pterostylis* sp. Northampton have included:

- Modifying a culvert to direct water to the opposite side of the road to divert the water flow and hence slow it down. This culvert becomes blocked during heavy rain, however.
- A gravel pit to the east of the population has been ripped to slow runoff and encourage regeneration. The pit was then planted with endemics in 2001 and 2002 by school children. Most of the seedlings have since died due to drought, and lack of topsoil has limited rehabilitation success. The Shire of Northampton placed

topsoil and native vegetation in the pit (available from a road widening operation) and will spread this over the surface to assist the rehabilitation.

- A drain that leads from an adjoining paddock into the road reserve has been brushed and planted with seedlings to stem the flow of water into the culvert.
- Piles of rock have been placed in the erosion gully. These rocks have helped to slow the water flow, but weed seed in soil attached to the rocks also increased weed invasion.
- The water flow through Population 2 of *Pterostylis* sp. Northampton was examined and mapped during a high rainfall event to help determine local topography and most appropriate actions to manage surface water flows.

Weed control was conducted at Populations 2 and 4 in April/May 2000, 2001, and 2003 by Geraldton District staff. Weeds at these populations were either removed by spraying with fusilade or roundup, or by hand weeding.

To help rehabilitate the sites, approximately 700 native seedlings were planted on Arbour Day 2001 at Populations 2 and 4 of *Pterostylis* sp. Northampton, and 300 seedlings were planted in 2002/2003 by CALM District staff, students and members of the Northampton Regional Herbarium group. These areas were also baited to control feral pigs, and property owners monitor the level of pig activity.

Seed was collected by staff of the Botanic Garden and Parks Authority (BGPA) in 1998 and 1999 and stored in liquid nitrogen. Fungal isolates were obtained in 1998 and 1999 did not result in seed germinating. Most of the seeds collected in 1998 and 1999 were used in germination trials. Further seed was collected in 2003 and is currently stored in liquid nitrogen at the BGPA.

Soil from Populations 1, 2, 3, and 4 was collected in March 2004 by CALM District staff and sent to BGPA for mycorrhizal association studies.

The Geraldton District Threatened Flora and Communities Recovery Team (GDTCRT) is overseeing the implementation of this IRP and will include information on progress in its annual report to CALM's Corporate Executive and funding bodies.

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

Future recovery actions

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

1. Coordinate recovery actions

The GDTCRT will continue to coordinate recovery actions for *Pterostylis* sp. Northampton and other Declared Rare Flora in their region. They will include information on progress in their annual report to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (Geraldton District) through the GDTCRT
Cost: \$2,100 per year

2. Map critical habitat

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

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

3. Undertake weed control

Weed control will be undertaken as required in populations of *Pterostylis* sp. Northampton, in consultation with the land managers. Appropriate methods of weed control are found in Brown and Brooks (2002) and may include localised application of herbicide. All applications of weed control will be followed by a report on the method, timing and success of the treatment, and the effect on *P.* sp. Northampton and associated native plant species. It is anticipated that regeneration of native species in the habitat will improve when weed competition is reduced.

Action: Undertake weed control
Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: \$1,500 per year

4. Develop and implement a drainage strategy for Population 2

Strategies to restore the habitat through drainage management, controlling weeds and reintroducing plant species native to the site is essential to conserve Population 2. A drainage control and rehabilitation strategy will be developed and implemented in liaison with relevant stakeholders including the local Shire. Water flows around the population have been examined during a high rainfall event to help determine local surface drainage and to help determine the most appropriate actions.

Possible actions include:

- Diverting the road.
- Lining the current erosion channels on the south side of the road with rocks.
- Levelling the spoon drain formed on the north side of the road, to ensure water flowing off the road flows along-side the road and not into the road reserve.
- On the south side of the road, channelling water so that it flows off farm land and into the road reserve in a different area.
- Filling in the current channel on the south side of the road and directing water through a large concrete pipe.
- Completely filling in the channel on the south side of the road with clean soil and create a much narrower rock-lined channel.
- Filling the current channel on the south side of the road at intervals with rocks to create riffles to slow the water flow and decrease erosion.
- Place smaller 'blunt ended' rock lined channels at angles to the current channel on the south side of the road to divert the water, and allow it to drain away more slowly. This is not a favoured option, as it will remove possible habitat and increase disturbance, weeds and flooding in the road reserve.
- Filling the channel on the south side of the road at intervals with brush cut from local species to slow water flow. This is unlikely to be very effective as the brush is likely to be washed away due to the high water flows at the site. This action may be more effective if combined with partial filling of the channel.

Action: Develop and implement a drainage and rehabilitation strategy for Population 2
Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: To be determined

5. Fence Population 5 and rehabilitate habitat

Where feasible, remnant vegetation on private property that contains Population 5 will be fenced. This will prevent damage by stock placed in the area during the summer, and by pigs moving through the area. Planting of degraded areas will also be undertaken to prevent weed encroachment.

Action: Fence Population 5 and rehabilitate habitat

Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: \$10,300 in the first year and \$2,400 in the second year

6. Conduct further surveys

Further surveys will be conducted during the species' flowering period (August, early September). Local volunteers such as members of naturalists clubs, WANOSCG and wildflower societies will be encouraged to be involved in surveys supervised by CALM staff.

Action: Conduct further surveys
Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: \$3,500 per year

7. Control fauna that impact the species

Grazing by animals such as rabbits, kangaroos and caterpillars will be monitored and managed at all populations. If necessary, grazing will be controlled through baiting (for rabbits) or alternative methods. Carbaryl dust has been shown to be an effective method for controlling caterpillars.

Action: Control fauna that impact the species
Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: \$2,500 per year

8. Liaise with land managers

Staff from CALM's Geraldton District will continue to liaise with the Shire and the managers of land adjacent to populations, to ensure that populations are not accidentally damaged or destroyed. Input and involvement will also be sought from any indigenous groups that have an active interest in areas that are habitat for *Pterostylis* sp. Northampton.

Action: Liaise with land managers
Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: \$800 per year

9. Seek long-term protection of habitat

Ways and means of improving the security of populations and their habitat on private land will be sought. This may include conservation covenants with a range of agencies or registration through the Land for Wildlife scheme. In addition, Population 4 of *Pterostylis* sp. Northampton is located on a Shire reserve for "Picnic Ground and Flora" and Population 5b is located on Unallocated Crown Land. The possibility of acquiring these reserves and vesting them with the Conservation Commission will be investigated.

Action: Seek long-term protection of habitat
Responsibility: CALM (Geraldton District, Land and External Funding Unit) through the GDTCFRT
Cost: \$1,500 in the second and third years

10. Seek to erect weed barriers, and continue to rehabilitate buffer at Population 4

Planting of degraded areas has already been undertaken and will be continued to help prevent weed encroachment into the reserve. Permission will be sought from the Shire to erect a shade-cloth barrier to prevent the spread of weed seeds.

Action: Seek to erect weed barriers, and continue to rehabilitate buffer at Population 4
Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: \$7,600 in first year, \$2,400 in second and third years

11. Collect seed and fungal material

Preservation of germplasm is essential to guard against extinction if wild populations are lost. Such collections are also needed to propagate plants for translocations. Some seed and endophytic material has been collected from *Pterostylis* sp. Northampton but further collections are required from all populations.

Action: Collect seed and fungal material
Responsibility: BGPA and CALM (Geraldton District) through the GDTCFRT
Cost: \$3,200 per year

12. Develop and implement a fire management strategy

A fire management strategy that defines fire control measures, fire frequency, intensity and timing will be developed in consultation with relevant authorities and land managers. In particular, occasional fire in conjunction with weed control may be required to limit competition from dense understorey shrubs at Population 2.

Action: Develop and implement a fire management strategy
Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: \$2,600 in first year and \$1,100 in subsequent years

13. Monitor populations

Monitoring of factors such as weed invasion, grazing, pig activity, habitat degradation, population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential. The impacts of increased salinisation, in particular, will be noted. All populations will be inspected annually.

Action: Monitor populations
Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: \$1,000 per year

14. Monitor salinity and groundwater levels

A number of bores will need to be installed at each population so that groundwater and salinity levels can be monitored. Soil salinity and pH readings will also be taken annually during winter. Soil samples will be collected using an auger to examine the soil profile. The monitoring results will be reviewed and the implications for management determined.

Action: Monitor salinity and groundwater levels
Responsibility: CALM (Geraldton District) through the GDTCFRT
Cost: \$2,500 in year one and two, \$1,500 per year thereafter

15. Obtain biological and ecological information

Increased knowledge of the biology and ecology of the species will provide a scientific basis for management of *Pterostylis* sp. Northampton in the wild. Investigations will include:

1. Study of the role of various factors including disturbance, competition, rainfall and grazing in recruitment and seedling survival.
2. Determination of reproductive strategies, phenology and seasonal growth.
3. Investigation of the mating system and pollination biology.
4. Investigation of population genetic structure, levels of genetic diversity and minimum viable population size.
5. Investigation of the distribution of fungi associated with *Pterostylis* sp. Northampton.

Action: Obtain biological and ecological information
Responsibility: CALM (CALMScience, Geraldton District), BGPA through the GDTCFRT
Cost: \$18,100 per year for first three years

16. Promote awareness

The importance of biodiversity conservation, the preservation of Critically Endangered species generally and the existence of *Pterostylis* sp. Northampton in particular will be promoted to the public. Awareness will be encouraged in the community by a publicity campaign through the local print and electronic media and poster displays. Formal links with local naturalist groups and interested individuals will also be encouraged.

An information sheet for *Pterostylis* sp. Northampton has been produced and distributed (see existing recovery actions). A mail-out information flier for distribution in the Northampton area will also be produced. These fliers are distributed to local residents to provide information and a contact if new populations of the species are located.

Action: Promote awareness
Responsibility: CALM (Geraldton District, Corporate Relations) through the GDTFCRT
Cost: \$1,400 in the first and second years; \$1,300 in third year and \$1,200 per year thereafter

17. Develop and implement a translocation proposal

Although translocations are generally undertaken under full Recovery Plans, the threats to all known wild populations of *Pterostylis* sp. Northampton is indicative of the need for a translocation proposal within the time frame of this IRP. A translocation proposal will be prepared and implemented by CALM and BGPA. Information on the translocation of threatened animals and plants in the wild is provided in CALM's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*.

Action: Develop and implement a translocation proposal
Responsibility: CALM (Science Division, Geraldton District) and BGPA through the GDTFCRT
Cost: \$13,300 in the second year; and \$6,200 in subsequent years.

18. Review the need for a full Recovery Plan

At the end of the fourth year of the five-year term of this Interim Recovery Plan, the need for further recovery will be assessed. If the taxon is still ranked Critically Endangered, the need for a full Recovery Plan, or to update this IRP will be assessed.

Action: Review the need for a full Recovery Plan
Responsibility: CALM (WATSCU, Geraldton District) through the GDTFCRT
Cost: \$23,700 in the fifth year (if required)

4. TERM OF PLAN

This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced. If the taxon is still ranked Critically Endangered after five years, the need to review this IRP or to replace it with a full Recovery Plan will be determined.

5. REFERENCES

- Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Perth.
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- Short, R. and McConnell, C. (2001) *Extent and Impacts of Dryland Salinity. Resource Management Technical Report 202*, Agriculture Western Australia.
- Stoutamire W.P. (1982) Pollination of *Pterostylis*. *American Orchid Society Bulletin*. 5 (8).
- Western Australian Herbarium (1998) *FloraBase – Information on the Western Australian Flora*. Department of Conservation and Land Management, Western Australia. <http://www.calm.wa.gov.au/science/>

6. TAXONOMIC DESCRIPTION

- Hoffman, N. and Brown, A. (1998) *Orchids of South-west Australia*. Revised 2nd edition with supplement. University of Western Australia Press, Nedlands.

Pterostylis sp. Northampton is a small tuberous terrestrial herb growing to 5 to 10 centimetres high. The flower spike emerges from a basal rosettes of leaves and bears between two and twenty pale green ‘greenhood’ flowers, each of which are approximately 5 by 5 millimetres in size. Flowering occurs from August to early September.

SUMMARY OF RECOVERY ACTIONS AND COSTS (Not for publication)

Recovery Action	Year 1			Year 2			Year 3			Year 4			Year 5		
	CALM	Other	Ext.	CALM	Other	Ext.	CALM	Other	Ext.	CALM	Other	Ext.	CALM	Other	Ext.
Coordinate recovery actions	1400	300	400	1400	300	400	1400	300	400	1400	300	400	1400	300	400
Map critical habitat	500		1500												
Undertake weed control	1000		500	1000		500	1000		500	1000		500	1000		500
Develop and implement a drainage strategy for Population 2	To be determined														
Fence Population 5 and rehabilitate habitat	1100		9200	900		1500									
Conduct further surveys	1100	1100	1300	1100	1100	1300	1100	1100	1300	1100	1100	1300	1100	1100	1300
Control fauna that impact the species	1500		1000	1500		1000	1500		1000	1500		1000	1500		1000
Liaise with land managers	500		300	500		300	500		300	500		300	500		300
Seek long-term protection of habitat				1000		500	1000		500						
Seek to erect weed barriers, and continue to rehabilitate buffer at Population 4	1100		6500	1100		1300	1100		1300						
Collect seed and fungal material		2000	1200		2000	1200		2000	1200		2000	1200		2000	1200
Develop and implement a fire management strategy	900		1700	100		1000	100		1000	100		1000	100		1000
Monitor populations	500		500	500		500	500		500	500		500	500		500
Monitor salinity and groundwater levels			2500			2500			1500			1500			1500
Obtain biological and ecological information	7000		11100	7000		11100	7000		11100						
Promote awareness	600		800	600		800	600		700	600		600	600		600
Develop and implement a translocation proposal				1000	2000	10300	400	600	5200	400	600	5200	400	600	5200
Review the need for a full Recovery Plan													15300		8400
Total	17200	3400	38500	17700	5400	34200	16200	4000	26500	7100	4000	13500	22400	4000	21900
Yearly Total		59,100			57,300			46,700			24,600			48,300	

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

Total CALM: \$80,600
 Total Other: \$20,800
 Total External Funding: \$134,600
TOTAL COSTS: \$236,000

